SOUTHERN CROPS

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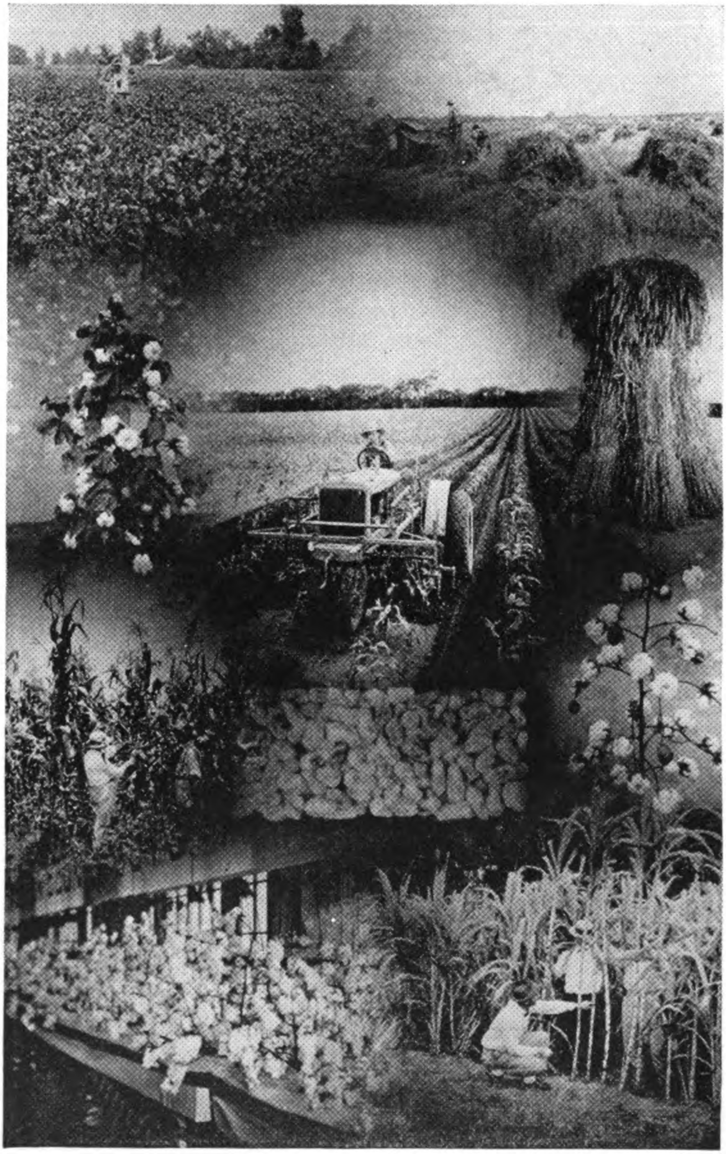
DEDICATED

TO THE

LEADERS OF SOUTHERN AGRICULTURE

whose portraits and biographies appear in this volume with the hope that the stories of their achievements will inspire many young men to prepare for a career in agriculture through which they may attain personal pleasure and satisfaction in addition to making a distinct and worth while contribution to the further adjustment and progress of farming in the South.



PREFACE

In 1925, the authors of this text, in cooperation with other workers in Southern agriculture, prepared for Turner E. Smith and Company the manuscript for their book FARM CROPS. In that book, which has been used by teachers and students in vocational agriculture throughout the entire South, the context was developed under the "job analysis" plan for each enterprise. This has since come to be the standard method of teaching and studying agriculture. The authors of SOUTHERN CROPS advocate the "job" method, but in this work the outlines have not been given although they were used by the authors for determining content. Each teacher will wish to develop his own outline, or to have each student prepare his own study and project plan.

This book is characterized by the same simplicity of treatment which made FARM CROPS a popular text.

In the development of SOUTHERN CROPS the authors recognize *agricultural adjustment* as the paramount problem in Southern farming. For years this section of the nation has emphasized the growing of cash crops. That this system of farming is not the most profitable is evidenced by the fact that the per capita farm income of the southern states is lower than that of other sections of the nation. Now, in addition to the usual reasons for advocating a better balanced agriculture, there is the necessity for limiting the acreage planted to the basic cash crops.

What can we do? What systems of farming should be followed? What should be the future trend of agriculture in the South? These are the questions that the younger generation must answer. These are the problems with which this book deals.

Unit A, which is introductory, is devoted to a consideration of the *Essentials of Management*. It deals with problems of the whole farm. It points the way to success through a treatment of the principles involved in agricultural adjustment, living-at-home, and conserving the soil so as to lead to a more constantly productive agriculture and better use of worn-out lands.

At the beginning of each chapter there is a picture of *a leader in Southern agriculture*. The biographies of these men are given in *Unit J*. They should be studied carefully. Half of these leaders are MASTER FARMERS and the biographical sketches tell how they farm. There is no better guide to profitable farming in the South than a study of the methods by which success has been achieved. Other biographies suggest careers open to farm youth.

Since forage crops represent the greatest need of Southern agriculture, hay, pasture, and soil conserving crops have been emphasized in relation to livestock production, crop rotations, and other factors in balanced farming.

The authors wish to acknowledge the debt of gratitude they owe to the agronomists and other specialists in Southern colleges and experiment stations who have supplied information, material, and illustrations. We wish to thank those who have read parts of the manuscript. We are most grateful to scientists in the Bureau of Plant Industry and the Soil Conservation Service for their aid. For many illustrations we are indebted to L. A. Schlup and Ralph Fulghum of the Extension Service, Washington, D. C.

PAUL W. CHAPMAN
ROY H. THOMAS

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Chapter 1

MASTER FARMERS OF THE SOUTH

*CLARENCE POE

ON THE evening of December 2, 1925, a banquet unique in the history of America was held in the city of Chicago.

This banquet was given in honor of twenty-three farmers of the Middle West. It was attended by the most outstanding business and professional leaders of the nation. Thousands, perhaps millions, of persons in all parts of the United States listened over the radio to the proceedings of this history-making banquet.

The Secretary of Agriculture in the President's cabinet said on this occasion, "The basic character of agriculture in our national economy makes it especially appropriate to recognize among farmers the same ability, initiative, business sense, and enterprise that are so widely recognized in other fields of activity."

This was the first Master Farmer banquet ever held. The twenty-three guests of honor were the first Master Farmers of the United States. They were chosen not for winning any particular contest, not for displaying prize-winning livestock or crops, nor for any one accomplishment. They were selected because over a period of years they had achieved distinction in the occupation which they had chosen for their life's work.

A farm journal, the *Prairie Farmer* initiated the Master Farmer movement. Since that time other standard farm papers, in cooperation with the agricultural

* See biography of Dr. Poe page 498.

extension service of the states, have selected Master Farmers. The movement has spread to all parts of the nation. In most states a small number of Master Farmers are now selected each year.

The Master Farmer selections in the South began in 1926 when the *Progressive Farmer* announced that fifteen would be chosen from among the farmers of Texas. Since that time Master Farmers have been named in

THE HOME OF A MASTER FARMER

practically all the Southern States. In most states the selection of Master Farmers has become an established annual event.

Aims and Objectives.—Why are we interested in the selection of Master Farmers? The purposes of the movement have been stated by the late Dr. Tait Butler for the *Progressive Farmer* as follows:

"First, the Master Farmer movement is a means by which farmers who have done really notable work in farming, and who represent a high type of citizenship are carefully selected in order that their work and character may be recognized and fittingly honored. In almost all other lines of human endeavor the man who achieves outstanding success is known and honored in some fitting manner by those in the same field and through them by the public generally. This has not been generally true of the farmer. The individualistic nature of his work and his isolation have left even the best farmers little known and unhonored outside their local communities. The Master Farmer movement seeks to find outstanding farmers of high character and to render honor to whom honor is due.

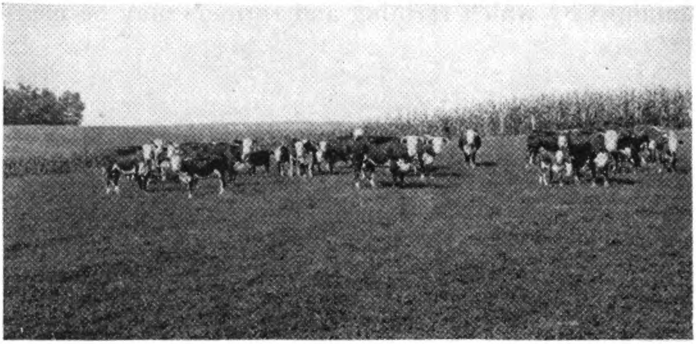
"Second, the Master Farmer movement has set a high standard by which farming and farmers may be meas-

STRIP CROPPING
Master Farmers control soil erosion.

ured or judged. The standard Master Farmer scorecard serves as a mark toward which all farmers may aim and by which they may measure their own efforts and success. Already many young and old farmers are using it as a goal toward which they are striving.

"Third, the Master Farmer movement is in effect a study of the methods, achievements, equipment, spirit and character by which success in farming is achieved. It is, therefore, a means for developing a better agriculture by carrying to all farmers in an effective manner the methods and equipment which have enabled other farmers to achieve outstanding success.

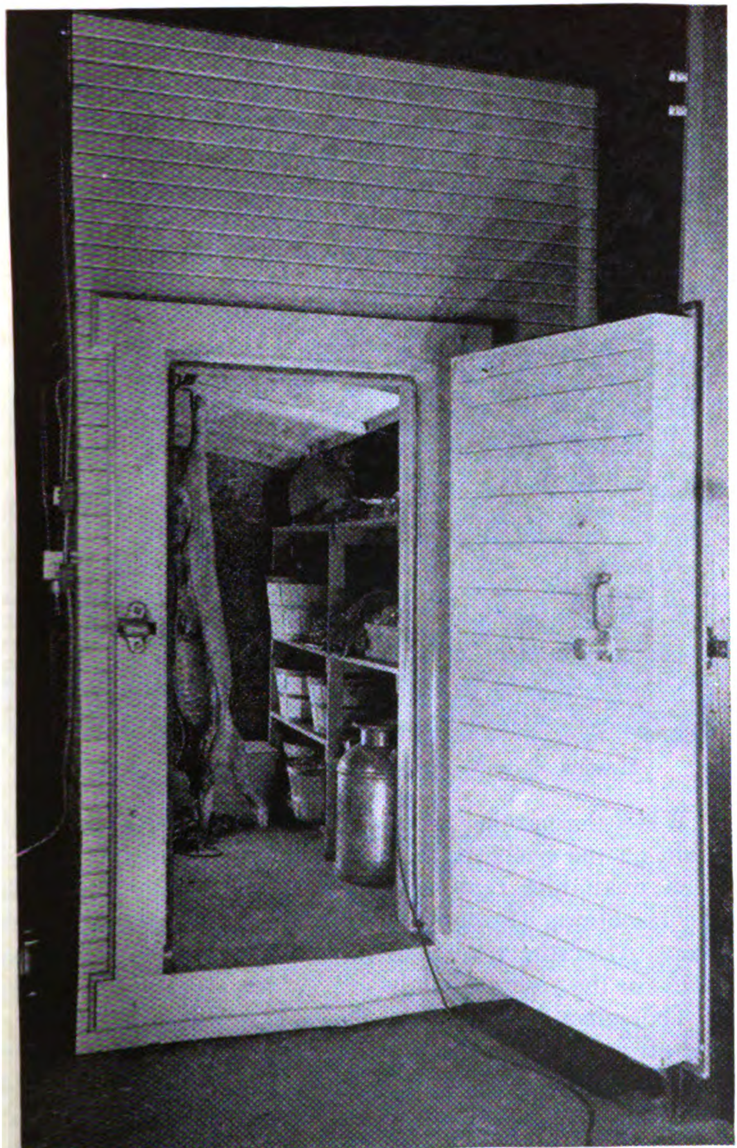
"Fourth, in the mind of the general public there is an all too common idea that farming is not as efficiently conducted as merchandising, manufacturing, banking, and other industries. The Master Farmer movement shows to the general public the high degree of efficiency



LIVESTOCK ESSENTIAL TO PERMANENT AGRICULTURE
The Master Farmers of the South maintain twice as much livestock as the average for the farmers of the Southern Region.

reached in modern agriculture. A challenge is offered to merchants, manufacturers, and bankers, for instance, to show from their ranks an equal number of men who in efficiency, service and character measure up to the high standard of the men selected as Master Farmers."

How Selected.—Master Farmers may be selected in any state in any way the agricultural leaders of the state may direct, but, in the main, the selections are made as follows: Every county agent is asked to nominate a farmer from his county. This nomination is made by filling out a booklet giving definite facts about the nominee on every point included in the Master Farmer Score



—*Courtesy TVA*

Master Farmers Live-at-Home

Card. Any person who cares to do so, as a matter of fact, may at any time nominate a Master Farmer by submitting to the state director of the Agricultural Extension Service or to the *Progressive Farmer* a detailed report such as is provided for in the plan.

After all nominations are filed, they are reviewed by a committee, and all but the very best eliminated.

MASTER FARMERS PRODUCE AN ABUNDANCE OF HAY

When the number has been reduced as far as is possible on the basis of the data submitted and the other facts available, representatives of the committee visit the remaining farmers and secure additional information. After the investigation is completed, final selections for the year are made.

The selection of Master Farmers is difficult. It cannot always be said that the best farmers are chosen, but it can be stated that all those chosen are outstanding farmers.

Why Important.—If the Master Farmer movement had no value other than to honor farmers of distinction, it would be worth while. But it has many other possibilities for service to agriculture.

Did you ever stop to consider from what basic sources one can get information about agriculture?

There are only two basic sources. One of these is the

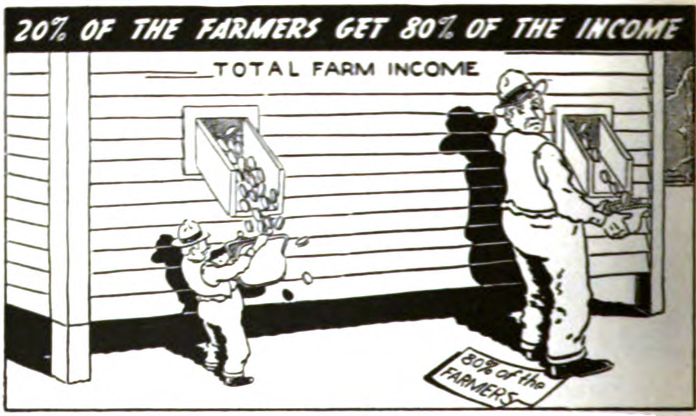
MASTER FARMERS GROW SOIL-CONSERVING CROPS

laboratory where experimental data or facts are discovered through scientific investigation. The other is the farm where facts are learned through the practical experience of farmers. Both are essential. But the experience of farmers is the test of the value of laboratory recommendations.

Master Farmers have selected and proved the value of the best farm practices adapted to their locality. Perhaps the safest, quickest, and surest way to learn to become a good farmer is to follow the plans and practices of those men in the occupation of farming who have been successful over a period of years.

Master Farmers of the South.—The South is dominantly rural. Farming is our most important occupation. The progress and prosperity of the region depend mainly upon agriculture. It is our fundamental source of income; it is our most important wealth-producing activity. It determines our standard of living.

While Southern agriculture has many achievements of which to be proud, and while many farmers enjoy a personal income greater than that of industrial workers,



our general average of attainment is unsatisfactory. Our average farm income is low compared with that of the farmers of other sections; our average acre yields are below those of any other section of the United States; our unfavorable balance of trade, between the things we sell and the things we buy, drains our capital resources.

On the basis of the figures given in the Yearbooks of the U. S. Department of Agriculture and other statistical services, the South does not make a good showing. Yet in every state and in every community there are farmers who make big acre yields, who enjoy good incomes, and who accumulate some degree of wealth.

MASTER FARMER EXPERIMENTATION

Master Farmers—like other industrial leaders—believe in the value of research, testing, and experimentation.

Who are these men and what are the secrets of their success?

This is a question that should concern every person engaged in farming. It should be the constant thought of young men preparing for an agricultural career. It should be the guide to all civic and legislative efforts looking to the progress of the South.

The Master Farmers of the South are outstanding among the successful farmers of the region. A study of their farming operations is the surest guide to progress. We must strive to profit from the example which they have set.

What are some of the management practices of Master Farmers which are different from those of the farmers responsible for the low averages of the South?

A study of all the Master Farmer records of the South reveals that the farming operations of all of them have certain characteristics in common. These include the following:

Farm Management Policies of Master Farmers

Most Successful Farmers in the South Have Incorporated All the Objectives Listed Below in Their Farming Programs

1. To live-at-home by producing all the food and feed requirements of the farm in so far as possible, and to have a surplus to sell.
2. To have many sources of income.
3. To practice a definite rotation system.
4. To grow legume and soil-improvement crops on as much of the land as possible each year.
5. To turn under some green manure crop each year and also to turn under all crop residues such as grain stubble and corn and cotton stalks.
6. To use labor-saving machinery.
7. To terrace all land properly where needed and to follow every possible plan for preventing erosion and for enriching the land.

8. To devote a portion of the farm to permanent pastures as a part of a rotation plan.
9. To keep some livestock if for no other reasons than to supply the home with meat and milk and to provide a means of marketing grass, hay, and other crops required in the farming plan to maintain the fertility of the soil.
10. To keep a cover crop on all the land all the time, winter and summer.
11. To take advantage of the God-given gift of a mild climate to do more farming in the winter months.
12. To work out a farm program that provides work for the entire year.

These are the "secrets" of successful farming. They are the ways in which the farm management policies of the Master Farmers of the South differ from those methods that are associated with low incomes. If every farmer would adopt these objectives a new era of prosperity would result. These objectives should be made the *Code of Principles* for every young Southern farmer. It is to their elaboration and explanation that the major portion of this text is devoted. Personal sketches of many Master Farmers are given in the last unit of this book which show how these objectives have been realized in practice.

The Master Farmer Score Card.—There is no better guide to successful farming than the Master Farmer Score Card. It deals with every aspect of farming and rural life. It embraces those things which make for good citizenship as well as good farming. For these reasons any time spent in the study of it will result in the accumulation of useful and worth-while knowledge which will be valuable in planning a career in farming, or in understanding the economic and social activities through which the further development and progress of the South will be brought about.

The Master Farmer Score Card is the measuring stick by which the achievements of the best farmers of the South are evaluated. It is so essential to any understanding of what good farming is that it is given in full below:

THE "MASTER FARMER" SCORE CARD

		Points
I. *Operation and Organization of Farm*		350
1. *Cropping System*	65	
The cropping system should provide, first, sufficient roughage, pasturage, and a large part of the concentrates for all livestock on the farm; second, for maintaining the fertility of the soil; third, at least two cash crops for which there is a good market; fourth, rotation with reference to insect and disease control; fifth, the fullest practical use of man, horse, and other power; and the system of farming should be suited to the available capital, equipment, soils, markets, and the abilities of the operator. Wooded acres should be properly cared for.		
2. *Maintenance of Soil Fertility*	65	
Should include the best methods for the prevention of soil erosion, conservation of moisture, and maintenance or increase of soil plant food for the particular soil and climatic conditions under which the farm operates with at least one-fourth of land planted to legumes each year. Consider care given manure, terracing and drainage, wise use of commercial fertilizers, conserving of all crop residues (particularly cornstalks), and pastures.		
3. *Crop Yields*	50	
Should be approximately 1½ times the county 5-year average.		

4. *Living at Home* 25
There should be an adequate home garden, orchard, poultry, with sufficient meat, milk, and feed production to supply the needs of the farm; also food grains as far as practicable.
5. *Good Seeds* 20
Planting seed should be of known and adapted varieties, pure and free from seed-borne diseases and receive good care. They may be obtained on the farm (at least cotton and corn should be field selected) or purchased from reliable sources.
6. *Feed and Care of Livestock and Poultry* .. 25
The care given the livestock and poultry will be judged from the facilities for proper care, the condition of the animals or fowls and their production and evidence of freedom from disease. In feeding, ample quantities of suitable feeds for the kinds of animals and for doing the work required must be considered, and balanced rations necessary for the best health and production of livestock must be fed.
7. *Quality of Livestock and Poultry*....... 30
All sires should be purebred and all females productive, either purebred or high grade. Cows should produce at least 250 pounds of butterfat per year and hens average 140 eggs per year.
8. *Adequate Buildings Conveniently Arranged* 25
The buildings should be adequate and suited to the kind of farming. Convenience of arrangement may be judged from two viewpoints, first, convenience of location, such as near the center of cultivated land, to roads, the residence, etc., and second, the convenience of location in relation to one another and convenience of interior arrangements for doing the work required.

9. *Adequate Tools, Machinery, and Equipment Well Housed and in Good Repair* 30
Equipment should be adequate for kind of farming practiced and to reduce cost of production, protected from weather when not in use, and kept in good repair.

10. *Layout of Farm and Fields*............ 15
Fields should be readily accessible from buildings, regular in form and free from gullies, rocks, bushes, etc. However, topography must be considered.

II. *Business Methods and Ability*................ 150

1. *Relation of Income to Investment*....... 60
Income should equal or exceed expenses with sufficient surplus to pay 6 per cent on conservative value of land. Money expended for education and family vacation should be added to net income.

2. *Marketing Methods and Efficiency*...... 40
Efficiency in selling the products of the farm counts for more than any particular method. The production of high grade products properly sorted and graded and marketed in acceptable standard packages is important. Cooperative marketing especially should receive credit.

3. *Accounting Methods*.................. 25
A complete account of farm income and expenses (preferably on each product) should be kept, then balanced and carefully analyzed once a year to determine where money is being made or lost.

4. *Business Reputation* 25
Reputation for honesty and ability should be good.

III. *Appearance and Upkeep of Farmstead*........ 100

1. *Repair and Upkeep of Buildings*........ 35
Should be in good repair and neat and clean. The condition of tenant homes and other tenant buildings should be given proper consideration.

2. *Condition of Fields, Fences, Terraces, Ditches, and Roads*.................. 40
Fields and fence rows should be free from weeds, stumps, etc. Fence posts should be sound; wires intact, gates in order, ditches clean, terraces maintained; pastures free from weeds and brush.
3. *Appearance and Condition of Yard and Lots* 25
Barnyard should be properly drained and kept clean. There should be a well kept lawn with trees, shrubbery and flowers properly placed and cared for.

IV. *Home and Home Life*...................... 300

1. *Convenient and Attractive Home and Grounds* 75
To be convenient the home must be sufficiently large and well arranged for the comfort and convenience of the family. An attractive home need not be large and expensive, nor need it be elaborately or expensively furnished, but it must be tastefully furnished and have a homelike appearance. The arrangement of the rooms must be such as to conserve the health and make for the convenience of those who live and work in the home. A green lawn is most important. The house should be underpinned solidly. It should be tied to the ground with a foundation planting of shrubs. Screen plantings to give privacy, and trees, are desirable.
2. *Labor-Saving Equipment in House*.... 50
Waterworks, lights, bath, and sewerage are labor-saving conveniences which count for much. If electricity is available, vacuum cleaner, electric iron, sewing machine motor, electric washing machine, and motor for churn should be among the labor-saving pieces of equipment in the home.

Kitchen arrangement and equipment are important.

3. *Sanitation and Health Standards*........ 50
Consider screening of doors and windows, sanitary toilet and facilities for bathing. Look for stagnant waters; consider proper placement of water supply in relation to toilet and barn lots. Ascertain whether the family's health appears to be safeguarded by proper observance of modern health rules, such as vaccination against typhoid, well balanced daily diets, etc., etc.
4. *Family Relationships*................. 50
Parents should not only be companions to each other but also companions to their children, take a deep interest in their training and recreation and in their problems. The woman's part in contributing to the farm income by thrift, gardening, canning, etc., should be considered.
5. *Interest in School and Education and Training of Children*.................. 60
All children of sufficient age should have received a high school education and where means would permit, should have received or have been urged to take a college education. Children should not be removed from school for farm work at any time. There should be an active interest in school affairs as indicated by participation in P. T. A. and other organized activities, and by voting regularly at all school elections and voting for adequate school facilities.
6. *Recreation* (Sports, games, hobbies, music, vacations, etc.).................. 15

V. *Citizenship* 100

1. *Neighborliness* 30
Do neighbors regard him as a good neigh-

bor and helpful friend? Is he cheerful and friendly and ready to help where help is needed? If so, give full score. If not deduct proportionately.

2. *Interest in Other Community Enterprises* 40
Should be willing to cooperate with other farmers in farm organizations for good of farmers as a whole and interest himself in all movements for improvement of his community and of rural life. Should attend farm meetings and keep up to date on agricultural affairs.
3. *Interest in Local, State, and National Governments* 30
Should vote in all elections and interest himself in election of honest, efficient officials. Should be well informed on public questions generally as well as on agricultural programs and policies, national, state and local.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What is meant by the term *Master Farmer?* Tell how Master Farmers are selected. Give an account of the development of the Master Farmer movement.
2. What are the aims and objectives of the Master Farmer selections as explained by the standard farm papers?
3. How is the Master Farmer movement of importance to all farmers?
4. What are the two original sources from which information about farm practices may be secured? Can you think of another original source? What are some of the secondary sources from which information may be secured?
5. What are some of the agencies that carry on scientific investigations in agriculture?
6. How can students of agriculture secure information from (1) those carrying on scientific investigations dealing with Southern farming, and (2) from farmers?
7. What are some of the farm management objectives of

Master Farmers? How do these differ from general practices?
8. What are the major sub-divisions in the Master Farmer Score Card? How many points are given to each?
9. How can young men going into farming profit from a study of the Master Farmer movement?
10. Why is it helpful to study the lives of men engaged in the occupations in which one is interested?

Suggested Activities

1. From the Yearbooks of the U. S. Department of Agriculture, or some other source, make a study of the acreage of the principal crops grown in your state, including the yields per acre, to determine how your state compares with others engaged in the production of the same crops.
2. From the statistics available, make a study to determine the rank of your state in the yield per acre of the principal money crops produced.
3. From agricultural statistics, determine the rank of your state in the production of (1) beef cattle, (2) dairy cattle, (3) hogs, (4) sheep, and (5) poultry. Do you produce enough meat and dairy and poultry products to be self-sustaining?
4. In the classroom, go over the Master Farmer Score Card in detail, section by section, and discuss each so that you will agree as to the exact meaning.
5. After getting a thorough understanding of the score card, apply it to your home farm. Let every member of the class do the same thing and then make a list of the items on which the farms of your community are generally deficient.
6. After a class discussion, agree in class upon the three or four most outstanding farms in the community. Have a committee from the class score each of these farms, using the score card. After the scoring is done invite the farmer who makes the highest score to visit the agricultural class and discuss his farming program. Before the time of his visit, make out a list of questions that you would like to ask him. Hold an informal discussion.
7. If Master Farmers are selected in your state, secure all the information you can about the men chosen. This informa-

tion can be secured from the *Progressive Farmer*, the *Farmer-Stockman*, or the state director of your Agricultural Extension Service. Many states publish bulletins dealing with the achievements of Master Farmers.

8. On the basis of your study of farm production and the achievements of good farmers, make out a list of items in which the farming of your community and state may be improved. Keep this until the end of the year and then revise it in the light of further study. The result of such an effort will be a progressive farm program.
9. On the basis of your study, write a paper on the subject: Methods of Improving Farming in My Community.
10. Select a Master Farmer, or some other farmer in your state in whom you are interested, and make a study of his life and farming operations. Write a personal sketch including the most important facts you can secure. Before carrying out this assignment decide through a class discussion what facts should be sought. The subject of this personal sketch may be a man in the community, or a man in some other part of the state. Information may be secured through farm journals, newspapers, and other sources. Perhaps the information may be secured through a school in the community in which the farmer lives. Prominent and successful men will almost always answer the letters of conscientious young men. If you write such a man a letter seeking information, prepare a list of questions so that he may answer them easily.

Chapter 2

AGRICULTURAL PROGRESS AND ADJUSTMENT

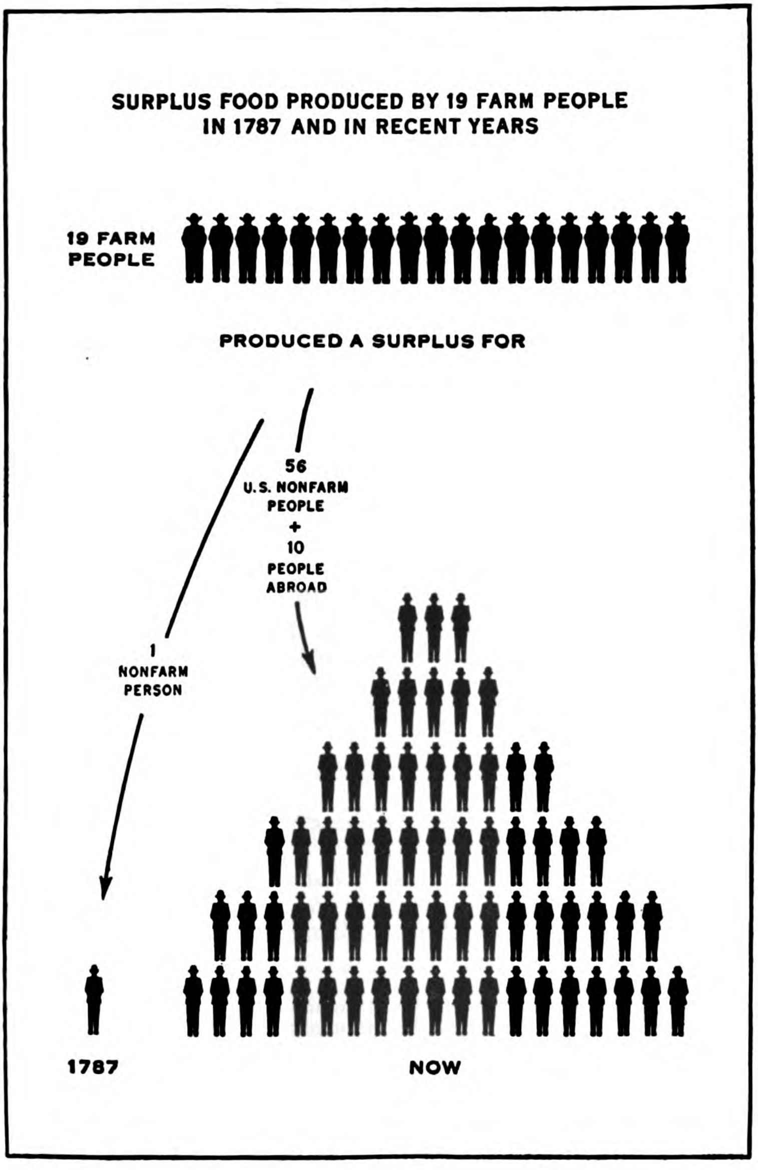
I. W. DUGGAN

NEW machinery, better seed, better livestock, and better cultural methods are continually increasing farm productivity. Few people realize how very astounding has been the progress of agriculture since Washington farmed at Mount Vernon.

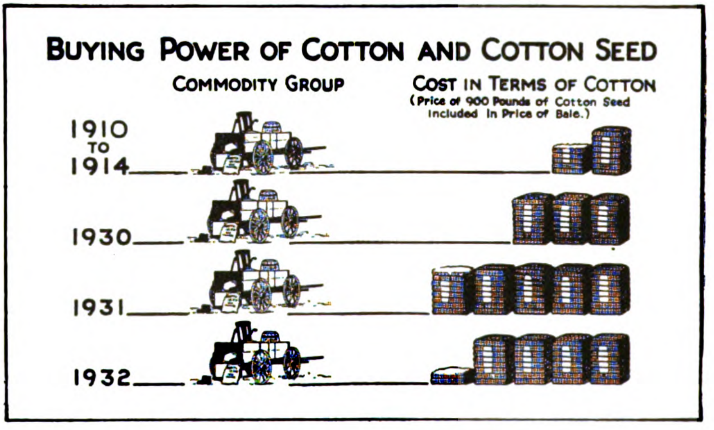
At the time the constitution of the United States was adopted, 19 farmers produced only enough food for themselves and one non-farming person. But when Henry A. Wallace, Secretary of Agriculture in the cabinet of President Franklin D. Roosevelt, began his work of agricultural adjustment, 19 farmers in this nation produced enough food for themselves and 56 non-farming people in the United States and, beyond that, enough to meet the requirements of 10 persons living in foreign countries.

Sydney Q. McAllister, president of the International Harvester Company, recently said, "If we had made no progress in farming since 1790, 123,000,000 of our people would need to live on farms in order to feed and clothe the other 7,000,000 living in cities. Actually, 75 per cent, or 98,000,000 of our people now live in cities, and are fed and clothed by the labor of the other 25 per cent, or 32,000,000 living on farms."

As a matter of fact, the development of America has been made possible by the efficiency of the farmers of the nation. Had they not learned to produce the necessi-


SURPLUS FOOD PRODUCED BY 19 FARM PEOPLE
IN 1787 AND IN RECENT YEARS
19 FARM PEOPLE
PRODUCED A SURPLUS FOR
56 U.S. NONFARM PEOPLE + 10 PEOPLE ABROAD
1 NONFARM PERSON
1787
NOW

ties of life so abundantly, there would have been no workers available to develop our great industries, our commerce, and our superior transportation facilities.



In many ways, the nation owes a debt of gratitude to its farmers.

The farm progress of one hundred years is strikingly revealed in the following table:

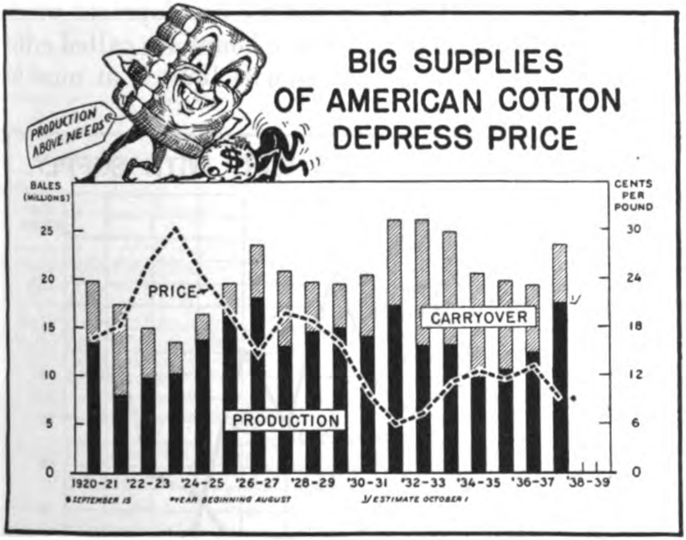
A CENTURY OF PROGRESS IN FARMING

A Table Comparing the Hours of Labor Required to Produce One Acre of the Common Crops by the Hand Methods of 1830 as Contrasted with the Machine Methods Practiced in 1930

Crop	*1830*	*1930*
Wheat	64 hrs. 15 minutes	2 hrs. 24 minutes
Corn	38 hrs. 45 minutes	5 hrs. 21 minutes
Timothy Hay	21 hrs. 5 minutes	1 hr. 48 minutes
Cotton	167 hrs. 48 minutes	5 hrs. 2 minutes

More power per worker is one secret of our efficiency in farming. This has been made possible by the invention and development of improved farm machinery.

In no phase of farming has machinery played a more important part than in grain production. In one hun-



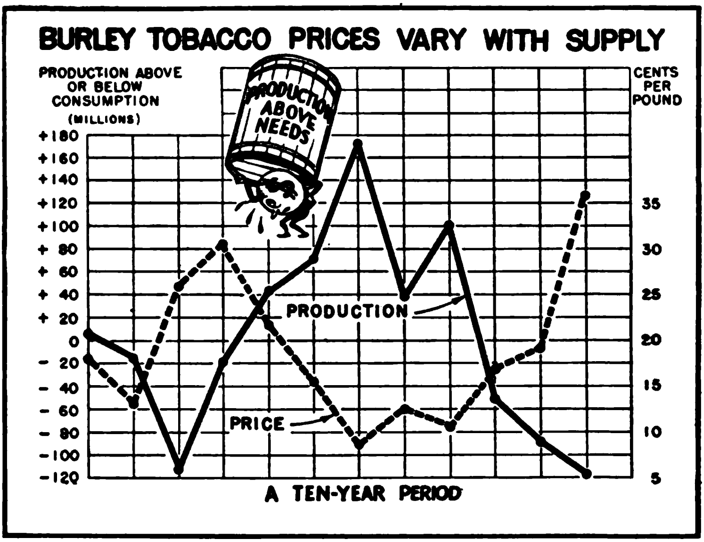
HARVESTING WHEAT

A Table Showing How the Time to Harvest an Acre of Wheat Has Decreased in the Last Century

Year	*Hours Labor Required*
1829	46
1830	37
1831	34
1840	11½
1896	3
1930	½

dred years the time required to harvest an acre of wheat has been reduced from 2,760 minutes to 30 minutes.

While it required 46 hours to harvest an acre of wheat in 1829, it now takes only one-half hour. The introduction of the stationary thresher cut about 20 hours off the time required for threshing. However, it was McCormick's reaper of 1931 that started the development which saved many critical hours. These hours are called critical because the harvesting season is limited at most to



little more than 10 days. Now a 16-foot combine performs all harvesting and threshing operations on one acre in just thirty minutes.

Cotton Production.—The remarkable reduction in the number of hours of labor required to produce cotton within a period of 100 years is explained in the table on page 25.

Only a small portion of the total cotton crop of America is now produced by the machine methods available.

Producing Cotton

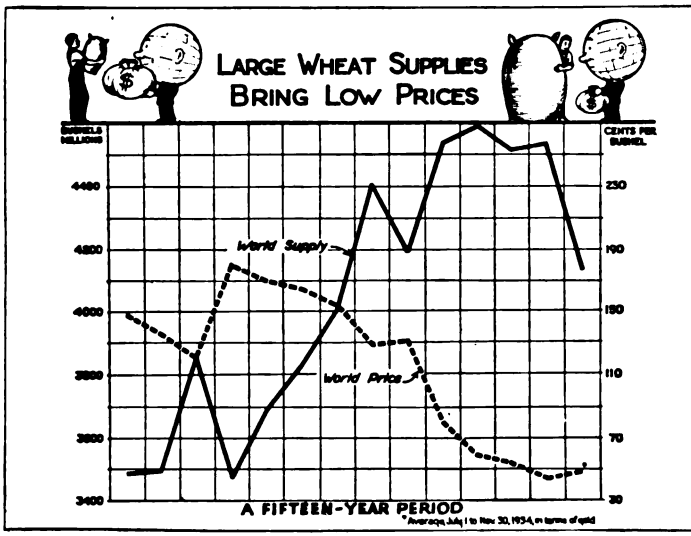
Labor Required to Produce an Acre of Cotton (750 Pounds Seed Cotton) *by the Hand Methods of 1841 and the Power and Machine Methods of 1931*

Hand Methods of 1841	*Labor Required Per Acre*		*Machine Methods of 1931*	*Labor Required Per Acre*	
	hrs.	min.		hrs.	min.
Bedding Land—Wooden Moldboard Plow	8	48	Middle Busting—Tractor		30
Opening Beds—Bull-Tongue Plow	2	12	Dressing Beds—Tractor		15
			Dragging—Tractor		8
Planting—Hand	4	24	Planting—Tractor		15
Seed Covering—Covering Block	2	12			
Hoeing and Chopping—Hoes (Hand)	27	—	Chopping and Dusting—Tractor		17
Barring off Cotton—Plow	4	24	Cultivating—Tractor (5 times)	1	7
Cultivating Cotton—Plow	26	24			
Cultivating Cotton—Wooden-Toothed Harrow	2	12			
Picking Cotton—Hand	77	—	Stripping and Cleaning—Tractor and McCormick-Deering 2-Row Cotton Stripper	1	—
Hauling Cotton to Gin—Wagon	13	12	Hauling Cotton to Gin—Motor Truck	1	30
Total labor required to produce one acre of cotton by hand methods of 1841	167	48	Total labor required to produce one acre of cotton by machine methods of 1931	5	2

—*Data International Harvester Company*

It seems inevitable, however, that the time is near at hand when these labor-releasing methods will be used more generally in cotton production, as they are already being used in the growing of grain and other basic farm commodities.

Machine methods in cotton growing will lower the cost of production per acre. They will also increase the income per worker. But, if largely adopted in any portion of the Cotton Belt, they will render hand methods obsolete. This, in turn will mark the final passing of those farmers who try to grow cotton by the methods which require 167 hours per acre. Already it has been esti-

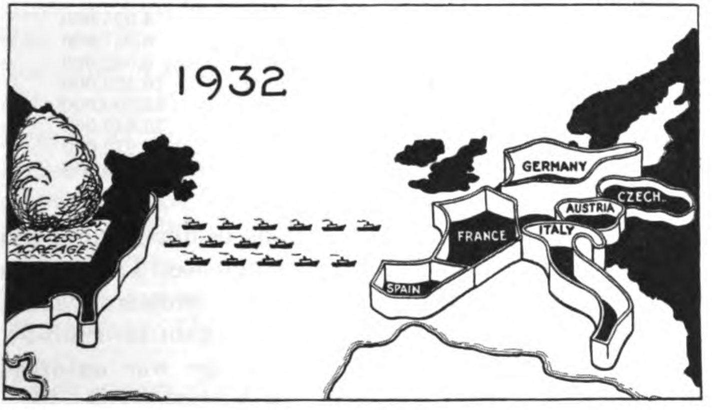


mated that the general use of the cotton picker will release the labor of 2,000,000 workers now employed in growing cotton.

The income of an individual is related very definitely to his production. For this reason ambitious men are always anxious to use the best tools and methods at their disposal. Hand methods have been largely discarded. In America, we live in the *Age of Power and Machinery.*

Farm Surpluses.—Our ability to produce so abundantly has brought many problems. We are now able to grow more than the consumers of the world are able to buy at prices that return an adequate income to farmers.

With the large crops produced by American farmers following the World War, surpluses accumulated. The farm income declined. As a result, the farmers did not have cash with which to buy the goods made by manufacturers. The business of merchants declined. There was less money to pay for the services of professional workers. As a result there was a general *de-*



Tariff Walls Are Trade Barriers

pression. Every one was affected by the reduced income of the farmer.

Let us consider our ability to produce and to sell one of the basic farm commodities—cotton, the most important money crop of the South.

The Cotton Situation.—We are told that cotton was first grown in America in 1621 when seeds from Siam were brought to Talbot County, Maryland, where the plant was grown for the beauty of its flowers. About the same time experimental plantings were made in Virginia.

Progress in cotton culture came slowly. It was 170 years after the first experimental planting before the total production reached 3,000 bales. Since that time, growth has been rapid and consistent.

Of course, the size of the cotton crop varies from year

COTTON PRODUCTION IN THE UNITED STATES

Growth Year	*Bales*	*Growth Year*	*Bales*
1790	3,000	1870	4,025,000
1800	73,000	1880	6,357,000
1810	178,000	1890	8,562,000
1820	335,000	1900	10,123,000
1830	732,000	1910	11,609,000
1840	1,348,000	1920	13,440,000
1850	2,136,000	1930	13,932,000
1860	3,841,000	1937	18,000,000

to year; but, except for two periods in our history, our production of cotton has tended to increase. There was a temporary decline about 1920, before growers learned how to combat the boll weevil, and again in 1933-34, when compulsory reduction of acreage was enforced under the Agricultural Adjustment Administration.

Cotton is also grown in foreign countries. The cotton production of other nations has increased even more rapidly than our own as shown from the following table:

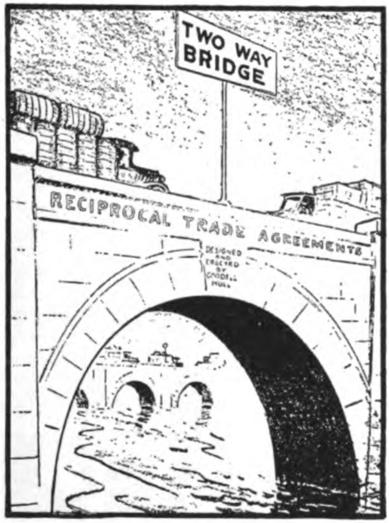
COTTON PRODUCTION IN FOREIGN COUNTRIES

(*Production in Bales*)

Year	*Production*	*Year*	*Production*
1890-91	3,165,000	1920-21	9,889,000
1900-01	4,676,000	1930-31	12,298,000
1910-11	6,791,000	1937-38	20,100,000

The United States, each year after 1790, produced more cotton than all other countries combined, until 1933-34 when, for the first time, the world production of other countries exceeded our own.

Increase in foreign cotton production has been taking place for more than fifty years. It has been most marked since 1930. While there was an acreage increase of one million in the United States, there was an increase of 3 million in Brazil, almost 5 million in Russia, 6 million in India, and 5 million in other countries. The increase in China was about equal to our own. The increase in Egypt was about 250,000 acres.

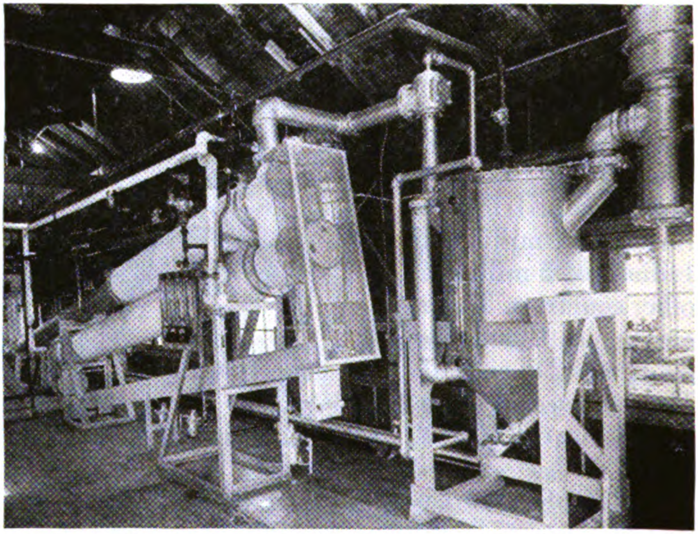


In 1891-92, the United States was producing 74 per cent of the world's cotton. In 1937-38, our production was but 46 per cent of the crop produced in the world.

Cotton Consumption.—Since the price of any commodity is normally determined by the relation of supply and demand, let us consider the consumption of cotton. Cotton consumption has not kept pace with production. For many years the world's cotton consumption was about 25 million bales annually. While the world consumption has increased slowly over several decades, it has never reached 35 million bales. For twenty years there has been no marked change in the consumption of American cotton in the United States.

Each year we may expect to sell 6 or 7 million bales of cotton at home. Our foreign sales, since the close of the World War, have varied from 5 to eight million bales.

In 1936-37 we consumed 7,766,000 bales of American cotton at home and sold 5,289,000 bales to other



INDUSTRIAL USES FOR FARM PRODUCTS
Equipment in plant of the Ford Motor Company for making plastics and paint from soybeans.

countries. The total consumption of American cotton for that year was 13,055,000 bales.

Cotton Prices.—The price of cotton has fluctuated from 35 cents per pound in 1919-20 to less than 6 cents in 1931-32. As the supply increases in relation to demand, the price tends to decline. It is a fact that the larger crops have often sold for less than smaller crops. And, naturally, since it cost more to produce the larger crops the grower was injured; injured in two ways—he spent more, and received a smaller income.

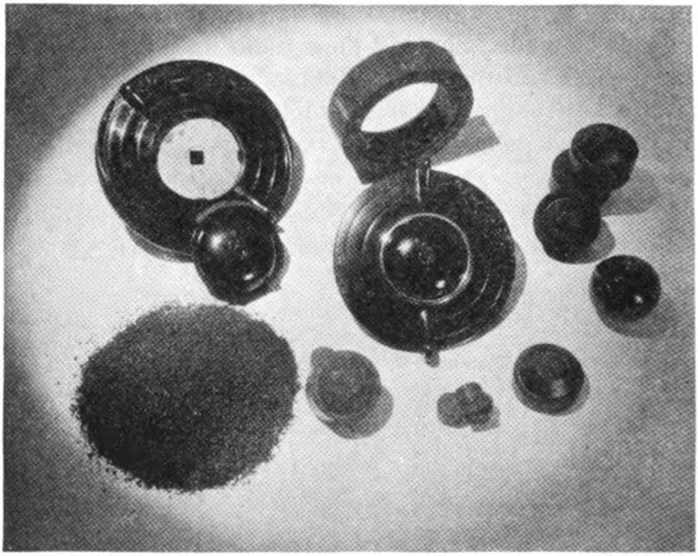
Agricultural Adjustment.—Since the collapse of farm prices in 1920, there has been a constant demand that some plan for insuring a better farm income be provided through national legislation. Several attempts have been made. Some of these plans have failed, others have increased the income temporarily, and there have been frequent changes in the plans, but no plan has been in operation long enough to be accepted as permanent.

Farmers feel justified in asking for Federal action to

COTTON PRODUCTION IN THE UNITED STATES

Year	*Acres Harvested*	*Yield Per Acre*	*Prod. 1000 bales*	*Price*
1909	30,550,000	156.5	10,005	13.6
1910	31,508,000	176.2	11,605	13.9
1911	34,916,000	215.0	15,694	9.6
1912	32,557,000	201.4	13,703	11.4
1913	35,206,000	192.3	14,153	12.5
1914	35,615,000	216.4	16,112	7.3
1915	29,951,000	178.5	11,172	11.2
1916	33,017,000	165.6	11,448	17.3
1917	32,245,000	167.4	11,284	27.1
1918	35,038,000	164.1	12,018	28.9
1919	33,566,000	161.5	11,411	35.2
1920	34,408,000	186.7	13,429	15.9
1921	28,678,000	132.5	7,944	17.0
1922	31,361,000	148.8	9,755	22.8
1923	35,550,000	136.4	10,140	28.7
1924	39,503,000	165.0	13,630	22.9
1925	44,390,000	173.5	16,105	19.6
1926	44,616,000	192.8	17,978	12.5
1927	38,349,000	161.7	12,956	20.2
1928	42,432,000	163.3	14,477	18.0
1929	43,242,000	164.1	14,825	16.8
1930	42,454,000	157.0	13,932	9.5
1931	38,705,000	211.5	17,096	5.7
1932	35,939,000	173.3	13,002	6.5
1933	29,928.000	208.5	13,047	9.7
1934	27,515,000	169.2	9,730	12.6
1935	27,335,000	186.0	10,638	11.1
1936	30,054,000	198.0	12,407	12.3

protect their income, because manufacturers have been accorded protection in the form of tariffs. They feel, too, that the entire nation will profit if the buying power of farm people is increased.



—*Courtesy Ford Motor Co.*

PLASTICS MADE FROM SOYBEAN MEAL

In any agricultural adjustment program a farm commodity that depends largely upon foreign outlets for a market, is placed at a distinct disadvantage. Any program for increasing the farm income tends to raise prices. On a domestic basis, this is not objectionable, for these prices are in line with those of other commodities. The farmer, at home, may reasonably expect a *parity price*. A parity price is one that is so adjusted from time to time that the same quantity of farm products, say a bale of cotton, will always pay for the same quantity of goods which the farmer buys. But if the price of a commodity that seeks a world market is raised in one country, it tends to reduce the sales abroad, if the same product can be secured elsewhere by foreign buyers.

What the future of cotton will be as an American crop, we do not know. Many factors tend to complicate the situation. Rayon is a competitor of cotton, other countries are increasing their production, and it is even said that chemical processes have been perfected for making garments out of the cellulose in pine trees. On the other hand experimental work is being conducted in an effort to find new uses for cotton.

Regardless of the current legislation in force, every farmer must make an *agricultural adjustment* of his own. This should take the form of a farm plan in which is included the crops that will be grown and the rotations that will be followed. The plan should vary from time to time on the basis of the *outlook*. By the word *outlook*, is meant the prospect for prices upon the bases of supply and demand. Outlook material is published for every farm commodity each year, both by the U. S. Department of Agriculture and your state Extension Service.

The basic question for every farmer to ask is, "*What can I grow for which there is a satisfactory market?*" A satisfactory market is one that will return a profit over the cost of production. Farmers, if they would be efficient, must know the cost of production per unit. This information is the best guide in deciding what crops to produce.

It is a fact of great significance that the South, though largely agricultural, does not feed its own people. Great quantities of meat, dairy products, and other foods are "imported" from other sections of the nation to feed the people of the South. The Southern farmer has a distinct advantage in reaching these customers but he has not realized it.

Any agricultural adjustment program in the South should include the objectives of (1) lower costs of production, (2) greater yields per acre, and (3) local production of all farm products consumed in the South, so far as this is possible. These objectives will contribute to a better farm income.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Give statistics which reveal something of the progress of agriculture since the adoption of the constitution.
2. What has agricultural progress meant to industrial development?
3. How is the reduction of hours of labor related to the cost of production per unit? How is reduction of hours of labor related to the income of an individual producer?
4. To what extent has agricultural progress been due to the use of improved farm machinery?
5. Discuss the use of improved farm machinery in connection with grain farming.
6. How has the combine affected employment? acreage in wheat? income of wheat producers? and competition in growing wheat in sections outside the "grain belt."
7. Can cotton be produced in your section with 5 hours and 2 minutes labor per acre? If this method of production were generally practiced how would it affect labor requirements?
8. Can a farmer produce wheat for the market and not use improved machinery? Why?
9. Can a farmer afford not to use the most improved machinery available? If there are exceptions, give the conditions.
10. Why has it been difficult to perfect a cotton picker?
11. Discuss the relation of a farmer's income to his total production, and to per acre production.
12. What is meant by the term surplus as applied to a farm crop?

13. Why do farm surpluses affect non-farm workers?
14. Discuss cotton production from 1790 to the present time.
15. In what foreign countries is cotton grown?
16. What change has taken place in foreign cotton production since 1865? since 1920?
17. What per cent of the world's cotton is grown in the United States now?
18. Has cotton consumption kept pace with cotton production?
19. What per cent of the American cotton crop was sold to other countries prior to 1930? since 1930?
20. How much cotton is consumed annually in the United States?
21. What would happen in the Cotton Belt if we could sell no cotton abroad?
22. Why is it that some of our larger cotton crops have sold for less than smaller crops?
23. What is meant by the term *agricultural adjustment?*
24. What is a tariff? Does the tariff help manufacturers? How? Does it help non-farm labor? How?
25. Does the tariff help or hurt farmers? Why?
26. What are some of the efforts that have been made to help increase the farmer's income through national legislation? Have these efforts been successful?
27. If the price of cotton is raised by legislative action, what effect, if any, will this have on the volume of our foreign trade?
28. What is meant by a *parity price?* by a *parity income?* Give examples.
29. To what extent can a farmer make an agricultural adjustment of his own that will increase his income? Is concerted action on the part of all farmers necessary? Discuss fully.
30. What is meant by the term *agricultural outlook?* When and by whom is outlook material published?

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Agricultural Adjustment Administration, U. S. Department of Agriculture.
Achieving a Balanced Agriculture.
Agriculture's Share of the National Income.

Agricultural Adjustment—1933-35 (other annual reports).
Farmers' Bulletins, U. S. Department of Agriculture
1774—*The Farmer Looks Ahead.*
Bureau of Agricultural Economics, U. S. Department of Agriculture
The Cotton Situation (In two parts).
Part I—*Cotton Production in the United States*
Part II—*Foreign Cotton Production*
U. S. Department of Commerce
174—*Cotton Production and Distribution.*
Cotton Exchanges
The Cotton Year Book—(annual) New York Cotton Exchange
The Cotton Crop (annual) New Orleans Cotton Exchange

Suggested Activities

1. From the Yearbooks of the U. S. Department of Agriculture, or other source, make a study of the trend in the production of cotton, tobacco, or some other crop. Chart the production for a period of years on graph paper and on the same paper plot the curve of the price for the same years. Determine the relation of production and price.
2. Make a study, over a period of years, of the production of cotton, tobacco, or some other crop in your state and determine to what extent your state conforms to the national trend.
3. Make a list of plans which have been tried to increase the farmers' share of the national income. This information can be secured by talking to farmers in your community. Determine to what extent such efforts have been successful, in the opinion of these farmers.
4. Make a study, from the reports of the U. S. Department of Commerce or elsewhere, of the export trade of the United States, especially that relating to farm products, and determine whether our exports are increasing or decreasing. If possible, determine the reason for the change.

Chapter 3

LIVING AT HOME

GEO. W. COLLETT

SHOULD every farm in the South produce all the staple food required by the family?

Should every farm produce all the feed required by the workstock and other farm animals?

Should every farm be made a self-sustaining unit? That is, should we attempt to live-at-home to a greater extent than we do at present?

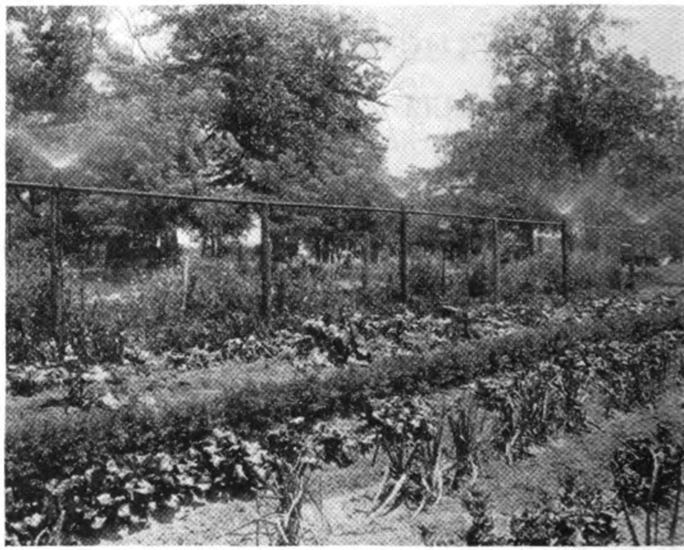
These are vital questions to consider in farm management. They are important in relation to net farm income and agricultural adjustment.

In the early history of this nation every home was self-sustaining. Not only was all the food consumed produced on the home farm, but it was processed by the members of the family. Even hats and shoes and the cloth for their clothing, as we know, were made in the home.

Under this pioneer plan of living, little money was available. But little was required. There was, however, an abundance of food, and the people of that period thought they had a very desirable and satisfactory standard of living.

With the invention and use of new and improved implements, farmers found that they could make a larger income if they specialized in the production of one or more crops. Thus we developed the *commercial type of farming*. Such farmers produced a "surplus" of one product and used the money derived from its sale to buy the necessities of life.

We have abundant proof to show that we have bene-



A Good Garden Is Essential

Every live-at-home program includes a large garden and this one in South Carolina has overhead irrigation made possible by the use of a windmill.

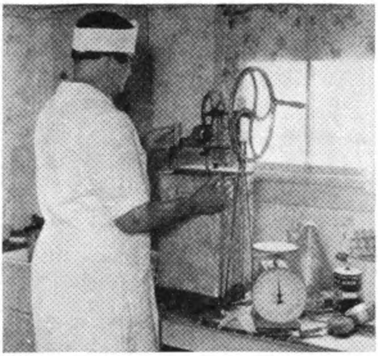
fited from the *commercial* system of farming. For the nation as a whole, it has proved more profitable than the self-sustaining plan which it replaced. But when the money earned from the production of one or two *cash crops* does not supply all the requirements for an adequate diet for the producers, then that type of farming has failed in its purpose.

The division of labor in the production of the necessities of life has, on the whole, made possible an improved standard of living. This applies particularly to farming. We cannot, in one part of the nation, grow all of the foods that we enjoy. Too, there are sections particularly adapted to the growing of crops which cannot be produced economically in other parts of the nation. But if the growing of one or two basic crops will not always provide the cash with which other supplies can be acquired, then there is no great advantage in the so-called commercial type of farming. This is especially true when surplus production depresses the selling price of basic farm commodities.

A WELL-STOCKED PANTRY
Few men realize how much food is required in the annual budget of an average family.

Years ago the demand for American cotton was so great that it was impossible to produce all that the market would absorb at a profitable price. Since cotton could be grown only in the South, that fact gave the section an economic advantage. Growers were quick to adjust farming to the demands for cotton. Hence the South became known as a "one crop" section. Such farming was profitable as evidenced by the fact that at one time the South controlled a large portion of the nation's wealth.

Today conditions have changed. We now grow many crops. But as yet we do not produce all the food and feed we need. In one Southern State there are 75,000 farms without a cow. These farmers do not buy the dairy products they need; they do without them. For the most part, the diet of persons on such farms is deficient in milk, butter, and the other delicious and healthful foods made from milk. Such farms should have one or more cows and grow the feed for them. In fact, if a system of rotation which is necessary to prevent soil erosion and to increase acre-yield is practiced, some crops must be grown from which cash returns can be realized only if they are used to feed livestock. With more livestock on Southern farms a balanced system will be attained, a distributed income will be made possible, and a more healthful and adequate diet will be provided for farm families.

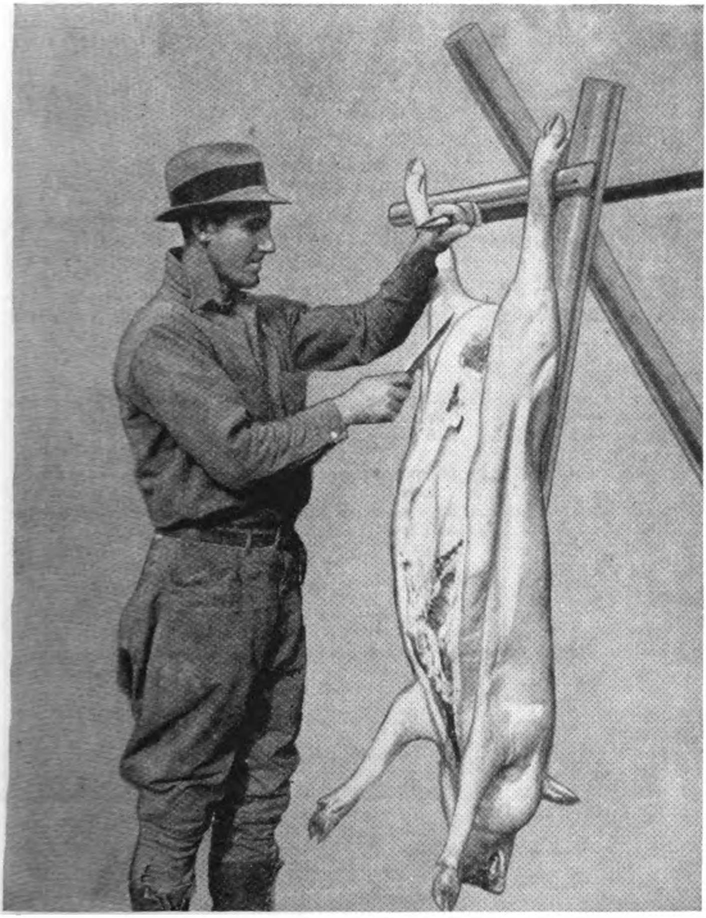


MAKING BUTTER FOR HOME USE
Dairy cattle can supply more essential items for the family food budget than any other class or kind of livestock. Every farm in the South should provide generously for cows, hogs, and hens, and the feed crops required by these farm animals.

Living at Home.—In recent years the tendency in Southern farming has been more and more directed towards providing, first of all, for a live-at-home program which will produce an adequate supply of food for the farmer's table and feed for his livestock.

How much food is required for a farm family? How much feed is required for the livestock on a given farm?

Tables to be used as guides for making such calculations have been prepared by the Extension Service of many colleges of agriculture. The plan following on page 42 was prepared by Clemson College:



An Important Home-Supply Item
Southern people consume more pork than the residents of any other section of the nation.

It Pays to Live at Home

Suggestions from the South Carolina Live-at-Home Plan

(For a Family of Five
Two Adults and Three
Children)

Product	*Yearly Amount*	*How to Provide*
Milk 1 quart per day per child 1 pint per adult	1,456 quarts (364 gallons)	Two cows, freshening at different seasons, giving two gallons of milk daily for a period of ten months. Reserve 15 gallons per week for butter
Butter 1 pound per week per person	260 pounds	
Meat 5 servings per week per person	650 pounds on a fresh meat basis	One beef—500 pounds live weight
48 pounds of beef and veal	240 pounds beef	
76 pounds of pork and lard	380 pounds of pork and lard	Three hogs—180 pounds live weight
6 pounds of lamb, mutton, fish, or game	30 pounds of lamb—or other meats suggested	One lamb—60 pounds live weight
Eggs and Poultry 10 eggs weekly per person	2600 eggs from 30 hens	A flock of 50 hens will provide this egg and meat supply. Hatch 200 baby chicks each year.
Chicken served twice a week	100 chickens for meat	
Cereals 20 to 24 pounds cereal products weekly	20 bushels of wheat furnishing 784 pounds of flour 10 bushels of corn furnishing 480 pounds of meal	1 or 2 acres each of corn and wheat would be ample to supply family needs
Vegetables Three servings daily including potatoes		
Leafy or Green 2 servings weekly Collards Spinach Turnip greens	174 pounds fresh	600 feet of greens divided as desired
2 servings weekly lettuce	65 heads	60 feet
raw cabbage	19 heads	25 feet

Tomatoes adults 3 to 4 weekly servings children 6 to 7 Fresh—9 pounds weekly, 26 weeks Canned—4 quarts weekly, 26 weeks	4.6 bushels fresh 6 bushels canned or 108 quarts	Make three plantings, early, medium, and late 200 feet each
Other Vegetables 7 servings weekly—3 servings per pound	303 pounds fresh (Average ⅓ pound per serving—26 weeks)	1000 feet distributed as desired
Beans Peas Corn Onions Okra Carrots Beets Others	130 pounds stored for 26 weeks 86 quarts canned requiring 301 pounds averaging 3½ pounds per quart	
Potatoes 1 serving daily, average 3 servings per pound	10 bushels, Irish and sweet	5 rows 100 feet each; 2½ pecks seed Irish; 600 sweet potato plants
FRUITS 2 servings daily 2 fresh fruits—26 weeks 1 fruit canned—26 weeks 1 fruit stored or dried—26 weeks	12 bushels fresh 180 quarts canned—as desired	10 apple trees 8 peach trees 4 pear trees 4 plum trees 4 fig trees 100 strawberry plants 16 grapes 50 each dewberry, blackberry, raspberry

SUGGESTIONS FOR YOUR LIVE-AT-HOME PROGRAM

Milk.—The amount given may be supplemented with cheese and cottage cheese. About one pound of cottage cheese is made from one gallon of milk, and whey is left for poultry. Where only one cow is necessary for a family, arrangements with a neighbor should be made so milk may be obtained during time when cow is freshening.

Poultry.—A flock of 50 hens should furnish the egg and meat supply. To maintain such a flock, besides providing year-round meat, 150 baby chicks should be hatched each spring and 50 in the early fall. Sixty layers should be secured from the spring chicks, while the cockerels, culls, and fall chicks should furnish the table meat. Any surplus cockerels and culls may be canned.

A COMMUNITY MEAT-CURING HOUSE

This community curing house in Arkansas is typical of those to be found in all parts of the South.

Meat.—In addition to poultry and eggs, five servings weekly of beef, pork, mutton, fish, or game is recommended. In order to distribute properly the lean meat supply throughout the year it is advisable to can approximately three-fourths of the beef as well as much of the pork at killing time. Pork loins, sausage, and spare ribs are adapted to canning. Beef is canned as steak, roast, stew, hamburg steak, and soup stock. The beef and veal for this budget might easily be produced from the calves of the cows kept for milk. A pressure cooker is indispensable in canning meat and vegetables. The hams, shoulders, bacon, and jowls of the hog carcass should be cured.

Vegetables.—A "serving" usually indicates about ½ cup portion. Garden plans naturally differ greatly, but fresh vegetables are possible in South Carolina during every month of the year and it is best to have at least one of the two daily servings a fresh or stored vegetable. Amounts of stored and canned vegetables should follow a regular budget plan to supplement where fresh foods are lacking. Special emphasis should be put on tomatoes in a strict live-at-home program since citrus fruits are not grown in South Carolina. Plant tomatoes so that they will not all mature at the same time, making the fresh season longer and the canning season easier. It is needless to can those vegetables which may be stored.

Provide for the Baby.—Small cans or jars of tomato juice and vegetable purees made from peas, beans, spinach, etc., are helpful to have on hand.

Fruits.—Use at least two servings of fruit daily, more if available. (Do not count preserves, jams, jellies.) Apples may be stored for year-round use, pears will keep stored a few months, and peaches and apples are often dried. The other fruits are canned for winter use.

Number of trees and berries recommended for use of an average family—*Ten apple trees:* 1 Early Harvest, 2 Starking or Delicious, 3 Stayman Winesap, 2 Winesap, 2 Yates. *Four pear trees:* 4 Kieffer. *Eight peach trees:* 1 Early Rose, 1 Carmen, 2 Belle of Georgia, 1 Hiley, 3 Elberta. *Four Plum trees:* 1 Abundance, 1 Burbank, 2 Shiro. *Four fig trees:* 4 Celestial. *Fifty raspberry bushes:* 25 Cuthbert, 25 St. Regis. *One hundred strawberry plants:* 50 Klondyke, 50 Aroma. *Sixteen grapevines:* 4 Moore's Early, 2 Concord, 4 Niagara, 4 Delaware, 2 Scuppernong. *Fifty dewberry:* 25 Lucretia, 25 Young. *Fifty blackberries:* 25 Snyder, 25 Eldorado.

Wheat.—Should be home-grown for use as flour and cereal. Approximately 20 bushels are necessary for this. Some flour should be ground from the entire wheat kernel.

Corn.—For use as corn meal, grits or hominy about 10 bushels will be needed. Some yellow corn should be grown.

Live-at-home plans for other states do not differ materially from the one proposed for South Carolina.

The Virginia Plan calls for the home production of certain sweets including 50 gallons of molasses or sirup; 50 pounds of honey; and 5 gallons of apple butter. One-half acre of sorghum and four hives of bees will supply the sirup and honey.

Of course, not all families will wish to include the same foods in the diet. And not all foods, for example, apples, can be produced easily in all parts of the South.

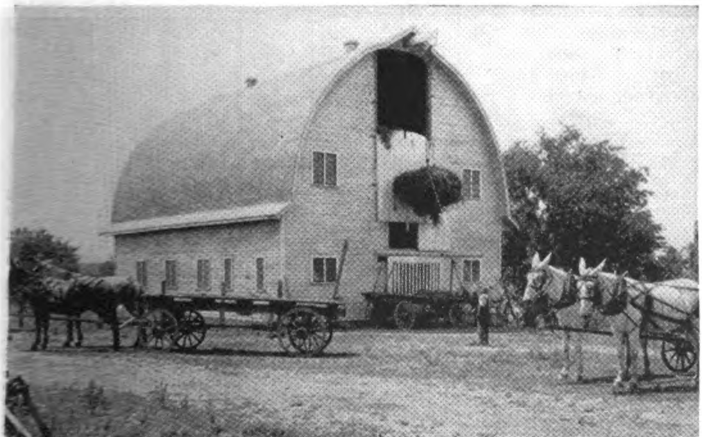
MAKING SIRUP IN ALABAMA

Making sirup from sweet sorghum or sugarcane is an essential part of a live-at-home program.

The *North Carolina Farm Food Supply and Feed Budget,* which is prepared for the family that is "*farming to make a living,*" includes the following feed suggestions for livestock:

FEED BUDGET FOR ONE YEAR

Kind of Feed	*Dairy Cow*	*Beef Animal*	*Hog*	*Mule*	*Sheep*	*Fifty Hens*
Corn (bu.).............	15	12	11	50	25 (lbs)	44
Oats (bu.)..............	12			20		23
Cottonseed meal (lb.)....	500	100			5	
Wheat bran (lbs.).......	200					
Hay (tons).............	2½	1½		2	⅕	
Pasture (acres).........	2	2		1	⅖	
Wheat Shorts (lbs.)......			50			
Meat Meal (lbs.)........			50			570
Wheat (bu.)............						35
Steamed Bone Meal (lbs.)................						116



LESPEDEZA HAY IN TENNESSEE

Filling the barn loft. A program of balanced farming which will control erosion and produce a better farm income in the South requires more hay production. The South produces less hay than any other section of the United States.

The livestock feed requirements as calculated in the State of Texas, Bulletin 99, are given in the following table:

FEED REQUIRED FOR FARM LIVESTOCK AND POULTRY

Product	*Yearly Requirements*						*Total*
	50 Laying Hens	*One Dairy Cow*	*One Beef Calf*	*One Hog*	*One Lamb*	*One Horse or Mule*	
Grain*......lbs.	3,500	1,760	1,500	840	150	3,400	11,150
Protein supplement**....lbs.	200		250	80	40		570
Cotton seed.....		800					
		or					
Cotton seed meal		400		or			
Tankage.......							
Meat scrap and bone meal....							
Fish meal.....							
Skim milk gals.	365			125			490
Minerals....lbs.							
Salt..........		50	25		10	50	135
Oyster shell...	50						50
Hay........tons		1		½	$\frac{3}{40}$	2	$3\frac{23}{40}$
Silage......tons		3					3
Improved pasture ....acres	½	2	½	⅛	¼	2	5⅜

* Grains such as corn, grain sorghum, wheat, oats, and barley.

** By protein supplement is meant a feed rich in protein to supplement the carbohydrate feeds such as corn or grain sorghums for the livestock. The protein supplement for dairy cows may be cottonseed meal, peanut meal, soybean meal, and so forth. For poultry the protein supplement may be skim milk or meat scraps.

Again, the rations will vary with the states, and, indeed with each farm. Peanuts and sweet potatoes will be used, instead of corn, to feed hogs in many places. A greater variety of feeds will be used in many cases. Velvet beans, and many other crops may be added. The principle, however, remains the same. The objective is to begin planning by determining the food and feed requirements for the farm.

Our Trade Balance.—Very few people have any conception of the vast quantities of goods that are bought

Baling Hay
Providing winter feed for livestock must be made a part of the live-at-home program.

The Trench Silo
The trench silo provides an economical way of storing succulent feed for livestock in winter.

from other sections of the country each year by Southern people. It is said that our unfavorable balance of trade is one billion dollars a year. This means that we, as a section, spend one billion dollars more with other people than they spend with us. It is very important to realize this for the reason that if we spend more than we receive in return then we cannot save capital. If we cannot accumulate capital then we cannot buy the things, such as improved farm machinery and better livestock, which will help us make a larger income.

Although the majority of the people of the South are engaged in farming, we buy a vast quantity of food and feed products from other sections of the country. With the decrease in satisfactory markets for the basic farm products, this practice is, for the most part, unwise. Of course, we cannot produce all the food and feed products that we want. It is fortunate, perhaps, that this is true. We must buy some things from others in order that they may have money to buy our surplus products. There are but two ways, however, to improve one's economic condition—one is to make more, the other is to spend less.

Since we spend such large sums for farm products, many Southern leaders have attempted to determine just what part of the necessities of life we produce at home and what portion we buy from others. Such a study was made in the state of Tennessee. It was found in every county in which such a study was made, that large sums were expended for food and feed products grown outside of the county, and for the most part outside the state. Below is given a table of a number of products showing to what extent one Tennessee county was self-sustaining. It should be stated that Tennessee makes a far better showing in this respect than many other states in the Southern portion of the United States. In the first column are listed some of the articles which farmers use. All are farm products—food and feed. In the second column is given the total quantity of these products sold by dealers in the county. In the third column is given the part of this supply which was shipped into the county. It should be said also that most of these products were produced outside the state.

A Partial Live-at-Home Statement for One Rural County

Products	*Quantity Sold By Merchants*	*Quantity Shipped Into the County*
Mixed feeds (tons)	806	806
Oats (bu.)	5,130	5,130
Millet (bu.)	295	295
Cowpeas (bu.)	1,514	510
Soybeans (bu.)	2,411	2,391
Dried beans (lbs.)	357,400	357,400
Corn meal (bu.)	12,183	8,077
Flour (bbls.)	22,078	22,078
Sirup (gal.)	5,234	2,988
Canned vegetables (c)	8,117	8,117
Butter (lbs.)	31,190	10,850
Fresh pork (lbs.)	110,300	8,000
Cured meat (lbs.)	367,570	357,570
Lard (lbs.)	647,700	647,700

The persons living in this rural county bought from merchants $427,191 worth of farm products in this particular year. Of this sum, a large part was shipped into the county and into the state. All the figures in the right-hand column represent the market for these particular farm products which exists in this one county. Recognizing that what farmers need more than anything else is a market, and that the economic conditions of counties and states, like individuals, is improved only when a favorable trade balance is achieved, the Agricultural Extension Service of Tennessee issued the following statement in connection with a campaign for securing a *Planned Farm Program:*

Reducing Cash Expenses

1. Produce and conserve an adequate supply of farm grown foods. Special effort should be made to have a good year-around garden and to keep and properly care for enough cows, hogs, and poultry to supply the family needs for vegetables, milk, meat, butter and eggs.

2. Produce ample feed for the farm livestock. The growing of early feed crops, such as oats, rape, and emergency crops, such as Sudan grass, together with ample pasture, will reduce the outlay for purchased feed.

3. Keep only workstock that can be profitably employed. A brood mare or two may be kept for the production of young stock for sale and to replace older stock.

4. Use idle winter months to repair machinery, harness, buildings, fences, terraces, etc. This will save valuable time during the rush season.

5. Produce some fertility in the form of soil improving crops on all land not otherwise employed. This will reduce a future fertilizer expense.

6. Plan the farm work ahead so as to utilize available labor to the best advantage throughout the year.

7. Provision should be made to save farm seed. This will reduce next year's seed expense, and the surplus may be sold.

8. Investments on borrowed money should only be made where a small expense now will save a relatively larger expenditure later, or will result in increased income. Sound conservative use of credit is the practice of the best farmers.

Increasing Income

1. Select the best land for most important crops. Seed idle acres to soil improving crops. Every acre on the farm should produce something, either for harvest, pasture or for improving fertility.

2. Keep busy at productive work throughout the year. The addition of supplementary crops and livestock will tend to distribute the labor throughout the year, reduce risks due to unfavorable weather and prices, and make possible a larger cash income.

3. The production for sale of surplus farm seed, truck crops, hogs, calves, colts, cream, butter, chickens, and eggs, may add

greatly to the income of farmers who have heretofore depended upon the sale of one or two products.

4. Produce quality products. This is especially important when the market demand is low.

5. Improve livestock by better selection, using good sires, better feeding and care and by providing good summer pasture and more winter pasture.

Soil Conservation

1. Improve idle acres with legumes. Establish rough and eroded areas to permanent pasture, locust, or timber.

2. Cover crops, legumes, terracing and crop rotation should be made use of along with lime and phosphate in soil building programs.

3. Farm manures, carefully saved and applied, increase soil fertility and add many dollars to the income that would otherwise be lost.

SUGGESTIONS FOR STUDY

Questions and Problems

1. To what extent can a farm produce all the food required by the family? What foods cannot be produced on the farm?
2. Should a farm produce all the feed required for the live stock maintained? What feed, if any, cannot be supplied from home-grown feeds? To what extent can a farmer afford to buy feed for live stock? What feeds should he buy? Give reasons for your answer.
3. Should a farm be self-sustaining? When, and under what conditions should a farm produce more food than is required at home?
4. What is *subsistence* farming? *commercial* farming?
5. Discuss the changes through which farming has passed, with respect to subsistence, since the days of the first settlers.
6. Should a state attempt to be self-sustaining? Give the reason for your answer.
7. What is meant by the term *living-at-home?* Do you think it is a good idea to live-at-home?

8. When is it important for farmers to emphasize living-at-home?
9. Should all farms have one or more dairy cows? Why is it that there are 75,000 farms in one Southern State that do not have a cow?
10. Do you think the South should strive to attain a self-sustaining basis in food and feed production? Is this possible?
11. If every state were self-sustaining, how would this affect commerce? national income?
12. What products must other sections buy from the South? What products does the South buy from other sections?

Selected References

State Publications

Texas—Bulletin 99—*Filling the Farm Storehouse.*

Virginia—E—298—*Save By Living at Home.*

North Carolina—Circular 208—*Agricultural Program for North Carolina.*

South Carolina—*A Food and Feed Budget for Farm Families.*

Tennessee—Bulletin 179—*A Farm and Home Program for Tennessee.*

(Every Southern State has one or more bulletins like those titles listed)

Suggested Activities

1. On the basis of the figures given in the chapter, adjusted to include the foods and feeds desired, determine your farm budget in annual requirements in terms of quantities and acreage. Base the acreage requirements on the average acre-yields for a period of at least three years.
2. At the current retail prices, determine the total cost of the food budget for your family. Calculate also the value of the feed crops required.
3. Ascertain the number of people living in your state. Assuming that each of them consumed the quantities of food per year allowed in the budget, determine the total quantities of each product required to make your state self-sustaining. On the basis of average acre-yields, as given in the yearbooks of the U. S. Department of Agriculture, could

your state produce all these requirements, including the feed for the livestock? How would the acreage for each crop, for example, pastures, compare with the present acreage?

4. On the basis of the total requirements for your state, determine how your present production of milk, butter, poultry, eggs, and pork, compares with your needs. To what extent would your livestock feeds be increased if these needs were met.
5. Prepare a *canning*, or *processing* budget for your family. How many cans of each product, and how many pounds of dried or dehydrated food products will be required for your family when *fresh* products are not available.
6. Record your total farm budget under the following heads: (1) Food and feed products (list on left hand side of form); (2) total of each item required to feed family; (3) feed for live stock (make a heading—at the top—for each class of livestock); (4) total requirement of each food and feed item; and (5) the acreage, or *units,* to provide.

Chapter 4

SOIL CONSERVING PRACTICES

D. M. CLEMENTS

THE legislation which created the Agricultural Adjustment Administration gave new emphasis to soil-improvement practices. Under the terms of this legislation, all crops were classified either as *soil-depleting* or *soil-conserving.*

The soil-depleting group included most of our so-called cash crops, such as cotton, tobacco, rice, and sugarcane. It is presumed that such crops "exhaust" the land. The soil-conserving group consists of those crops which improve the soil. It includes legumes, grasses, and all plants grown as green manure crops.

One of the objectives of the Agricultural Adjustment Program was to reduce the acreage planted to soil-depleting crops. To compensate farmers in part for reducing the acreage devoted to cash crops, payments were made to them for carrying out soil-conserving practices. Many such practices were listed under the AAA Program with a definite payment assigned for each.

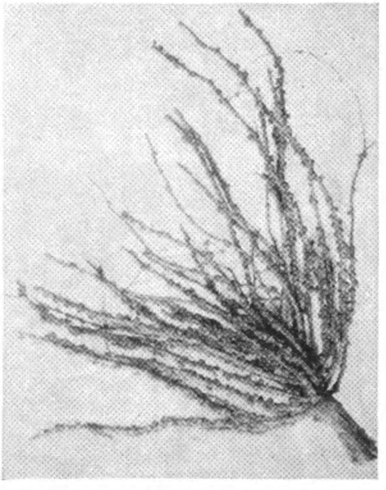
Soil-conserving practices may be summarized under the following heads: (1) growing legumes; (2) turning under vegetative matter, or green manure crops; (3) establishing permanent pastures; (4) applying lime or plant food which will be available over a long period of time; or (5) planting trees. These are desirable practices and should be included in all systems of permanent agriculture. They should be more universally adopted on

Southern farms because they will make for a better balanced agriculture. They will make farming more profitable, and ultimately make this part of the nation self-sustaining in food and feed products. Even though direct payments for adhering to the methods of good farming are ultimately discontinued by the government, dividends will continue to be collected in the form of larger incomes by those who afterwards follow good farming methods consistently.

Growing Legumes.—It has been pointed out that in any plan for the proper utilization of land, a part of it must, on account of slope or other conditions, be put into trees. The need for grasses in the control of soil erosion has been emphasized also. Probably the most important plank in a program for soil conservation and improvement is that which pertains to the growing of legumes.

A legume is a plant which has the ability to gather nitrogen from the air and store it in the growing plant and consequently in the soil. Legumes are very valuable because of their ability as nitrogen-gatherers. Nitrogen is usually the controlling chemical in crop production. It is the most expensive or costly of the plant foods when purchased in a commercial form. For this reason every crop rotation should contain at least one legume. But legumes are also very excellent feed crops, and they do better on thin, poor soils than any other class of plants.

How are legumes able to gather nitrogen from the air?



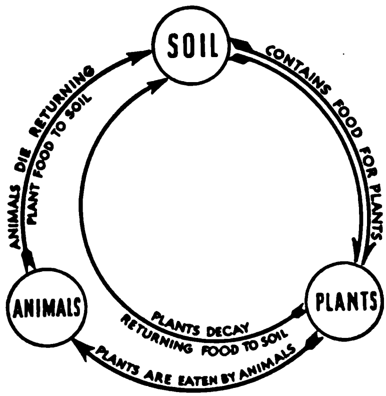
ABUNDANT NODULE DEVELOPMENT ON THE ROOTS OF A LEGUME

Legumes gather nitrogen through the bacteria that live in nodules on their roots. If you pull up any thrifty leguminous plant, you will find little balls, or nodules clinging to its roots. These nodules are the homes of bacteria. If there are no bacteria in the soil, of the kind required by the particular legume, then there are no nodules. Under such conditions the legume is not thrifty and it is gathering no nitrogen, but, like other plants, is using the nitrogen supply of the soil.

If legumes, of any particular kind, have not been grown on a piece of land previously, then it is not likely that any of the required bacteria are in the soil. In that case they must be introduced; that is, they must be planted. This is called *inoculation.*

Inoculation is the practice of providing the legume with the requisite bacteria when the crop is seeded. It is merely a means of making certain that the roots of the legume crop when they grow, will find in the soil those bacteria which supply them nitrogen from the air.

Inoculation, if thorough, provides the growing plant with an unlimited supply of nitrogen. It is the nitrogen supply which determines the protein that a legume can produce. As more nitrogen is provided, the hay or feed becomes richer in protein. Again, since protein is the most costly nutrient in feed, it pays to try to increase the protein content of the plants that are grown.



THE NATURAL CYCLE
This chart illustrates Nature's way of maintaining the productivity of the earth. When this cycle is interrupted by man, artificial methods of restoring the fertility of the land must be applied without which all life would ultimately disappear from the planet.

Legumes may be inoculated in two ways. *First,* by the use of bacteria-laden soil. In any soil on which a particular legume has been grown for some time, there is an ample supply of bacteria. This soil may be scattered over the field where the legume is being introduced and the bacteria will establish themselves. Several hundred pounds per acre should be used. Bacteria die in the sunlight; they do not live well in dry surroundings. These things should be taken into consideration in transferring the soil to the new field. Also a little soil from a well-inoculated field may be mixed with the seed. Both practices may be followed to make certain of success. *Second,* by the use of a culture. One may be introducing an entirely new legume to the community. In that case there will be no bacteria of the kind required in the soil. Under such circumstances, the bacteria must be purchased in a culture produced in a laboratory. These cultures are for sale at all seed houses. The culture is used by mixing it with the seed in accordance with the directions that are given.

Do different legumes require different bacteria? Yes. One kind of bacteria, for example, will grow on soybeans. Alfalfa and sweet clover require another. For

Turning under Crimson Clover

peas and vetches another kind of bacteria is necessary, while cowpeas and lespedeza demand another. It will be seen that there is some cross inoculation. The extent to which this cross inoculation may be depended upon in growing legumes is shown in the table prepared by the Department of Agronomy, Virginia Polytechnic Institute:

Cross Inoculation of Legumes

(Note: **Cross marks indicate which legumes are inoculated by bacteria from other legumes. For example, alfalfa is inoculated by bacteria from bur clover, sweet clover, and black medic.)**

	Bur Clover	*Alfalfa*	*Sweet Clover*	*Black Medic*	*Red Clover*	*White Clover*	*Alsike Clover*	*Crimson Clover*	*Vetch*	*Garden Pea*	*Canada Field Pea*	*Austrian Winter Pea*	*Garden Bean*	*Soybean*	*Cowpea*	*Partridge Pea*	*Peanut*	*Lespedeza*	*Beggar Weed*
Bur Clover	+	+	+	+															
Alfalfa	+	+	+	+															
Sweet Clover	+	+	+	+															
Black Medic	+	+	+	+															
Red Clover					+	+	+	+											
White Clover					+	+	+	+											
Alsike					+	+	+	+											
Crimson Clover					+	+	+	+											
Vetch									+	+	+	+							
Garden Pea									+	+	+	+							
Canada Field Pea									+	+	+	+							
Austrian Winter Pea									+	+	+	+							
Garden Bean													+						
Soybean														+					
Cowpea															+	+	+	+	+
Partridge Pea															+	+	+	+	+
Peanut															+	+	+	+	+
Lespedeza															+	+	+	+	+
Beggar Weed															+	+	+	+	+

Classifying Legumes.—All legumes may be classified as *annuals, biennials,* and *perennials.* The annuals may again be subdivided into *summer* legumes and *winter* legumes. Some of the common legumes belonging to each group which are becoming increasingly popular with Southern farmers are classified as shown below:

Summer Annuals	*Perennials*
Soybeans	Alfalfa
Cowpeas	White clover
Velvet beans	Alsike clover
Common lespedeza	Lespedeza sericea
Canada field peas	Kudzu
Winter Annuals	*Biennials*
Crimson clover	Red clover
Vetch	Mammoth clover
Austrian winter peas	Sweet clover

Value of Winter and Summer Legumes.—Experiments that have been conducted at experiment stations in the Southern States show conclusively that the growing of legumes pays big dividends in the increased yields of cash crops that follow in a rotation.

Alabama has the oldest rotation experimental field in the South. In 1896, at Auburn, a test was started to show the value of legumes as indicated by the yield of cotton. On one plot, cotton was grown continuously without any legumes; on a second, cotton and vetch were grown continuously; on a third, cotton and vetch were grown in a two-year rotation with cowpeas. This test has been in operation for more than three ten-year periods. The results are shown in the table on page 63.

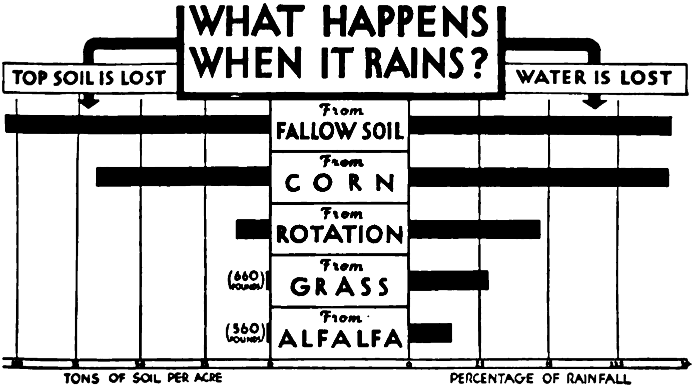
This long-time experiment shows conclusively that continuous cotton without a legume does not pay. Marked improvement is made with continuous cotton and vetch. Whether the summer legume, which for almost fifteen years has been cut for hay, pays is open to question.

Countless other experiments have shown the value of winter legumes. At the Tennessee Station, for a period of five years, the agronomists tested the value of crimson

THE EFFECT OF LEGUMES ON THE YIELD OF COTTON

Cropping System	*Yield of Seed Cotton Per Acre*			
	First 10-Yr. Aver.	*Second 10-Yr. Aver.*	*Third 10-Yr. Aver.*	*Six Year Period*
Cotton continuously no legumes	803	573	349	555
Cotton and vetch continuously	813	678	756	1,229
Cotton and vetch with cowpeas	890	958	1,041	1,211

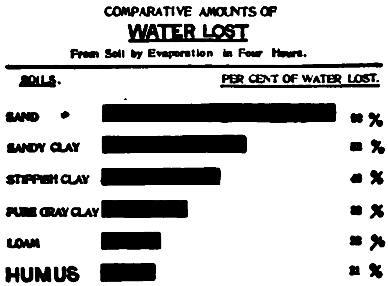
clover as measured in increased yields of corn. An average of yields for the length of the trials showed that they grew 30 bushels of corn per acre on land where no crimson clover was grown. On land where the crimson



clover was grown, but removed, the average corn yield was 41.8 bushels per acre; and on the land where the clover was turned under, the average corn yield was 43.4 bushels per acre. All plots were fertilized annually with 200 pounds of acid phosphate and fifty pounds of muriate of potash to the acre.

The gains that are made in the yields of the cash crops that follow summer legumes are more striking, if possible, than those following the popular winter legumes.

In an effort to ascertain the results which farmers were obtaining with lespedeza, the Division of Farm Management and Costs of the Bureau of Agricultural Economics, U. S. Department of Agriculture, made a number of inquiries to determine to what extent the growing of this legume influenced the yield of cotton. The results of this investigation, as reported in Farmer's Bulletin 1724, is given in the table below.

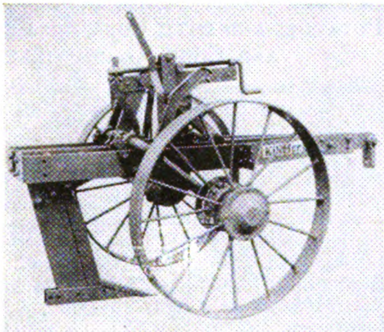


Crotalaria is one of the most striking "soil improvement" legumes now being grown in the South. It is

EFFECT OF LESPEDEZA ON THE YIELD OF SUCCEEDING CROPS OF COTTON IN NORTH CAROLINA AND TENNESSEE

State	*Acreage in Cotton*	*Period in Lespedeza*	*Yield of lint cotton per acre*		*Increase after Lespedeza*	
			Before Lespedeza	*After Lespedeza*		
	Acres	*Years*	*Pounds*	*Pounds*	*Pounds*	*Percent*
North Carolina	15	1	250	500	250	100
Do	12	2	250	500	250	100
Tennessee	15	2	100	250	150	150
Do	23	2	375	500	125	33
North Carolina	16	3	125	500	375	300
Tennessee	12	3	167	500	333	199
Do	30	3	250	500	250	100
Do	29	3	250	600	350	140
Do	17	3	334	750	416	124
North Carolina	24	4	125	800	675	540
Total	193	—	2,226	5,400	3,174	—
Average or percentage	19.3	—	222.6	540	317.4	142

strictly a crop to be turned under as it has no value as a forage. There is no crop, however, which under favorable circumstances makes a larger vegetative growth. In the Coastal Plain this crop is increasing rapidly in popularity as its influence on subsequent crop yields is noted.



—*Courtesy Killefer Mfg. Cor.*

THE KILLEFER SUBSOILER

An experiment to test the value of crotalaria and other legumes as measured by the increased yield of the other crops which followed them was made by the Agronomy Department of the Florida Agricultural Experiment Station. A two-year rotation of sweet potatoes and corn was used. As a check against the value of the legumes selected for the test, Florida pusley, a nonlegume, was used. The results obtained are shown in the table on page 66.

It will be noted that crotalaria was the most valuable cover crop and that it increased the yield of sweet potatoes 18 bushels per acre, and the yield of corn 7.9 bushels per acre.

Such very favorable results as those obtained from experimental tests, and from the experience of the farmers in the State, has led the Florida agronomists to reach the following conclusions in regard to crotalaria as a green manure crop:

"As a soil improver for Florida, crotalaria has given better results than any other leguminous crop. The percentage and quantity of nitrogen in crotalaria is as high as or higher than in any other leguminous crop, depending on the stage of growth. This high percentage of nitrogen, coupled with the large yield of top growth, has produced from 83 to 207 pounds of nitrogen per acre in

EFFECTS OF "CROTALARIA STRIATA," AND OTHER SPECIFIED SUMMER COVER CROPS, IN A 2-YEAR ROTATION WITH SWEET POTATOES AND WITH CORN IN THE YIELDS OF SWEET POTATOES AND CORN, GAINESVILLE, FLORIDA, 1925-28

Cover Crop	*4-Year Average Yield of Cover Crop per Acre 1925-28*	*Sweet Potatoes*		*Corn*	
		4-Year Average Yield per Acre 1925-28	*Increase in Yield per Acre*	*3-Year Average Yield per Acre 1925-28*	*Increase in Yield per Acre*
	Pounds	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Florida pusley	1,134	20.8	—	8.7	—
Beggarweed	766	23.4	2.6	12.0	3.3
Velvetbeans	1,722	26.9	6.1	16.8	8.1
Cowpeas	1,759	27.9	7.1	14.2	5.5
Crotalaria striata	5,445	38.9	18.1	16.6	7.9

tests carried out at the Gainesville and Lake Alfred stations. The greater part of this nitrogen is fixed from the air by the nodule bacteria on the roots of the plants. Turning under this high nitrogen crop not only increases the available nitrogen in the soil but also adds to the humus content of the soil. When compared with other green manure crops turned under, crotalaria produced 3,000 pounds more organic material per acre.

"Decomposition goes on very rapidly if crotalaria is turned under in a succulent stage of growth. When it is turned under in the more mature growth stages, it decomposes more slowly and prevents the heavy loss of nitrogen and organic matter which generally takes place in Florida during the long periods of favorable temperature and moisture conditions. This slower decomposition of the plant residue provides available nitrogen to the growing crop over a longer period of time or in amounts favorable for the needs of the crop. This increase of organic matter in the soil decreases the loss of fertilizer constituents, augments its water holding capacity, and lessens excessive aeration by cementing together the sandy soil particles."

—Courtesy Killefer Mfg. Cor.

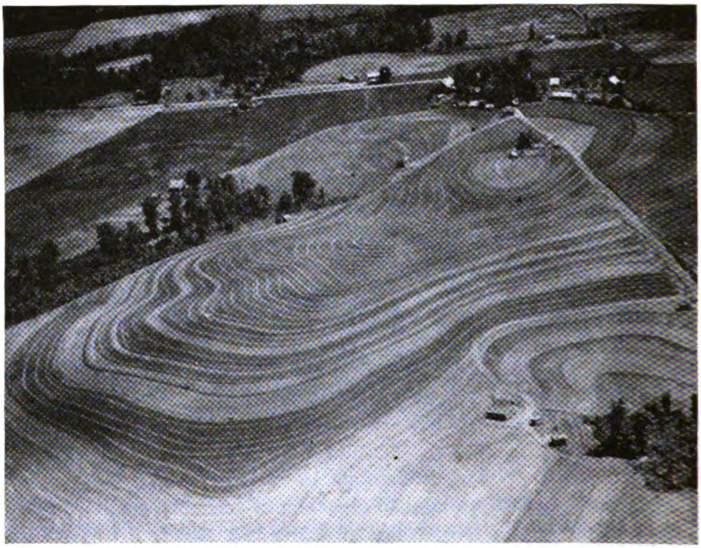
THE SUBSOILER IN ACTION

The subsoiler breaks up land to great depth without bringing "raw" soil to the surface. It is often used above newly-formed terraces, in pastures, and for "breaking" the stiff subsoil prior to planting.

Water Requirements of Plants.—One of the greatest values of green manure crops is that when turned under they increase the water-holding capacity of the soil.

Few people have any adequate appreciation of the vast amount of water plants drink.

Did you know that to produce one pound of dry alfalfa hay 831 pounds of water are required? Did you realize that 146 barrels of water are needed to grow one bushel of oats? These are large quantities, but all plants demand generous supplies of water. To make one pound of corn, 368 pounds of water are needed; one pound of cotton represents a product in which 646 pounds of water were required in the making. It takes

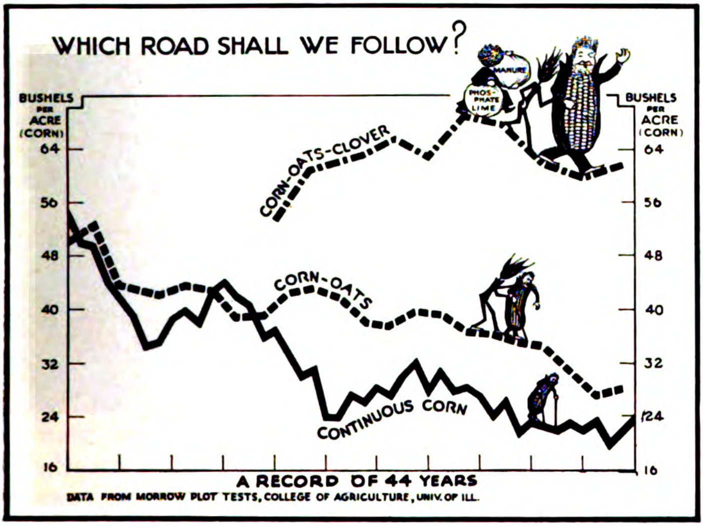


CONTOUR CULTIVATION

Air tourists over this farm in the Spartanburg, S. C., erosion control demonstration area see a new pattern of farming that farmers are using to keep the good land good and put every acre to its best use. Contour cultivation with improved terraces, rotations that always include strips of close growing crops around the slopes are replacing destructive one-crop, up-and-down-the-hill farming.

710 pounds of water to produce a pound of rice, 322 for one pound of sorghum. Incidentally, sorghum is a drought-resistant crop. This is shown in the water requirement of the plant as compared with the others included here. Sorghum is one of the most dependable crops that can be grown in the South; its acreage should be increased in order to supply grain, hay, and silage.

Water is the determining factor in the production of most crops. Did you ever notice that we generally have good crops when we have ample rainfall, well distributed? In the Corn Belt it is said that the size of the corn crop is determined by the July rainfall. In irrigated regions, where water may be applied when needed, the largest acre yields of the nation are recorded.



Water acts as a carrier of plant food. This is the principal reason why such large quantities are required. The leaves of the plants are like little factories, manufacturing the requirements for cell growth. The leaves call on the roots to supply the raw materials, or plant foods. These foods are conveyed through the plants just as bricks and mortar are carried by elevators to the place on the wall of a high building where the work is being done.

Controlling the Water Supply.—The farmer cannot control the amount of water that falls on his land. But he can do several things which will hold and conserve the supply that is made available.

CRIMSON CLOVER IN PECAN GROVE

What are some of these things?

(1) He can construct terraces which will control the rate at which water flows off the fields. When the rate of run-off is retarded not only is less soil removed, but more water is absorbed by the soil.

(2) He can practice rotations which include crops that reduce the run-off. This has the same effect upon the amount of water absorbed as do terraces.

(3) He can turn under soil-conserving crops and all crop residue, such as cotton stalks, grain stubble, and straw. One of the fine things about the new combine, which is used in the harvesting of grain and other crops,

is that it puts the straw back on the land so that it may be turned under immediately. Such vegetative matter decays and adds to the *humus* content, and consequently the water-holding capacity of the soil. The practice of

INOCULATING LEGUME SEED
Spreading out to dry.

turning under soil-conserving crops is very important in the South. Our soils do not contain enough vegetative matter. We have farmed too much with row crops. This custom is responsible, to a great extent, for our low acre yields. And low yields per acre are almost invariably associated with low incomes.

Turning under vegetative matter will make many a crop profitable that otherwise would be a total failure. Frequently in the most critical period of the growing season, or when summer or fall crops are planted, there is a period of drought. Seeds do not germinate, or plant growth stops. It has been found, at such periods, as well as at other times, that far better results are obtained on land with a large humus content. The reason for this is that in such soils there is a larger supply of water available for plant growth. Anything that the farmer can do to increase the water-holding capacity of the soil is very important in relation to yields and profits. But

A GOOD STAND OF AUSTRIAN WINTER PEAS

if green manure crops are to be provided, they must be given a definite place in the farming program. This means the adaptation of a rotation of crops to the type of farming and the locality.

Rotations.—Soil-conserving crops must be grown and soil-conserving practices followed by working out a system of rotations for the farm that will include leguminous plants. To make it possible for these legumes to render their best service, it will be necessary, on many soils, to use lime and probably some form of phosphoric acid.

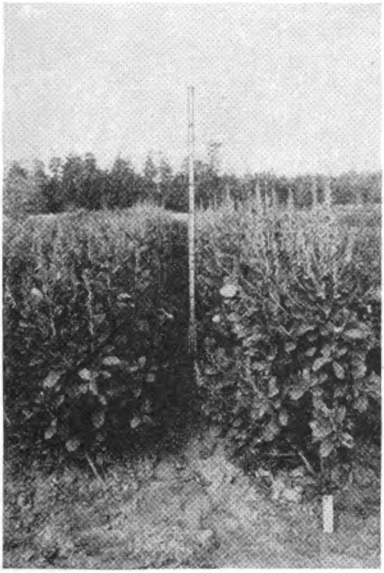
A rotation is a plan for rotating the crops grown on any one field. One of the simplest rotations that can be practiced on a Southern farm where cotton is the main cash crop is to divide the cultivated land into two parts and follow the plan in the following outline:

A CORN-COTTON ROTATION

Year	*First Field*	*Second Field*
1st......	Cotton—vetch or clover	Corn and beans
2nd......	Corn and beans	Cotton—vetch or clover

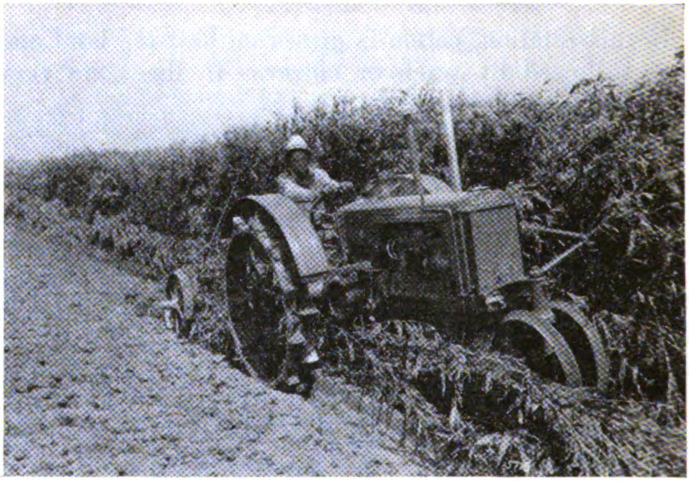
In this rotation, cotton is grown on half the land one year followed by vetch or clover. In the same year corn and beans are grown on the second half of the land. The beans, or peas, may be planted in the row with the corn, or the rows may be alternated. The second year the plan is reversed.

This rotation, which illustrates the principle of alternating or rotating crops, permits a legume to be grown on all the land each year. The ideal rotation is one that has a legume on all the land each year and provides a cover crop for all the land each winter. Rotations may be developed on the basis of a two-, three-, four-, or five-year plan.



CROTALARIA
One of the best soil-improvement crops for the lower South.

In connection with the Agricultural Adjustment Program, type-of-farming studies have been conducted in all of the states. The natural adaptation of each area has been carefully considered, and cropping plans, including rotations, developed. All of the principles taken into consideration in such planning are illustrated by the rotations given below, which constitute the recommendations for one area in North Carolina:



Power Equipment Essential for Turning under Rank Vegetative Growth

Rotations for North Carolina

(Developed for Use in Area 3 Which Lies Partly in the Flatwoods and Partly in the Middle Coastal Plain Region)

(1) Well Drained Sandy Loams

For Cotton and Corn Farmers:

(1) 1st year—Corn (for grain) with soybeans (for seed or grazing) or velvet beans (for grazing). All vines to be turned under.

2nd year—Spring oats (for hay) with lespedeza (for hay or grazing) or soybeans (for hay, seed or grazing).

3rd year—Cotton, and vetch or crimson clover in fall (to be turned under for corn).

(2) 1st year—Corn (for grain) with soybeans (for seed or grazing) or velvet beans (for grazing). All vines to be turned under.
2nd year—Soybeans (for seed or hay) or peanuts (for nuts and hay).
3rd year—Cotton, vetch or crimson clover in fall (for turning under).

(3) 1st year—Corn (for grain) with soybeans (turned under), abruzzi rye.
2nd year—Abruzzi rye (for seed), followed by soybeans and velvet beans mixed (for grazing and turning under).
3rd year—Cotton, with crimson clover after first picking (turned under the following spring).

(4) 1st year—Corn with cowpeas, followed by abruzzi rye.
2nd year—Abruzzi rye (for seed), followed by soybeans or lespedeza (for seed and remaining part turned under).
3rd year—Cotton, followed by oats-and-vetch.
4th year—Oats-and-vetch (for hay) followed by soybeans or lespedeza (turned under).

For Tobacco Farmers:

(1) 1st year—Tobacco, abruzzi rye, vetch or crimson clover in fall (for turning under).
2nd year—Corn (for grain) with velvet beans (for grazing and turning under).
3rd year—Cotton, abruzzi rye in fall (turned under the following spring).

(2) 1st year—Tobacco, with cowpeas at last cultivation (for turning under).
2nd year—Cotton or corn, abruzzi rye in fall (turned under the following spring).

For Peanut and Cotton Farmers:

(1) 1st year—Corn (for grain) with soybeans in the corn (for seed, grazing and turning under).
2nd year—Peanuts with abruzzi rye in fall (for grazing and turning under).

3rd year—Cotton or tobacco, with vetch or crimson clover in the fall (for turning under the following spring).

(2) 1st year—Corn (for grain), with soybeans in the corn (for seed, grazing and turning under).
2nd year—Cotton, with abruzzi rye after the first picking of cotton (for grazing and turning under).
3rd year—Peanuts, with crimson clover, vetch or abruzzi rye after harvesting peanuts (for turning under).

For Dairy and Livestock Farmers:

(1) 1st year—Corn (for grain) with velvet beans (for grazing and turning under), abruzzi rye in fall (for grazing).
2nd year—Corn (for silage or grain) with soybeans (for grazing and turning under).
3rd year—Oats-and-vetch (for hay) followed by lespedeza or soybeans for hay, crimson clover or vetch in fall (for grazing and turning under).

For General Livestock Farmers:

(1) 1st year—Corn (for grain), with soybeans in the corn (for seed, grazing and turning under).
2nd year—Peanuts with abruzzi rye after harvesting peanuts (for grazing and turning under).
3rd year—Cotton or tobacco, followed by oats and vetch in fall.
4th year—Oats and vetch (for hay), followed by lespedeza or soybeans (for hay), followed by fall seeding of crimson clover or vetch (for turning under).

(2) Poorly Drained Loams, Sandy Loams and Silt Loams

(1) 1st year—Corn (for grain).
2nd year—Irish potatoes; corn (for grain) or soybeans (for hay).
3rd year—Soybeans (for seed, vines turned under), or oats (for hay), followed by lespedeza (for turning under).

(2) 1st year—Corn (for grain).
2nd year—Soybeans (for seed, vines turned under); oats-and-vetch or oats and Austrian winter peas (in fall).
3rd year—Oats-and-vetch or oats and Austrian winter peas (for hay), lespedeza (for soil improvement and reseeding).
4th year—Lespedeza (for hay and turning under).

(3) 1st year—Corn (for grain); oats-and-vetch in fall.
2nd year—Oats-and-vetch (for hay); lespedeza or soybeans (for seed and vines turned under).

(4) 1st year—Peanuts, followed by crimson clover.
2nd year—Crimson clover (turned under); corn, with cowpeas at last cultivation.
3rd year—Corn, followed by abruzzi rye (for turning under).

SUGGESTIONS FOR STUDY

Questions and Problems

1. What is meant by the term *agricultural adjustment?*
2. What is a *soil-depleting crop?* Give examples.
3. What is a *soil-conserving crop?* Give examples.
4. What is meant by the term *soil-conserving* practices? How may such practices be classified? Why is each soil-conserving?
5. What is meant by the term *permanent agriculture?* by *balanced agriculture?*
6. How are farmers benefited by reducing the acreage devoted to soil-depleting crops?
7. What is meant by *proper land utilization?* Give an example.
8. What is a legume? How can legumes be identified?
9. What are bacteria? What are nodules?
10. Discuss nitrogen as a controlling factor in crop production.
    What does this expression mean?
11. What is meant by *inoculation?* How may inoculation be carried out.
12. Are all the bacteria on legumes the same? How do we know?
13. What do the terms *annual* mean, *biennial*, and *perennial?*

14. What are some of the summer annuals in the legume family? winter annuals?
15. What is the advantage of a biennial? of a perennial? Give examples?
16. How does the growing of legumes help the farmer?
17. What is meant by *protein?* Why are protein feeds highly prized? How can the protein content of legume feeds be increased?
18. What proof do we have that legumes increase the yields of cash crops? Give an example. Give an example from your state, from your community, from your farm.
19. What is meant by a *crop rotation?* Why must crop rotations be followed?
20. What are the essentials of an ideal rotation? Do you know a rotation that can be carried out successfully on your farm?

Selected References

Agricultural Adjustment Administration, U. S. Department of Agriculture.
SRAC 1—*Effects of Summer Soil-Conserving Crops on Yields of Other Crops.*
SRAC 2—*Effects of Winter Soil-Conserving Crops on Yields of Other Crops.*
SR 101—*Agricultural Conservation Program.*
Farmers' Bulletins, U. S. Department of Agriculture
1250—*Green Manuring.*
1663—*Winter Legumes for Green Manure in the Cotton Belt.*
1750—*Summer Crops for Green Manure and Soil Improvement.*
Leaflets, U. S. Department of Agriculture
137—*Crotalaria: A New Legume for the South.*
State Publications
Alabama—Bulletin 232—*Experiments With Legumes in Alabama.*
Oklahoma—Bulletin 206—*Soil Fertility and Sweet Clover Production in Oklahoma.*
Kentucky—Bulletin 374—*Legumes in the Cropping System.*
Circular 56—*Lessons on Farm Crops.*
North Carolina—Ext. Circular 208—*Agricultural Program for North Carolina.*
Virginia—Bulletin 97—*A Handbook of Agronomy.*

Suggested Activities

1. Make a list of all the crops grown on your farm, classifying each as a soil-depleting or soil-conserving crop.
2. Make an examination in the field and in the laboratory of the roots of legumes, looking for nodules. Enter your observations and impressions in your notebook.
3. Make a study of the available cultures used for inoculating legumes. Carry out the instructions for inoculating seed on the project plot of one or more members of the class. Also carry out the soil distribution plan, and that of mixing inoculated soil with the seed to be planted.
4. Make a farm study of the rotations practiced in your community. After securing a number of rotation plans, bring them to the class and make a comparison to determine, in theory as well as by observation, which is the best for each type of farming practiced in the community.
5. From the results of the discussion dealing with rotations, determine what adjustments, if any, may be made in the cropping plans in effect on your home farm to bring about better results.
6. Make a list of all the legumes grown in your community, classifying them under the four headings given in this chapter. Under each head list the crops in the order of their local value or importance.
7. Make a study in your community of winter and summer legumes in order to determine to what extent growing them has increased the yields of cash crops. Get statements from the leading farmers giving their estimates, if accurate records are not available.
8. Secure, from your county agent, a farm program for your county or area and become familiar with the adjustment recommendations that have been made. If not available locally, write your state college of agriculture for this information.

Chapter 5

SOIL EROSION CONTROL

H. H. BENNETT

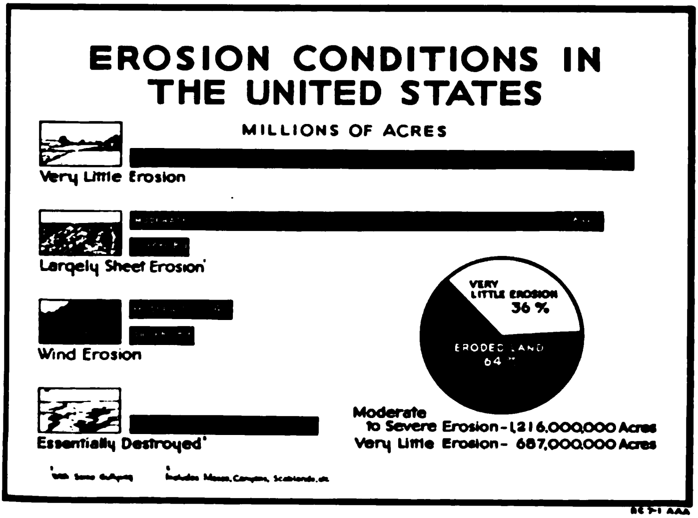
THE soil is our basic source of wealth. Man is dependent upon it for existence. The food he eats and the clothing he wears come from the land. Land is our most valued possession; we must learn to care for it properly.

Two hundred years ago most of North America was a virgin continent. The soil, for the most part, was abundantly rich. But within the short space of two centuries much of our land has been rendered practically worthless through the ravages of *soil erosion.*

Soil erosion is the uncontrolled removal of soil by natural forces. It is caused by the action of *wind* and *water*. Of the two, the soil loss from running water is the more universal and destructive. Yet there are parts of the country where *wind erosion* has done great damage. This type of erosion is usually found in areas of less than average rainfall. Following extreme droughts in such areas, dust storms occur. In fact, a great section of this country was known for a time as the "Dust Bowl" because of the effects of wind erosion.

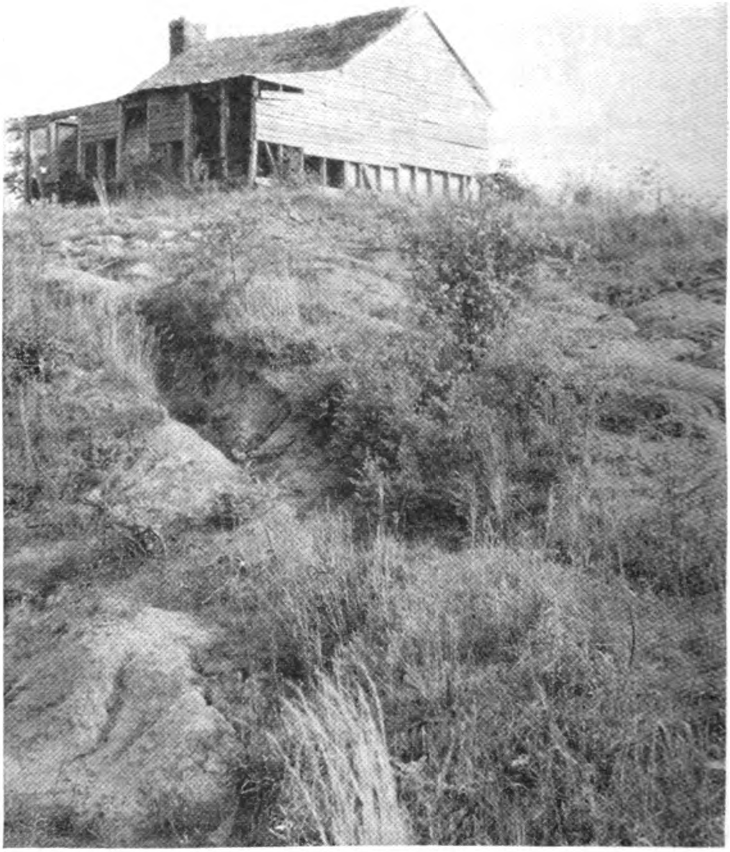
Erosion produced by the action of running water is of two types—*sheet erosion* and *gully erosion.* Sheet erosion is insidious. It is constantly in progress, but is not readily apparent. For this reason, extreme losses of valuable topsoil and plant food may be sustained before the casual observer sees that any change is taking place.

After sheet erosion progresses for a time, small finger-like depressions occur. Then the water, after a rain, runs faster and carries more soil with it. The depressions become small gullies and water rushes through them. The force and power of this water is not appre-



ciated. Cornell University tells us that if the speed of a stream which can carry a one-pound rock is doubled, it can then move a 64-pound rock with equal ease. The force of this run-off water deepens the gullies. Finally, some of them become great yawning canyons. Under such conditions, soil losses go forward at a rate that will soon make the land unfit for farming.

Each year erosion removes 126 billion pounds of plant food from our fields. This loss is as much as that removed through the production of crops in a quarter of a century. Should this loss continue, we, as a nation, will be reduced to the poverty of North China.



Poverty and Finally Abandonment Follow in the Wake of Soil Erosion

Soil Erosion in China.—"Northwestern China provides a striking example of what happens when a country continuously mis-uses its land," according to information given us by the United States Department of Agriculture.

FLOODS DESTROY LIVES AND PROPERTY
Soil erosion control will reduce flood losses.

"There, farmers for centuries have worked the land to the limit. They cut down the trees on the slopes and uplands. They tried to put every acre into intensive crops.

"The slopes and uplands could not continuously bear intensive cultivation. The rain, no longer held back by trees and grass, rushed down the mountains. It carried the soil away. Millions of acres of sloping uplands became waste.

"Millions of people had to leave the higher lands and settle in dense hordes on the plains bordering the rivers. There the land is so intensely used that even the roots of grain crops are dug up for feed or fuel.

"When rain comes, it flows rapidly over the surface of the land and into the rivers. The swollen rivers flood the bottom lands where people are densely concentrated, sometimes drowning many thousands. When the water is gone, often there is drought and famine."

Wind Erosion

This is a sad picture. But America is moving toward such a condition. Our crop lands are being impoverished. And each year, in the spring, there are floods in some portion of the nation which exact a heavy toll in lives and property.

Results of Erosion.—Erosion results in (1) a loss of water, (2) a loss of soil, and (3) a loss of plant food. As a result, the yields per acre are greatly reduced. In fact, erosion results in a change of the *soil type.* When erosion conditions obtain, farming cannot be profitable. Producers are reduced to poverty. Land values decline, farms are abandoned, and everyone is affected by the results. Erosion must be checked to insure the national welfare.

How great the loss in yields may be from erosion has been determined by experiments conducted in various parts of the nation. Some of these results are given in the table following:

EROSION AND CROP YIELDS

Yields on Surface and Desurfaced Soils

		Yields Per Acre	
Place	*Crop*	*Surface Soil*	*Desurfaced Soil*
North Carolina	Cotton	1093 lbs.	467 lbs.
Texas	Cotton	306 lbs.	12 lbs.
Oklahoma	Cotton	609 lbs.	309 lbs.
Texas	Corn	34 bu.	5.7 bu.
Kansas	Wheat	25.2 bu.	4.2 bu.
Texas	Oats	66.5 bu.	19.2 bu.

The important fact in each of the experiments cited is the reduced yield per acre obtained on the desurfaced plots which are typical of eroded soils. Can any producer afford to labor under the handicap which one faces in attempting to grow crops on eroded land? Can any farmer hope to make a satisfactory income on land where erosion is not controlled?

The weight of soil on an acre to a depth of seven inches is about 1,000 tons. If 40 tons of soil are eroded annually seven inches of topsoil will be lost in twenty-five years. Thus it may be seen that the value of a farm may be almost totally destroyed in one generation of unwise or shiftless farming methods.

Controlling Soil Erosion.—The farmer is concerned with the problem of discovering ways of controlling erosion. In general, it may be said that the following means of control must be employed: (1) the proper use of the land; (2) the establishment of rotations; (3) contour planting and strip-cropping; (4) terracing.

Proper Use of Land.—The topography of the land is very important in determining the use to which it may properly be put. Erosion increases with the slope. This fact is shown very clearly by the following table taken from Bulletin 245 of the Alabama Experiment Station:

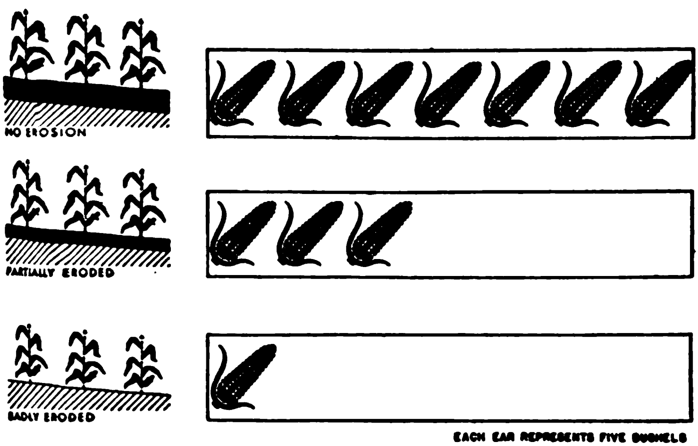
THE SIGNIFICANCE OF LAND SLOPE

Soil Losses on Controlled Plots of Cecil Clay on Different Slopes When Fallow and When Planted to Various Crops, Auburn, Alabama

Land Use	*Soil Loss in Tons Per Acre on Slopes of*				
	0 per cent	*5%*	*10%*	*15%*	*20%*
Vetch	0.35	2.77	3.71	5.33	6.89
Rye	0.97	3.37	3.63	5.95	7.00
Fallow	0.46	13.78	45.11	67.59	91.33
Cotton and soybeans in alternating rows	—	2.76	3.76	5.68	7.24
Cotton	—	3.49	7.07	25.60	23.67
Corn interplanted with velvet beans in rows	0.12	1.70	6.57	17.46	21.61
Fallow	0.34	14.57	36.89	46.04	59.10
Cotton, not chopped	1.09	6.69	19.52	40.69	47.18
Cotton, chopped	0.59	8.98	28.11	51.52	57.36
Oats	0.81	4.95	11.54	26.45	30.07
Average	0.59	6.31	16.59	29.23	35.14

It will be observed that regardless of the *land-use* indicated, the loss of soil increased progressively with the slope. It varied from an average of about half a ton on level land to 35.14 tons on land with a twenty per cent slope. On the land of steeper slopes, the loss from the production of cultivated crops was too great to be sustained. It may be noted, for example, that the loss on land of twenty per cent slope was more than 50 tons greater per acre on land in chopped cotton than on land

EROSION AND PRODUCTION PER ACRE



planted to vetch. These facts give some idea of the relation of slope to proper use.

Experiments conducted by the Soil Conservation Service indicate the following adaptation of land, on the basis of slope:

ADAPTATION OF LAND

Slope Class of Land	*Slope*	*Adaptation*
A	0-5%	may be used for any purpose desired. Little or no control necessary.
B	5-15%	Recommended for cultivation if strip-cropping and contour farming are practiced.
BB	15-25%	Recommended primarily for close-growing crops, either annual or otherwise. It may be used for intertilled crops if the farm has too little A and B land, but in such cases the strips must be narrow, and cover only a small per cent of the total slope.
C	25-35%	Not recommended for tillage but may be used for permanent pasture.
D	35%	Too steep to control erosion effectively unless forested.

An analysis of the above recommendations will reveal that on the steepest slopes erosion can be controlled only when the land is planted to trees. Land of the class indicated as C should be used only for permanent pastures. These two recommendations are of great importance to

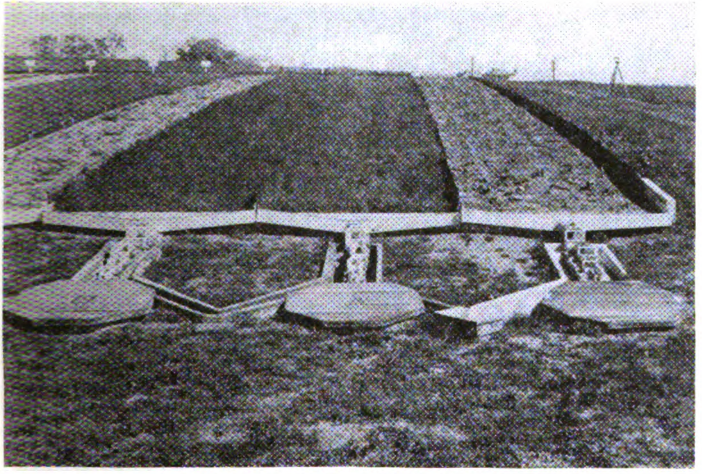
RUNNING WATER DESTROYS HIGHWAYS

This gully at Spartanburg, S. C., cost the highway department several hundred dollars before the volume of water carried was reduced through erosion control measures carried out on the farms of the county.

the Piedmont Section of the South where erosion control presents a major problem.

District Law.—The farmers of any watershed may form an erosion control district and secure assistance from the Soil Conservation Service. One of the most valuable aids available under such circumstance is a map of each farm indicating the proper land use for each field or sub-division. Half the states of the nation have passed "Conservation District Laws" which entitle the farmers of these states to Federal aid in erosion control, if they wish to take advantage of it.

Crop Rotations.—In the table giving the results of experimental work at the Alabama Experiment Station, it may be observed that the soil losses are greatest on



EQUIPMENT FOR DETERMINING EXTENT OF SOIL EROSION

the land planted to row crops. This means that soil productivity will be rapidly reduced when corn, cotton, and like crops, are planted year after year on the same land. To reduce these losses, rotations should be established. In the rotation there will be close-growing crops, such as grain. Very little soil erosion, relatively speaking, occurs on land planted to grain and forage crops.

Erosion can be reduced further if the rotation includes a soil-improvement crop which is to be turned under. Turning under a cover crop adds humus which makes it possible for the soil to absorb more water. When that is done run-off is reduced and more moisture is made available for plant growth.

Strip-Cropping.—Erosion on sloping fields can be reduced also by planting alternate strips, of close-growing crops, such as grass, small grain, sorghums, or legumes, on the one hand and of cultivated row crops, such as corn, cotton, and tobacco, on the other.

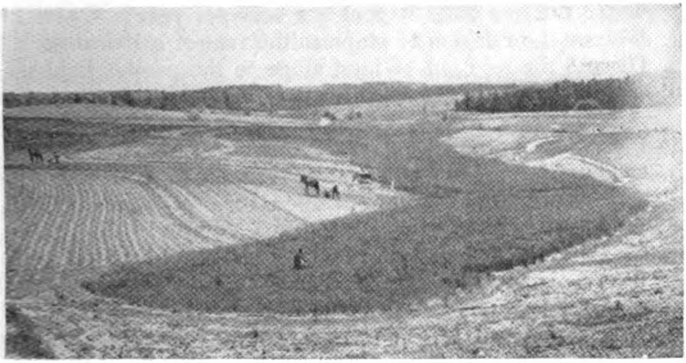
GULLY CONTROL

This ugly gully near Rome, Ga., has been mulched and is being planted to shrubs and other plants that will provide food and cover for wildlife as well as slowly reclaim the gully instead of letting it grow bigger and deeper with every rain.

The loss of water and soil from the strips planted to row crops is greatly reduced by the intervening strips of thick cover crops, which catch the washing soil and water, and thus protect the field as a whole.

Contour Planting.—Still another method of tillage which, at little trouble, may effect large savings in soil and moisture, is cultivation of sloping land along the contour lines.

Contour lines are the lines which follow the surface of a slope at the same level of elevation. Cultivation along the contours means plowing, planting, and cultivating row crops along these lines, rather than in straight furrows across or up and down the land.



A MEADOW STRIP

This meadow strip on a Georgia farm is absorbing surplus water from near-by fields and turning it into a bumper crop of hay instead of letting it wash off and be lost as well as take tons of soil with it.

SUGGESTIONS FOR STUDY

QUESTIONS AND PROBLEMS

1. Discuss the statement—The soil is our basic source of wealth.
2. Define the term *soil erosion.*
3. What are the natural forces which cause erosion?
4. What is *sheet erosion? Gully erosion?*
5. Which removes more plant food from our soils, crop production or erosion?
6. Why does erosion reduce crop yields?
7. If the yield of cotton in Oklahoma is reduced from 609 pounds to 309 pounds per acre of seed cotton by erosion, what is the amount of the loss at current prices?
8. At the present price of oats, what was the erosion loss in Texas when the yield of oats was reduced from 66 to 19 bushels per acre?

9. If the loss of soil from erosion is 57 tons per acre per year from a field planted continuously in cotton, how many years will elapse before seven inches of topsoil is lost?
10. If six tons of soil are lost per acre from land on which vetch is planted, how many years will elapse before as much soil is lost as when the land is planted to cotton where the loss is 57.36 tons per acre per year?
11. Discuss the relation of slope to the rate of soil losses.
12. Discuss the relation of land slope to the proper land use.
13. Give four ways in which losses from erosion may be reduced.
14. Define strip-cropping and contour planting.
15. On land of the same slope, give in the proper order the erosion loss when the land is in forest, pasture, alfalfa, oats, corn, cotton, and left fallow. Explain the reasons for these differences.
16. Why is it desirable to have crops rotated as a means of erosion control?
17. What is meant by *run-off?* How is run-off related to erosion control?
18. What is *humus?* How is it related to erosion control? How may humus be incorporated in the soil?
19. What crops do you grow on severely eroded land on your farm? Why?
20. Why should city people be interested in helping farmers control soil erosion?
21. How is soil erosion related to flood control?
22. How is soil erosion related to clear and muddy streams?
23. What is the Soil Conservation Service? Do you have a Soil Erosion Districts Law in your state?
24. Outline a plan for controlling soil erosion on your farm.
25. How did the Agricultural Adjustment Administration contribute to the control of soil erosion?

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Suggested Activities

1. Make a trip through your community to observe soil erosion conditions. Before starting on the trip, make a list of the things you will look for and the questions that you will try to answer. One of the questions might be: How is soil erosion related to the slope of the land? List at least nine other questions. Record your observations.
2. From field studies of your community, determine and list the most effective soil-conserving practices that are being followed.
3. If your state has passed a Soil Erosion Districts Law, secure a copy and make an abstract of its provisions.
4. Determine the per cent of slope on the fields of your home farm, using level and rods. The level should be set up and so adjusted that the bubble remains in the center when turned in various directions. Rod readings are taken at two points on the slope so located that one point is 100 feet from the other. The smaller reading subtracted from the larger one gives the slope of the land per 100 feet. It is expressed as a percentage.

Map your farm indicating the slope of the land at each point according to the symbol given in the following table:

Symbol	*Per Cent of Slope*
A	0-3
B	3-7
BB	7-10
C	10-14
D	over 14

What is the relation of slope to the degree of erosion found?

5. Using the map of your home farm and the information you are able to secure concerning the control of erosion, outline a farming and land-utilization plan that will result in reducing soil losses.

Chapter 6

TERRACING FARM LAND

M. L. NICHOLS

TERRACING protects farm land by partially controlling the run-off of water. Terracing will reduce, but not prevent soil erosion. It is, however, an important part of a program of soil conservation. When terracing is combined with a system of rotation, contour planting, strip cropping, the growing of cover crops, and other methods of soil-protection, the removal of soil will largely be prevented and the fertility of the land will largely be maintained.

Farmers in the South have terraced land since the earliest periods of our history. The first terraces were very crude. In a state examination on agriculture given several years ago, the question was asked: *What is a terrace?* One reply given was, "A terrace is a mound of earth with weeds growing on it." This answer was correct; it was based upon observation.

The narrow, high terraces of long ago have been abandoned. They have been replaced by *broad-base* terraces on which crops are planted.

One of the first popular broad-base terraces is known as the Mangum Terrace. It was named for Priestly H. Mangum, Wake Forest, North Carolina. First constructed in 1885, some of the terraces on the farm of Mr. Mangum are still serving rather effectively.

In recent years, the Nichols Terrace has been accepted as the most desirable type that can be built. This terrace was named for M. L. Nichols, the originator, who for some years was head of the Department of Agricultural Engineering, Alabama Polytechnic Institute,

—Courtesy Caterpillar Tractor Co.

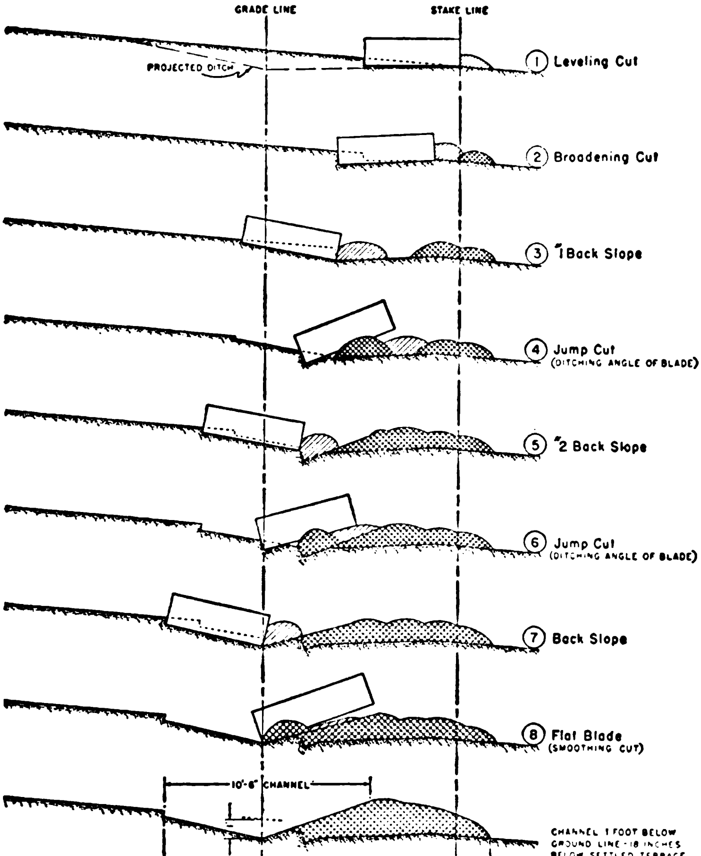
Power Machinery Is Best for Constructing Terraces
Many cooperative plans have been developed for making such machinery available.

Auburn, and who was later placed in charge of research work for the Soil Conservation Service.

The Nichols Terrace is not a terrace in the true sense of the word. It is a shallow water-way, which conducts run-off water slowly from cultivated fields. The terrace is built entirely from the upper side. This means that the soil is moved only downhill.

When supplemented by a small ridge on the lower side of the channel, the terrace can be developed gradually with reasonably satisfactory results. Each plowing operation deepens and broadens the channel. Thus normal farming operations make the terrace more, rather than less effective.

Dr. A. F. Gustafson, professor of soil technology, Cornell University, in his book *Conservation of the Soil,*

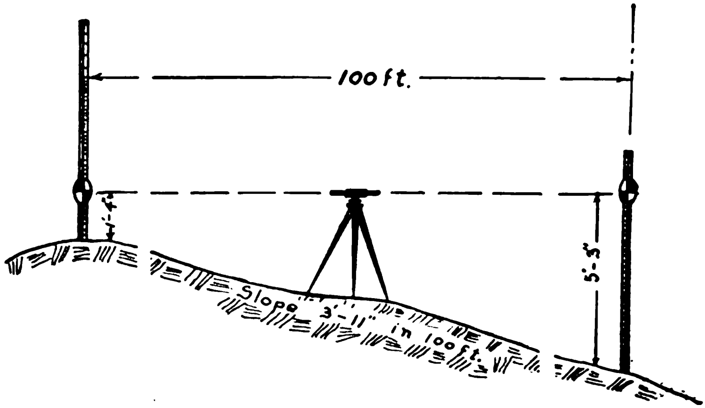


From Farmers' Bulletin 1790

THE NICHOLS TERRACE

This diagram shows the progressive steps in the construction of the improved Nichols channel-type terrace.

makes the following comment on the Nichols terrace: "Several advantages are claimed for the Nichols terrace as compared with the Mangum terrace: (1) Less power is required to move soil down hill than up hill. (2) The outer side of the embankment is not so steep. It is

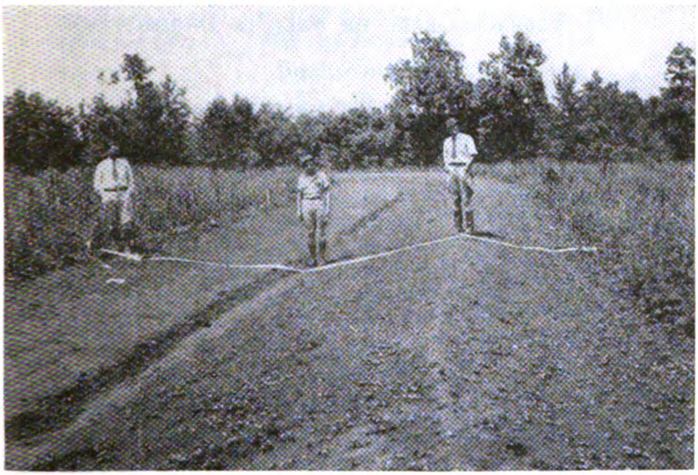


How to Determine the Per Cent of Slope
When targets are located as shown in this chart, the difference in the readings indicates the percentage of slope.

easier to use large implements on it. (3) Fewer failures occur because part of the water channel is cut below the original surface of the soil. If the entire embankment is cut out, some of the water channel remains, and less repair is required. In the Mangum terrace a cut in the dike is much deeper because it was built up partly from below; consequently, the dike has less support on the lower side and is more vulnerable to erosion. Both the Mangum and the Nichols are broad-base terraces, and both are effective aids in the control of erosion."

The Nichols Terrace cannot be used successfully on land with a slope of more than 12 or 15 per cent. However, land with a slope greater than 15 per cent should not be planted in cultivated crops. Such land should be devoted to pastures, meadows, and trees.

How to Lay Out Terraces.—First, locate the highest point in the field. Begin work at this point. Layout the lines for the first terrace at the highest point, and locate



BROAD CHANNEL TERRACES ARE BEST

Broad channel terraces like this one have proved far more effective than the narrow ridge terraces commonly built by farmers over the Southeast.

others with respect to the first. It is necessary to control water at its source. Make a general survey of the field and determine the location of *outlets*. The outlet is the point from which the water is discharged from the water channel above the terrace. The outlet should be located (1) where the water will do no damage, and (2) where as much as possible of it will be conserved. Dense woods, permanent pastures, and natural water channels make excellent areas on which to release water from outlets.

No terrace should be longer than 1600 feet. The grade of a terrace is determined by the slope of the land and the length of the terrace. The following table, developed at the Alabama Polytechnic Institute, may be used as a guide:

TERRACE GRADE OR FALL IN INCHES

Clay Subsoil

Terrace Length (feet)	*Fall Per 100 Feet in Terrace on Land Slope of—* 5%	10%	15%
100 to 400	1	1¼	1½
400 to 700	2	2½	2¾
700 to 1000	3	3½	4
1000 to 1300	4	4¾	5
1300 to 1600	5		

Sandy Subsoil

Terrace Length (feet)	*Fall Per 100 Feet in Terrace on Land Slope of—* 5%	10%	15%
100 to 400	¼	½	¾
400 to 700	¾	1¼	1½
700 to 1000	1¼	1¾	2½
1000 to 1300	1½	2½	3¼
1300 to 1600	2	3	4

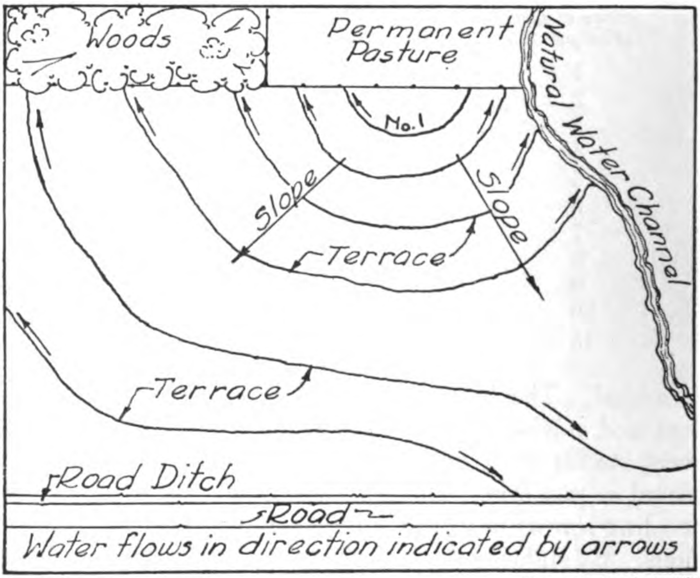
The distance between the terraces is determined by the slope of the land. This may be computed, when the slope is known, in terms of the *vertical* or the *horizontal* distance. The table on page 101 for determining the distances between terraces on land of different slopes accompanies the previous one developed at Alabama.

Using the Farm Level.—Since a level and rod enable one to determine accurately the difference in elevations, they are essential for laying out terraces. To determine, with the use of such equipment, the difference in elevations of any two locations, one must set up the level at a point half-way between the two turning points —that is, the two points where the elevation is to be de-

DISTANCES BETWEEN TERRACES

Slope of Land (Feet per 100)	*Vertical Distance Feet and Inches*		*Horizontal Distance Feet*
1	2	6	180
2	2	9	140
3	3	0	100
4	3	3	80
5	3	6	70
6	3	9	63
7	4	0	57
8	4	3	53
9	4	6	50
10	4	9	48
15	6	4	40

termined. The level is set up by spreading the tripod legs and pushing them into the ground until the instrument stands firm, and the degree plate is as near horizontal as possible. The telescope is leveled by means of leveling screws until the bubble stands center in all positions. By sighting through the telescope after it has been focused properly, the levelman signals to the rodman on the first turning point, directing him to bring the horizontal line of the target into line with the horizontal cross-hair of the telescope. The target marker will then be pointing to a definite mark, in feet and inches, on the rod corresponding to the height of the telescope line of sight. This reading should be recorded. Then the rod is moved to the second location, or turning point. The target must be raised if the rod is moved downhill, or lowered if the rod is moved uphill, so as to coincide again with the horizontal line of the telescope, which has not been moved. The target marker will now be pointing to another definite mark, or rod reading, which should be recorded. The difference between the two readings represents the true difference in elevation of the two locations on which the rod was held. This statement ex-



From Ga. Bulletin 394

plains the way in which the level and rod are used. Four steps are involved in laying out a system of terraces for a given field. These, in their proper order, are: (1) To determine the highest point in the field; (2) to determine the per cent of slope; (3) to locate and lay off the first terrace; and (4) to locate the second, and subsequent terraces.

(1) *To determine the highest point in the field,* set up the level near the top of the incline. Take rod readings

at different points thought to be the highest point. *The point with the lowest rod reading is the highest point.*

(2) *To determine the per cent of slope*, move the rod from the highest point down the slope 100 feet. With the level set up at a place half-way between this and the

SOUND EROSION CONTROL

Good terraces check the flow of water and let the soil absorb it. With contour cultivation and a cropping system to check soil washing between the terraces and provision for taking care of the water at the end of the terraces, they form the basis of a sound erosion control program on most farms.

highest point, take readings at both points. The difference found by subtracting the lower reading (that taken at the highest point) from the higher is the per cent slope, or the slope in 100 feet.

(3) *To locate and lay off the first terrace* requires the exercise of some judgment. To some extent, locating the first terrace is a matter of trial; it may be discovered, after running the first tentative terrace-line, that a slight change in location will produce more effective water control. Bulletin 394, *Terracing Farm Land in Georgia,* contains the following suggestions for locating the first

terrace, "The first terrace should always be located near enough to the highest point of the field so that no small gully or wash will cross the line of the terrace. One of the most common faults or mistakes made in terracing

OUTLET CHANNEL

Terraces from all directions empty surplus water into this outlet channel, but the mass of vegetation that has been established in it checks erosion and prevents the making of another big gully. The channel is carrying several inches of water as can be seen between the grass that is pushed back.

is due to the fact that the first terrace is too far from the point in the field where water begins to flow. The first terrace must be near enough to the top of the hill to get the water under control, otherwise there will be trouble later with one or more terraces, and often with all the terraces in the field. If any small gullies cross the line of the terrace, they will usually cause a break or serious collection of sand or silt in the water channel. In most fields, it is good practice in locating the first terrace to reduce the normal vertical distance, this putting the terrace closer to the highest elevation in the field.

"Laying off the first terrace is very much a trial process. If the first trial terrace, near the top of the field, crosses the smallest wash, change its location nearer to the top.

"A plan that works very well is to drop down about the proper vertical distance between terraces from the highest point in the field, and lay off the first terrace. If it is apparent that the first terrace will be short, and a good outlet is available at one end, run all the water in one direction. If the terrace is long and outlets are available at both ends, divide the water at a desirable place near the middle and run the water to each side of the field. If a good outlet is not available it might be necessary to make the first terrace level."

To lay off the first terrace, take the rod to the point where the water is to start flowing along the terrace. This will be the first station of the terrace line. Locate the level on ground as high or higher than that on which the rod is held. Set the target on the rod in line with the cross-hairs of the instrument. When they are so in line, the rod reading represents the standard for all readings for the given terrace.

If the terrace is to be level, the target is kept at this reading. Move the rod forward in the direction of the terrace line 25 or 50 feet and locate a point on the slope where the center of the target again coincides with the cross-hairs of the telescope. Mark this point with a stake and locate others in the same way.

If the terrace is to have a fall towards an outlet, it is necessary to change the position of the target on the rod at each station. When the rodman is carrying the rod in the direction the water is to run, he should raise the target from the previous reading one-fourth or one-half the distance the terrace is to fall in 100 feet, depending upon whether the stakes are 25 or 50 feet apart. For example, if the terrace is to fall 4 inches to the 100 feet of terrace and the stakes are 50 feet apart, the target

MEADOW STRIPS

A good example of how meadow strips of close-growing vegetation break the flow of water and cause it to spread out.

should be raised two inches from the previous reading, starting with the standard. If the rod is being carried in the direction opposite to that in which the water is to run, the target should be lowered at the same rate.

When it becomes necessary to move the level, the rod should be held at the last point located, while the instrument is moved to a place about level with the last station on the terrace and convenient for further readings. From here, the instrument man sights at the rod and has the target moved up or down until it is again brought into line with the cross-hairs. This new target reading is now used as the standard. Laying out the line of the terrace is then continued as though the instrument had not been moved.

(4) *To locate the second terrace*, set up the instrument a few steps below the first terrace and place the rod on

A SODDED FLUME

Concentrated surplus water from the end of this terrace is being handled safely by this sodded Bermuda flume.

the first terrace for a reading. Consult the table based upon the slope of the land, page 100, for the vertical drop between the terraces recommended for the per cent slope found in your field. Add this sum to the reading of the target to establish the standard reading for the second terrace. After the target is set, the rod is moved down the hill until the cross on the target is in line with the cross-hairs in the telescope. This is the location for the second terrace. It is laid off in the same manner as the first.

The description of these operations constitutes the technical information essential for laying out terrace lines. A little practical experience will make one proficient in the art of laying out a terrace.

Constructing Terraces.—Power machinery is required to construct good terraces. A 35 to 40 horse-

Close-Growing Vegetation Spreads Water
Terraces on both sides empty large volumes of surplus water into this depression or natural draw. This Virginia farmer is saving that water and saving his soil as well because the close-growing vegetation spreads the water and slows its flow so that it sinks into the soil. It comes back to the farmer in an extra good crop of hay.

power tractor is needed. A complete terracing outfit costs approximately $4,000. Few individual farmers can afford to own such an outfit. Various plans for making equipment available to all farmers of a given section have been developed. In many counties, the county officials have purchased several terracing units and have employed the required personnel to operate them. The farmers who wish to have land terraced pay at a stipulated rate per hour or per acre. In this way the cost is liquidated over a period of years; the work costs the county nothing and the individual farmers are not required to invest in more power and machinery than is needed for the usual farm operations. In some instances such service has been rendered through the organization of Soil Conservation Districts. Of course, if such equipment is not available, the individual farmer can construct terraces with mule-drawn equipment. The Nichols terrace has an advantage in such instances in that all the soil is moved downhill.

The Nichols terrace requires only seven or nine through trips with the standard equipment recommended. The entire objective is to create a water channel (see diagram) through which the water may flow. The channels need not be built to full size in the first operation. They may be enlarged gradually until they are of sufficient size to carry off the maximum quantity of water. When completed, the channel should be one foot below the ground-level, or 18 inches below the settled ridge of the terrace, and from six to ten feet in width from the top of the terrace ridge to the same level on the upper side of the channel.

The channel may be plowed out twice each year. For the first two or three years after the channel has been built one extra plowing each year is advisable to develop an adequate waterway rapidly.

Terrace Outlets.—Since the program of the Soil Conservation Service was inaugurated, great progress has been made in methods of saving soil and water. One notable field of development has been made in the matter of terrace outlets. As has been stated, dense woods and permanent pastures make excellent land-utilization areas on which to release the water from terrace outlets. The reason for this is obvious: They reduce run-off and use the water in the further development of plant growth. Formerly, it was often recommended that outlets be constructed of concrete and other forms of masonry. These were expensive. More recently it has been learned that outlets can be protected in many instances with vegetative growth, and that very wide, flat-bottomed water channels may produce forage of some value. The contour of the land often permits directing the flow of the water so that it may be utilized in producing a crop of hay. In any event, it must be remembered that a terracing system for a farm is not complete until the water is directed from all fields through a system of protected waterways.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What is a terrace? What is the aim or objective of terracing?
2. Will terracing alone control erosion? Give reason for your answer.
3. What is meant by a broad-base terrace?
4. In what respect is the Nichols terrace different from other terraces? What are the advantages of this type of terrace? What is meant by saying that this is not in reality a terrace?
5. Tell how to determine the slope of land. Tell how to locate and lay out the first terrace in a field, and the second.
6. What determines the distance between terraces? What determines the grade?
7. What machinery and equipment are required for building terraces? Are you familiar with any cooperative plan for securing the use of the best type of equipment?
8. Tell how the Nichols terrace is maintained and improved.
9. What is a terrace outlet? Discuss the type of outlets with which you are familiar.
10. Why is it desirable to use vegetative covering for terrace outlet channels?

Selected References

Farmers' Bulletins, U. S. Department of Agriculture
1234—*Gullies: How to Control and Reclaim Them.*

1669—*Farm Terracing.*
1737—*Stop Gullies: Save Your Farm.*
1767—*Soil Defense in the Piedmont.*
1789—*Terracing for Soil and Water Conservation.*
1790—*The Nichols Terrace.*

Suggested Activities

1. With a level and rod determine the percentage of slope of a piece of land with which all members of the class are familiar. Let several groups do this on the same land to determine the correlation secured.
2. With the same equipment lay out the terraces for a small field, one of your own if you prefer. Have the work checked by other groups from the class to determine what errors, if any, have been made.
3. Make a study of terracing in the community to determine (1) what types of terraces are used; (2) what equipment is used; (3) if a cooperative plan is followed, how it operates; (4) what type of outlets and outlet channels are in use; and (5) how much work is required to maintain the terraces.
4. Write to your State Conservation Office, or the district office for your region, and secure all the information you can about the most recent recommendations for terracing and for constructing terrace outlets, channels, baffle dams, and other forms of water carriers.

Chapter 7

FOOD FOR PLANTS

F. P. LATHAM

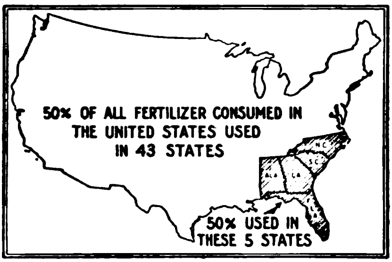
FARMERS are manufacturers. They make corn, cotton, meat, milk and like commodities. The raw materials with which the farmer works are plant food, sunshine, and rain. How much of each product the farmer is able to make per acre of land depends upon his supply of raw materials and the labor that is applied in using them. If either labor or raw materials are not supplied in ample quantity, production is reduced.

The farmer cannot control the supply of sunshine and rain. He does, however, control the labor, the available plant food, and—to some extent—the supply of moisture in the soil.

Plant food is, generally speaking, the most important factor in crop production. Usually, when a generous supply of plant food is available, a good crop is produced.

How Plants Use Food.—Plants absorb food through their roots, consequently it must go into solution. Of course, you have seen sugar "melted" by water. This melting is merely the process of dissolving the sugar in a liquid. The same process, with many variations, must take place in the soil before plants secure food for growth.

The food of plants consists of a number of chemical elements. These food elements are: nitrogen, phosphorus, potassium, calcium, carbon, hydrogen, oxygen, iron, magnesium, sulphur, and a few others. Plants must have the necessary quantity of each of these foods in order to grow well and to produce abundantly. But none of these food elements exist in the soil in the free state; they are found in combination with other elements. In this condition they are known chemically as *compounds*. In common terms, these compounds are spoken of as our plant foods. Our interest, then, centers around these compounds. They include such well-known materials as nitrate of soda, sulphate of ammonia, dried blood, superphosphate, muriate of potash, and many others.

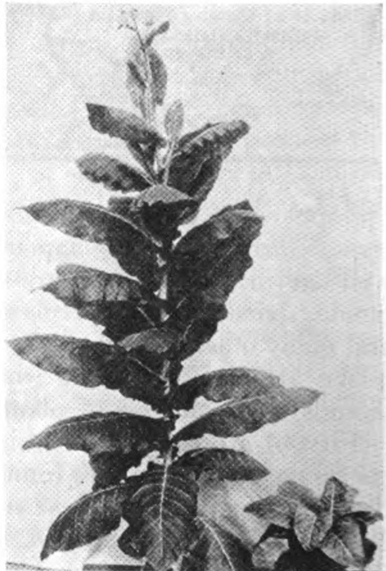


We are concerned with what happens to these compounds in the process of plant growth.

First of all, compounds which contain some or all the necessary plant foods are found in all agricultural soils. By the action of water, these compounds that are soluble go into solution. This liquid, which bears the plant food in solution, passes through the cell walls of the tiny roots of the plants and is carried through the root system to the crown of the plant and then through the stems to the leaves. Here, with the aid of sunlight, it is changed into the form in which the plant can "digest" it. The result of this continuous process is plant growth. Hence, one can readily understand that (1) plant food must be soluble, and (2) that all the different kinds of plant food required must be present in the soil if satisfactory growth and development take place.

The Supply of Plant Food.—When we say that a soil is "rich" or fertile, we mean that it is productive. And, it is productive because it contains all the food elements required for plant growth. On the other hand, "poor" soils are deficient in plant foods.

Nature has provided a plan that makes it possible to use all the good things of the earth without ever diminishing the available supply. There is a continuous cycle going on of building, tearing down, and rebuilding. Did you ever realize that all animals live, directly or indirectly, on plants? The elements of the earth, together with the action of sunshine and rain, make plant growth possible; plants furnish food for animals. Animals eventually die and the elements are restored to the earth. The process, as it exists in nature, is eternal. But man has interfered with the natural processes. He pours the fertility of soils, year after year, into the cities, which in turn pour what they do not use down the sew-



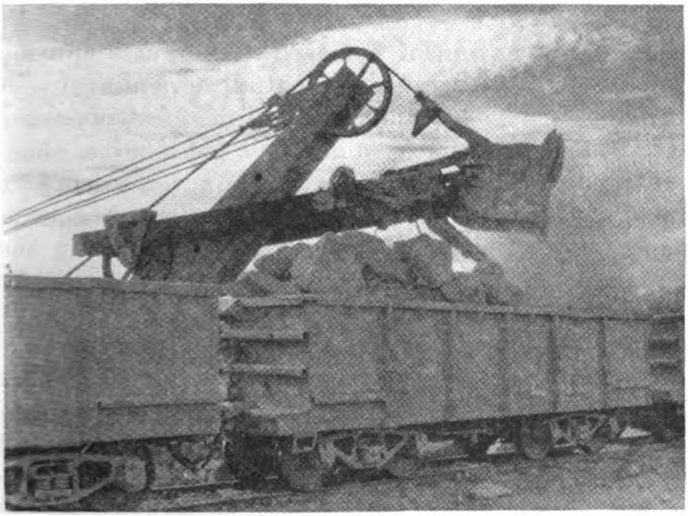
—*Courtesy New Jersey Exp. Station*

MANY FOOD ELEMENTS REQUIRED

Demonstrating that plants require food elements of many kinds for the best growth. Right grown with solution No. 1, consisting of potassium, calcium, magnesium, phosphorus, sulphur, and nitrogen, the nitrogen derived from chemically pure nitrate of soda. The plant on the left was grown with Solution No. 11, which was the same, except that the nitrogen was derived from Chilean nitrate of soda. The difference was due to the boron contained in the natural nitrate.

ers into the rivers and the oceans. Nature's scheme of things has been changed; consequently, farmers, as users of plant food materials, must learn to adjust their operations so that foods may be made available.

The Food Elements in Soils.—Not all soils contain the same plant foods. The materials out of which the soils were formed and the climate of the region in which they are located, determine, in large measure, the plant

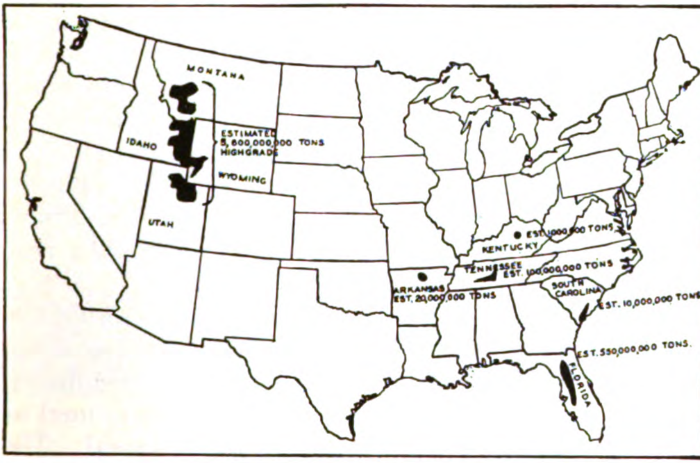


CHILEAN NITRATE ORE
The first step in preparing this fertilizer material for shipment.

foods which they contain. For example, the soils formed in part from limestone rock are generously supplied with calcium. Incidentally, the crops grown on such lands, when fed to livestock produce animals of superior bone. But stock given only the feeds produced on calcium-deficient land will be weak in bone structure unless mineral is added to the ration. Another interesting example is found in the soils of the Coastal Plains. These plains were at one time covered by the salt-water of the ocean, consequently, they are rich in iodine. Iodine is required by glands of the throat. When not supplied, goiters result. There are few people in the Southeast who have goiters, while they are quite common in certain iodine-deficient regions of the United States. These two examples will serve to show that not all soils are fundamentally alike, even in the state or condition in which they existed before man brought about many destructive changes.

Elements Essential for Growth.—Years ago soil scientists were of the opinion that all agricultural soils contained in sufficient quantities all the elements essential for plant growth except nitrogen, phosphorus, potassium, and calcium. More recently, however, it has been found that some of the so-called minor elements such as magnesium, sulphur, and boron, may be lacking and must be added to the soils in the form of commercial fertilizers to insure maximum production. This was an important discovery; it may bring new practices into farming with which we are not now acquainted. But it is also true that the minute quantities of these elements that are required are often found in the compounds that are commonly used as carriers of plant foods. Therefore, for all practical purposes, farmers may usually concern themselves with the plant requirements for nitrogen, phosphorus, potassium, and calcium.

Nitrogen.—Nitrogen is so essential to the growth of all plants and animals that all life would cease to exist without it. The rate of plant growth is more dependent upon nitrogen than upon any other element. It stimulates growth and delays maturity. Crops with an ample supply of nitrogen look healthy; those without enough of this food have a stunted appearance and lack the green color associated with superior crops. Nitrogen helps start plants off quickly; it stimulates leaf developments and thus aids in the utilization of phosphorus and potassium compounds. Too much nitrogen, however, tends to reduce the resistance of plants to disease.



PHOSPHATE ROCK DEPOSITS IN UNITED STATES

The soils of the South contain less nitrogen than those of any other part of the nation.

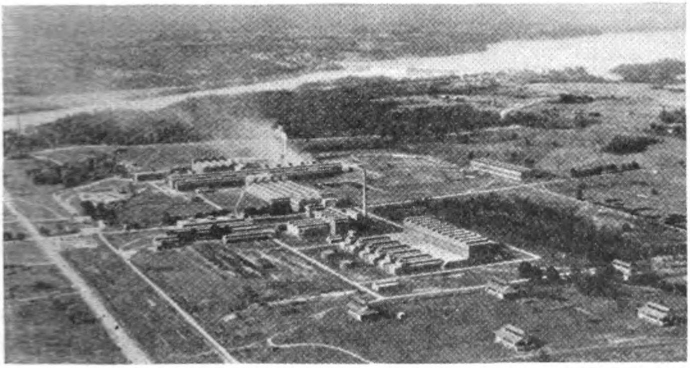
A careful analysis of the nitrogen-content of the soils of the principal agricultural regions of the United States has revealed that the soils of the Cotton Belt contain about 4,000 pounds of nitrogen per acre as compared with 6,700, 8,000, 10,700, and 16,000 pounds for other regions. In other words, Southern soils contain less than one-half as much nitrogen as the average for the other farming regions of the country. But, in addition, the climate of the South is such that it is difficult for farmers to increase the nitrogen content of their soils. Quoting from the 1938 Yearbook of the United States Department of Agriculture, "It is possible to build up the nitrogen content of northern soils by the addition of organic matter, as the low temperatures favor its preservation. Conversely, in the South it is rather difficult to increase the nitrogen content permanently by green-manuring practices, because the high temperatures favor decomposition, and nitrogen in the soil does not accumulate to the same extent as in the more northern soils."

As is generally known, the nitrogen content of any soil may be increased by growing a crop and turning it under. These are called green-manure crops. Any close-growing crop may be used for this purpose, but the best results are obtained by using legumes, for, in proportion to growth, they add more nitrogen than non-legumes.

It is often said that a farmer may grow his own nitrogen. When purchased in commercial fertilizers, nitrogen may be secured from (1) inorganic or mineral sources, such as nitrate of soda, or (2) from animal or plant sources, such as tankage or cottonseed meal. The first are quick in availability; the latter release plant food slowly.

Phosphorus.—Phosphorus is sometimes called the "master key" to agriculture. It is an interesting and noteworthy fact that for years there was a popular demand that the Federal Government use the Muscle Shoals power plant to manufacture cheap nitrogen fertilizers for farmers. This was one of the tasks assigned to the Tennessee Valley Authority. But investigation convinced those in control that farmers could grow their own nitrogen in the form of green-manure crops, and that phosphorus was the most essential plant food needed by American farmers.

The phosphorus content of any soil can be increased only by adding in the form of fertilizer some carrier of this element. For the most part this means superphosphate. This fertilizer material is prepared by treating raw rock phosphate with chemicals which make it more soluble. Phosphate rock deposits are found in Tennessee, Florida, and several of the states in the Far West. Years ago superphosphate, or acid phosphate as it was



TRIPLE SUPERPHOSPHATE PLANT
Wilson Dam and Powerhouse in Background.

commonly called, was the most concentrated form in which this plant food was available, but more recent processes have created triple-superphosphate with a phosphoric acid content of more than 40 per cent. Through the work of the Tennessee Valley Authority in manufacturing and studying the results of using triple-superphosphate, it has been shown that crop yields may be materially increased in most sections of the South through the use of this relatively new fertilizer. This is especially true with respect to the development of profitable pastures which are needed if the South is to enjoy the benefits of a more nearly self-sustaining agriculture.

Phosphorus is essential to plant life. It promotes rapid growth, hastens fruiting or maturity, and improves the quality of the vegetation.

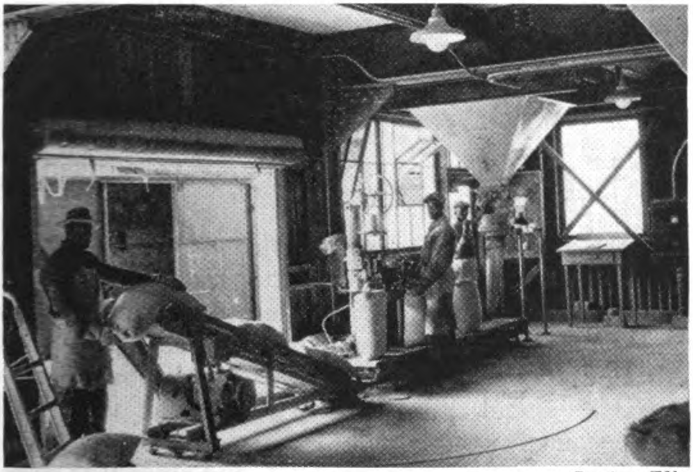
Potassium.—Many plants remove relatively large quantities of potassium from the soil. This is especially true of tuber crops and those producing starch or sugar. This element promotes the health and improves the quality of the plant, insures greater efficiency in the growth-functions of the leaves, increases resistance to disease, and helps the plant make more efficient use of soil moisture. Potassium insures the development of well-filled kernels in cereal grains and adds to the stiffness of the straw.

The principal sources of potash fertilizer materials used commercially are potassium chloride (muriate of potash), potassium sulphate (sulphate of potash), potassium nitrate, and manure salts. Prior to the World War most of the potash used in this country came from Europe. Now, however, the United States produces as much as is imported. The domestic supply comes mainly from the Western States.

In the Southeastern States where the rainfall and temperature are relatively high, the potash content of the soil is low for the reason that plant foods in soluble form leach out of the feeding zone of plants. A large per cent of the potash fertilizer sold in the nation is used in the South. The five leading states in the consumption of potash fertilizers are, North Carolina, Florida, Georgia, South Carolina, and Alabama.

Calcium.—Calcium is not a plant food in the same sense of the term as are nitrogen, phosphorus, and potassium. In the form of lime, it is used to correct the acidity of soils. Neutral or alkaline soils are required by many plants, notably the majority of the legumes. The soils in many parts of the South are acid in character and require applications of lime.

The Farmer and the Soil.—The farmer, as a manufacturer of plants, must assume responsibility for maintaining an adequate supply of plant food in the soil. All good farming practices help to conserve the supply found in the soil, to add to it at the lowest possible cost, and to keep the soil in the best condition as a home for plants. Such practices include: (1) suitable tillage; (2) the maintenance of organic matter; (3) the correction of acidity; and (4) the use of mechanical means for controlling erosion. But in most sections of the South, it is necessary to buy some plant food in the form of commercial fertilizer.



—*Courtesy TVA*

PACKING AND LOADING 43 PER CENT TRIPLE SUPERPHOSPHATE

Fertilizer Consumption.—The consumption of commercial fertilizers in the United States has been increasing consistently for several generations. The annual fertilizer consumption of the nation for several decades is given in the table on page 122.

There is every reason to assume that this trend in the use of commercial fertilizer will continue. As yet we do not use anything like as much fertilizer per acre as is used in the older countries of the world.

Our greatest use of commercial plant food per acre is found in Florida; New Jersey ranks second; Maine third. But none of these states uses so much per acre as Holland, Belgium, or some other of the European countries.

ANNUAL FERTILIZER CONSUMPTION

Year	*Tons Used*
1880	1,150,000
1890	1,950,000
1900	2,200,000
1910	4,912,000
1920	7,176,000
1930	8,163,000

The Southern States use more commercial fertilizer than all the other portions of the country combined. It is not uncommon for the South to use two-thirds of the total tonnage of the nation. This is necessary, but it is a drain upon the net income of Southern farmers. Several states spend more than ten per cent of their total farm income for commercial fertilizers. Since so much money is expended for plant food, and since it is so essential in determining production and consequently farm income, it behooves every student of farming to make a very careful and critical study of the feeding of plants.

Sources of Commercial Plant Food.—As has been stated, plants feed upon chemical elements found in the forms of compounds which are used for making commercial fertilizers. Our study of commercial fertilizers, then, may well begin with these compounds. They include such well-known materials as nitrate of soda, superphosphate, muriate of potash, and many others. The analysis of each of these substances or materials is available, consequently one knows, when a given amount is applied, just exactly how much supplementary plant food is being "fed" the plants on an acre of land. These materials are combined in mixed fertilizers so that something of a "balanced ration" is being given the crop when such a fertilizer is applied.

Sources of Plant Food.—There are a number of compounds that are commonly used as plant food carriers in commercial fertilizers. The value of each is determined by the amount of plant food it contains which can be used by plants. This plant food is expressed in terms of the per cent of nitrogen, (N); phosphoric acid, (P_2O_5); and potash, (K_2O). We are also interested in the per cent of calcium oxide, (CaO) which is important in that it helps neutralize the acid condition of the soil which is so often objectionable.

LIME ESSENTIAL FOR LEGUMES AND GRASSES

Southern farmers must increase their production of forage crops. This means a greater use of lime on most soils in the Southern Region.

The more important of the fertilizer plant food carriers are listed in the table on page 124.

In addition to these compounds there are a number of mixed compounds sold under trade names which are being used in increasing amounts since fertilizers in the mixed form tend to carry larger amounts of plant foods. Among these are: Ammo-phos, with from ten to sixteen per cent of nitrogen and twenty to forty-eight per cent of phosphoric acid; Cal-urea with thirty-four per cent nitrogen; and Cal-nitro with a nitrogen content of from sixteen to twenty per cent.

It is interesting to note that among the common plant

Common Plant Food Compounds

Carrier	*%N*	*%P_2O_5*	*%K_2O*	*%CaO*
(Nitrogen Group)				
Nitrate of Soda	14-16			
Nitrate of ammonia	35			
Nitrate of calcium	15			
Sulphate of ammonia	20-21			
Calcium cyanimid	22			
Urea	46			
Dried blood (red)	13-14	1.5	1.0	
Cottonseed meal	6-7	2.8	1.5	
Nitrate of potash	13		44.0	
Tankage	5-8	10-12	.3	
Fish, acidulated	7-9	8		
Meat meal	13-14	8		
Tobacco stems	2	1.5	6.0	
(Phosphorus Group)				
Superphosphate		14-20		
Triple-phosphate		40-48		
Basic slag		15-20		20-60
Rock phosphate		18-32		
Bone, steamed	2.3	25-30		30-40
Ammonium phosphate	12	61		
Di-ammonium phosphate	21	53		
Potassium phosphate		22-23	34-35	
(Potash Group)				
Kainit			10-13	
Muriate of potash			48-50	
Sulphate of potash			48-50	
Manure salts			20-30	
Potassium nitrate	13		44	
Hardwood ashes		2-3	5-6	20-40
(Lime Group)				
Lime, burned, fresh				90-100
Lime, hydrated				65-70
Limerock, ground fine				45-50
Oyster shells, fine ground				40-48

food compounds the only carriers containing all three of the plant foods—N-P-K—are the vegetative and animal substances. Such complete plant foods may, however, be manufactured by the chemical industry.

The Fertilizer Formula.—Fertilizer is bought and sold on the basis of a guaranteed analysis. This analysis, or plant food content, is expressed in a formula. For example, a fertilizer known as a 3-8-3 contains 3 per cent of N; 8 per cent of P_2O_5; and 3 per cent of K_2O—or, 3 per cent of nitrogen; 8 per cent of phosphoric acid; and 3 per cent of potash.

This "mixed" fertilizer, represented by the formula 3-8-3, may be made by the manufacturer from any materials which provide the analysis as stamped on the bag, provided that no state law limits the selection of materials.

Let us see what such a fertilizer might contain!

The numbers in the formula represent percentage. A 3 representing the nitrogen means three per cent of this plant food. But, since fertilizer is usually bought by the ton of 2000 pounds and since one per cent of 2000 is 20, we have come to speak of 20 pounds as *unit* of plant food. So, the formula 3-8-3 means, 3 units of nitrogen (60 pounds); 8 units of phosphoric acid (160 pounds); and 3 units of potash (60 pounds). In other words, a ton of such a fertilizer actually carries only 280 pounds of the plant food which the purchaser desires.

How might such a fertilizer be made?

If we depend upon nitrate of soda for the 3 units of nitrogen, we have a problem in arithmetic which may be expressed as follows: How much nitrate of soda, containing 16 per cent nitrogen, will be required to supply 60 pounds? The answer is 375 pounds.

In the same way, if we want a ton of fertilizer containing 180 pounds of P_2O_5 and use 18 per cent superphosphate, we must use 1000 pounds of the material. And, to get 60 pounds of potash from a 50 per cent muriate of potash, 120 pounds of the compound will be required.

Thus one ton of 3-8-3 may contain the following materials:

One Ton of 3-8-3

Nitrate of soda	375	pounds
Superphosphate	1000	"
Muriate of potash	120	"
Total plant food carriers	1495	"
Filler	505	"
Total weight	2000	"

The filler is included to make the formula correct. If more of the plant food carriers were added, the formula would not be 3-8-3, but something representing a higher plant food analysis.

Years ago most mixed fertilizers contained filler. This might have been sand or any waste material. Now, however, most mixed fertilizers contain little or no filler; the higher analysis commonly used makes it unnecessary. But where filler is included some states have stipulated in their laws that the filler must be dolomite or some substance which neutralizes the acid-forming tendency of soils.

More and more farmers are using fertilizer with a higher plant food content. This is desirable for many reasons, including the fact that fewer tons need be bought and handled in applying a given amount of plant food.

How Much Fertilizer to Apply.—High production per acre is associated with large net profits; high production per worker is associated with large net incomes. The amount of plant food per acre should be increased to the point where the *law of diminishing returns* begins to operate. This means that if a small amount of fertilizer is used and the production is increased, a profit is made on the fertilizer investment. Perhaps a larger profit can be made by increasing the production through larger applications of fertilizer. There will be a point, however, at which the application of fertilizer cannot be increased with profit. It is the task of a wise producer to find that point for the conditions under which he is operating.

The best guide for the rate of application is the fertilizer tests of your state college of agriculture or experiment station. Few farmers use as much fertilizer as is recommended and, therefore, have not reached the maximum of profitable production.

Where to Put the Fertilizer.—Several national committees have been engaged for years in experimental work to determine the best method of applying commercial fertilizers. Their conclusions are presented by H. R. Smalley, chief agronomist of the National Fertilizer Association, as follows: "For some time farmers have known that, to be effective, fertilizers should be placed fairly close to the seed. They have also known that if fertilizer is applied too near the seed the results are likely to be unsatisfactory. Sometimes they have blamed the fertilizer for poor results when, in reality, the trouble was due to improper application.

"In general, experiments have shown that the best results are obtained when the fertilizer is placed in bands at the sides of the row. It is true that the placing of fertilizer under the row has been satisfactory in some seasons, but if poor results are obtained even one year in five, that is a poor method of applying plant food. Experiments conducted all the way from the Eastern Shore of Virginia to the Black Prairie Region of Texas have shown that the side placement of fertilizers has, on the average, been better than the practice of bedding on the fertilizers or mixing the fertilizers in the soil in the row."

Home Mixing.—For many years the home mixing of fertilizers has been advocated. Whether or not it is advisable for the individual farmer to buy the ingredients and mix his own complete fertilizers is a question which can be answered only in terms of whether or not it may be the means of decreasing the cost of the necessary plant food. Certainly, the individual user of small tonnage will find no advantage in it; on the other hand, it may be profitable for the large plantation. Again, the relative price of ingredients and mixed goods in any season may be the determining factor.

A number of farmers' cooperatives have found it profitable to supply fertilizer requirements of their own members. This is made profitable by the volume which they handle and has the advantage, in some instances, of enabling members to select the ingredients or to arrange for a formula not ordinarily available on the market. This is especially true with respect to very high grade mixtures.

SUGGESTIONS FOR STUDY

Questions and Problems

1. In what respects do the farmer and the manufacturer perform services which are similar?
2. What are the raw materials with which the farmer works?
3. Why is soil not included as a raw material in the text? How do you explain this point of view?
4. What are some of the factors which may limit the production of a crop?
5. What are the determining factors in crop production which the farmer can control? What are those which he cannot control?
6. What does it mean to say that the farmer can control the moisture content of the soil *to some extent?*
7. What is the trend in fertilizer consumption in the United States? Give figures.
8. What states use the largest amount of fertilizer per acre? On what crops, do you suppose, most of this fertilizer is used?
9. How does our fertilizer consumption per acre compare

with that of the old countries? How does our acre-production compare with that of European countries? Our production per worker?

10. Do you know what per cent of the farm income of your state is spent for fertilizers? What per cent of the income of your own farm is used for fertilizers?
11. Explain how plants use foods?
12. What elements are required for plant growth? Which are required in the largest quantities?
13. What are some of the common plant food carriers? How can each be classified?
14. What is meant by a fertilizer formula? What is meant by the formula 3-8-3; 4-10-4; 6-12-2?
15. What is meant by a unit of plant food?
16. What is meant by a high-grade fertilizer?
17. What is meant by the term—*a complete fertilizer?*
18. What is meant by *filler?* Do all complete fertilizers contain filler?
19. What is the function of each of the plant foods?
20. What is meant by the term *side-dressing?* Why is nitrogen so used?
21. What are some of the more important sources of nitrogen? How may they be classified?
22. Can the farmer grow some of his own nitrogen by producing and turning under legumes? What is a legume?
23. Where are the phosphorus deposits of America found? In what form is phosphorus found? How is it treated before being used as fertilizer material?
24. Fertilizers may be classified as *organic,* that is, animal or vegetable; and *inorganic,* or mineral. Discuss this statement and give examples of each.
25. Where does the potash used in the commercial fertilizers sold in the United States come from?
26. What is the relation between calcium and lime?
27. What does it mean to say that lime is not a plant food to the same extent as N-P-K?
28. What is the function of lime? When and to what crops is it essential?
29. How should fertilizer be applied? How much per acre should be used?
30. What is meant by the home-mixing of fertilizers? What are the advantages and disadvantages?

Selected References

Trade Publications:

National Fertilizer Association, 616 Investment Building, Washington, D. C.

Methods of Applying Fertilizer (The results of long-time research conducted by many cooperative agencies)

Fertilizer Consumption in the United States

The Fertilizer Review (Published bi-monthly)

The Barrett Company, 40 Rector St., New York.

Nitrogen Solution 11

Sulphate of Ammonia

A Nitrate of Soda Reference Manual

Chilean Nitrate Educational Bureau, Rhodes-Haverty Building, Atlanta, Georgia.

Vital Elements

The Chilean Nitrate Industry

F. W. Berk & Co., 420 Lexington Ave., New York.

Magnesium for a Full Harvest

E. I. du Pont de Nemours & Co., Wilmington, Delaware.

Urea-Triple Plus Nitrogen

Crop Protection Institute, 21st & B Sts., Washington, D. C.

Copper Sulfate as a Plant Nutrient and Soil Amendment

Obear & Farley, Grant Building, Atlanta, Georgia.

Basic Slag for Best Results

U. S. Department of Agriculture, Washington, D. C.:

Yearbook, 1938, *Soils and Men*

Leaflet 70—*Home Mixing of Fertilizers*

Circular 436—*Production and Use of Sodium Nitrate*

Suggested Activities

1. The National Fertilizer Association has prepared a graph in which it is shown that the farm income of the nation is directly related to the volume of fertilizer sales for each year. On the basis of a local community survey, is that true where you live? What is the relation between the rate of fertilizer application per acre and the crop yields in your community? What is the usual rate of application of fertilizer made by the farmers of your community to the common crops that are grown?
2. Write to your state experiment station and get the fertilizer

recommendations that are made for each of the more important crops. From the data obtained through a local survey, what per cent of the farmers of your community apply as much fertilizer per acre as is recommended? How do the yields made by these farmers compare with the average for the community?

3. From the table of fertilizer sources given in this chapter, determine how a ton of each of the popular analyses of fertilizers might be made.
4. From the references given in connection with this chapter and from data secured from the Agricultural Department of the TVA, Knoxville, Tennessee, and from publications of the U. S. Department of Agriculture and your state experiment station, make a study of the sources of *nitrogen*, *phosphoric acid*, and *potash*. From the same sources, make a study of the use of lime in crop production.
5. Make a study of the machinery available for distributing fertilizer according to the recommendations in the publication, *Methods of Applying Fertilizer.*

Chapter 8

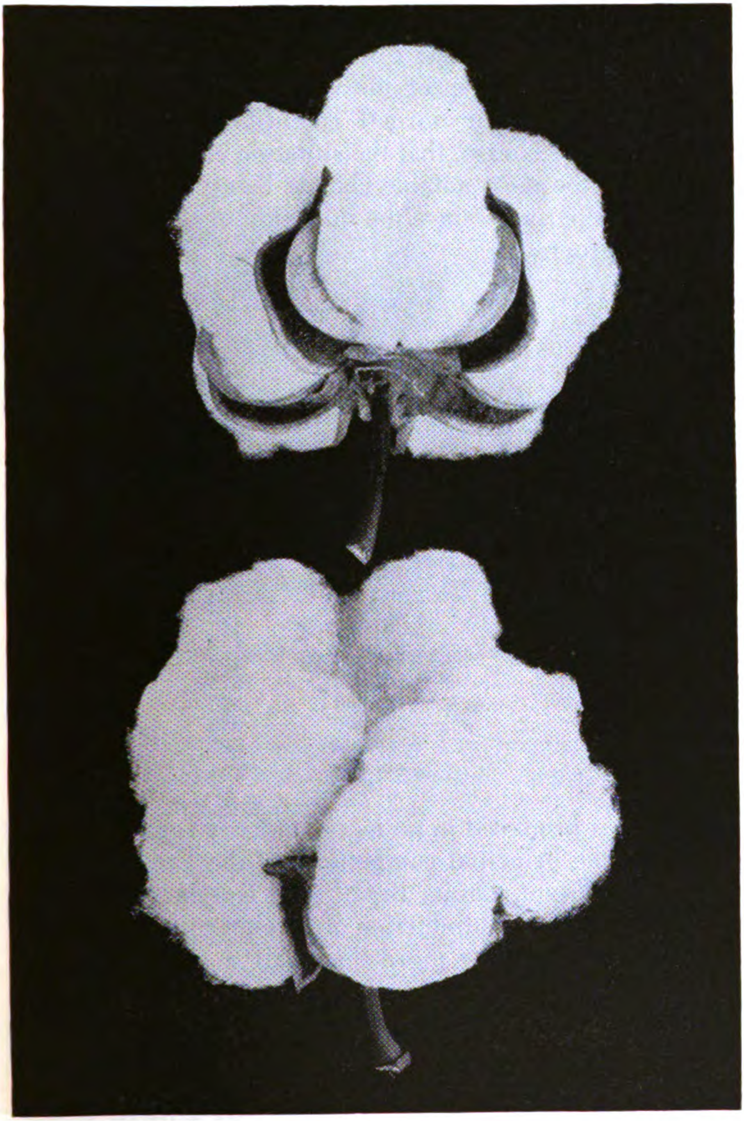
THE IMPORTANCE OF COTTON


OSCAR JOHNSON

IN THE lives of the American people, cotton is the most important crop grown in the nation. This statement is true, not because cotton occupies the greatest total acreage of crop land and not because it sells for more dollars than any other crop, but because more people depend upon cotton for a livelihood than upon any other single commodity.

There are more cotton farms in the United States than farms of any other type. On more than one-third of all the farms of this country cotton is the main source of income. More than one-third of the total farm population of the nation resides in the Cotton Belt. But city people, as well as farmers, depend directly upon cotton for a living. It supports the gigantic textile industry, which employs more persons than any other branch of manufacturing. It provides the raw material which sustains the cottonseed oil industry. It makes possible the employment of thousands of persons in business, industry, transportation, and commerce. It is the basis of the economic life of the South, and to a lesser degree that of the entire nation. Anything that affects the cotton situation affects in some measure the economic and social life of every citizen of the United States.

Where Cotton Is Grown.—Cotton is a warm-weather plant. It is grown in all of the states in the southern third of the nation and in all the other countries



of the world that have a climate like that of our South.

The following figures, for one five-year period, will give a general picture of the cotton production of the United States under normal conditions. It must be understood, of course, that the situation changes slightly each year, the most notable change being the increased production per acre since the initiation of the cotton adjustment program:

COTTON PRODUCTION IN THE UNITED STATES

(*A Five-Year Period*)

State	*Acreage*	*Yield Per Acre*	*Bales Produced*
Missouri	372,000	256	228,000
Virginia	79,000	270	45,000
North Carolina	1,432,000	269	752,000
South Carolina	1,879,000	208	856,000
Georgia	3,164,000	176	1,241,000
Florida	124,000	125	35,000
Tennessee	1,066,000	197	479,000
Alabama	3,373,000	172	1,255,000
Mississippi	3,967,000	191	1,559,000
Arkansas	3,383,000	188	1,352,000
Louisiana	1,847,000	192	745,000
Oklahoma	3,707,000	149	1,109,000
Texas	15,598,000	139	4,580,000
New Mexico	122,000	318	90,000
Arizona	186,000	327	128,000
California	222,000	386	200,000
All other	20,000	225	288,000
United States	40,541,000	169	14,667,000

Cotton is produced in no less than forty foreign countries, but the principal competitors of the United States are India, Egypt, China, Brazil, and Russia.

The acreage and production of foreign cotton has been increasing slowly for more than half a century. Yet, until recently, the United States produced more than half the world's supply and exported approximately 60 per cent of the annual crop.

In 1921-22, the world acreage of cotton was 57 million acres; by 1936-37 it had increased to 84 million acres.

In the former year the United States produced 63 per cent of the world's supply; in the latter 40 per cent.

Within a period of twenty-five years, the foreign acreage of cotton doubled.

PEDIGREED COTTON
The Secretary of Agriculture inspects the cotton breeding work of David R. Coker.

Naturally, this increase of foreign production reduced the sale of American cotton abroad; naturally too, the increased production decreased the price per pound. What the future holds for American cotton is impossible to predict. World conditions may change the situation. New uses may be discovered. But, in any event, one of the major problems of a farmer in the South is to determine what place cotton is to occupy in his farming program. This place may change from time to time due to the limiting of acreage or the price of the lint and seed. But the fact remains that cotton is better adapted to the climatic conditions of the South than any other cash crop of major importance. The problem of the future is to bring the cost of production in line with the market conditions that exist.

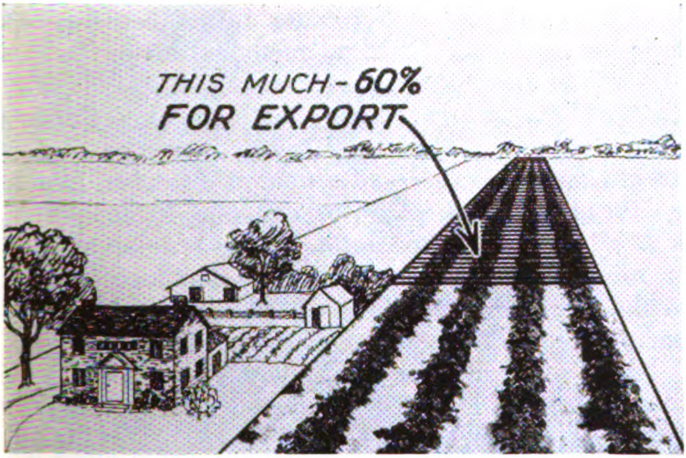
Soil Adaptation.—Cotton will grow, and make a good crop, on a wide variety of soils. It is said that with good management, nearly all types of soil within the Cotton Belt can be made to produce profitable crops. Much of the cotton grown in this country is produced on soils too thin, dry and poor to make good corn. This is one of the very important reasons why the South *wants* to grow cotton and why it has been difficult to develop a balanced type of agriculture.

With the mounting cost of producing cotton, the increased competition from foreign countries, and the failure of consumption to keep pace with production, it is unwise to attempt to grow cotton on poor soils. It would be far better if such areas were returned to forests or used for some extensive type of production. The agronomists in the agricultural colleges and experiment stations recommend that for the production of cotton, only the best land on the farm be used. To this end, they stress the use of only well-drained, fertile, and, when available, early soils. Under boll weevil conditions, the lighter soils are more profitable than the heavy, poorly-drained soils.

Many persons are of the opinion that no land can be used profitably for growing cotton which will not produce one-half bale per acre. In the light of state production statistics this figure is perhaps a little high, but it is also true that cotton is grown on land which cannot, under present conditions, return a profit to the producer. Such low producing soils should be planted to legume crops, if there is a possibility of bringing them to a profitable state of fertility.

Labor Requirements.—Even if it is permissible to grow any amount of cotton that one may wish to produce, the acreage may be limited by the labor and capital requirements.

Cotton, as grown in the major portion of the Cotton Belt, requires more hours of labor than any other field



COTTON ACREAGE MUST BE ADJUSTED TO MARKET DEMANDS

For more than a generation sixty per cent of America's cotton crop has been sold to foreign countries. A portion of this market has been lost. Foreign production has increased. Either this market must be regained, new uses discovered at home, or drastic reductions made in the acreage devoted to cotton production.

crop except tobacco. One acre of cotton requires, at present, 144 hours of man labor as compared with 78 for peanuts, 44 for corn, 21 for cowpea hay, and 15 for wheat and oats. The work in cotton production is distributed throughout the year with the peak loads coming at planting and harvesting, usually in May and October.

Authorities who have made a systematic study of crop production report that, on the whole, the cultural methods as applied to cotton are, primitive. It is true that little improved machinery is used, especially in the

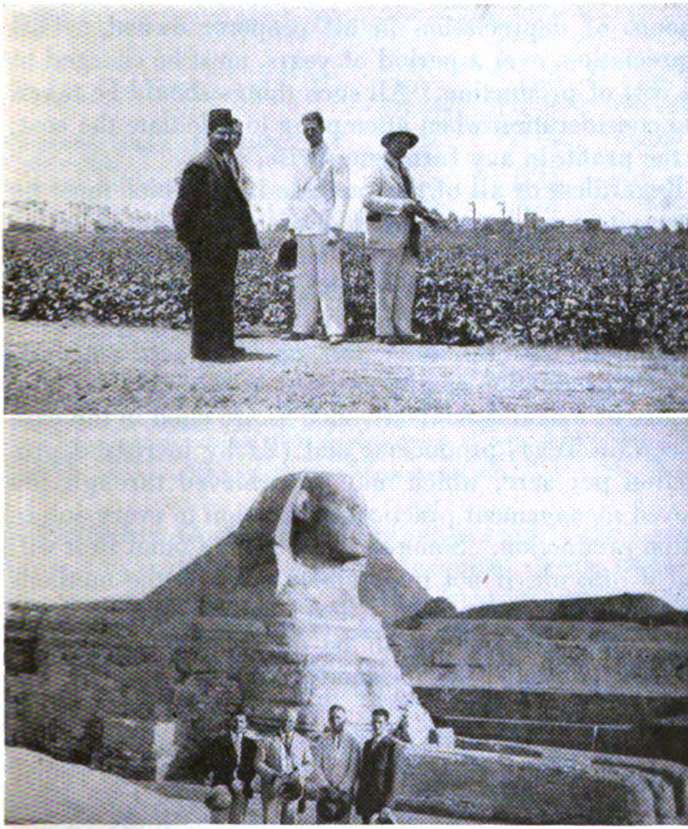
Southeast, and that as long as the worker handles only *eight acres to the plow* the income per worker will continue to be small. In commenting upon the changes that are being made in cultural practices, *The Progressive Farmer* makes the following statement: "While it is true that on the smaller cotton farms there has been little change in the cultural methods during the past fifty years, many old practices have been abandoned on the broad level plains of both South and West Texas.

"In these areas the use of tractor power enables one man to handle 200 acres of cotton. He can bed 15 acres a day, and harrow, plant, or cultivate 40 acres a day with a four-row tractor outfit. Close spacing and lack of rainfall hold weeds in check and reduce chopping to the minimum, and in a pinch one man can 'sled' harvest four to five acres of cotton a day.

"As a result of these large scale methods, cotton can be produced at less cost per pound than in any other section of the Cotton Belt."

Cost of Growing Cotton.—In determining the acreage of cotton to plant, the cost of production must be the guiding factor.

The actual cost of producing cotton will vary from year to year. It will not be the same in all sections, nor on all farms in the same section. The production costs that are given in any publication, therefore, will not be accurate for any one farm, or for the same farm in different years. Some of the cost items will not represent actual cash outlays on all farms. For instance, the item of land rent will not be a cash outlay on the place operated by an owner. But the land owner is required to pay taxes, insurance, interest and perhaps other costs which take the place of rent in a cost account. There may not be any cash outlay in one year for farm implements, or for mules or tractor power, but there will be a certain



—Courtesy J. S. Mogford

Studying Cotton in Egypt

Under the direction of Professor J. S. Mogford of the Department of Agronomy, Texas A. & M. College, each year a trio of students study cotton production and marketing in some of the foreign countries. Such study on the part of American growers is essential in order that we understand the world situation. Not all of us can travel abroad, but all of us can become better informed with respect to world trade in cotton.

amount of depreciation in all property owned. This depreciation, over a period of years, must be charged to the cost of production. All such things should be taken into consideration when attempting to calculate the cost, or the profit, in any farm enterprise.

Regardless of all of the variable items which must be taken into consideration when one is attempting to arrive at an accurate cost statement, there remains one definite fact—a principle—with which every student of farm management should be familiar. *Greater production per worker is essential for an increased income.* Greater production can be realized in two ways: (1) by the use of machine methods, such as are cited in the case of certain Texas producers; and (2) by increased production per acre, which may be achieved through improved management practices in relation to every job in cotton production. Some sections of the Cotton Belt will find it difficult, if not impossible, to adopt the methods available to growers on flat, level lands, but the net income of every grower can be augmented through increased production on the land devoted to growing cotton.

Dr. Gilbeart H. Collings in his book, *The Production of Cotton,* has given a table, a part of which is reproduced on page 141, that brings out the relation of the yield per acre to the cost of cotton per pound. He shows that when it costs nine cents a pound to produce cotton if the yield is a bale of 500 pounds to the acre, it costs $1.45 cents a pound when the yield of lint is under twenty pounds per acre. This same table, as given on page 141, shows that when the yield varies from 101 to 140 pounds per acre the cost is 22 cents per pound; when the yield is from 261 to 300 pounds the cost is 12 cents per pound; when the yield is from 441 to 500 pounds the cost is 10 cents per pound.

COST OF GROWING COTTON

Cost Items	*Yield Groups in Lint Per Acre* (1) 101-140	(2) 261-300	(3) 441-500
Preparing land and planting	$4.25	$5.01	$6.09
Cultivation	6.12	7.08	7.75
Harvest and market	6.69	11.13	17.71
Misc. labor	1.03	1.64	3.04
Fertilizer	3.39	6.27	9.73
Seed	1.24	1.54	1.55
Ginning	1.76	3.08	5.17
Land rent	4.98	8.05	10.43
Misc. costs	3.06	3.44	5.54
Total cost (per acre)	32.52	47.24	67.01
Cottonseed value (per acre)	5.13	11.00	17.94
Net cost of lint (per acre)	27.39	36.24	49.07
Lint cost per pound	.22	.12	.10*

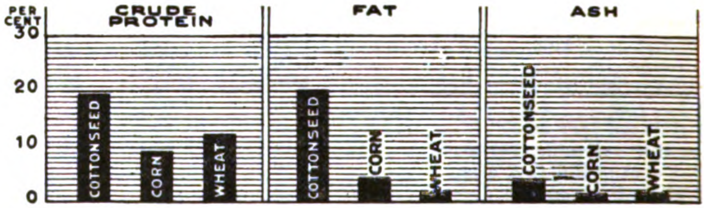
* At the time this cost table was prepared the actual cost of lint per pound on 16 farms where a 500 pound bale was made per acre was .09 cents, as contrasted with 22 cents per pound when the yield was from 101 to 140 pounds per acre, and 12 cents when the yield varied between 261 and 300 pounds per acre.

Utilizing Cotton Seed.—Cotton seed is the second largest cash crop for Southern farmers. While the seed has many uses, the main products coming from the seed are oil, shortening, margarine, cottonseed meal, and cottonseed hulls. There is an oil mill near every cotton producer. This mill will accept seed in exchange for meal, on the basis of the relative prices.

This exchange is very important for the reason that cottonseed meal is one of the most valuable livestock feeds produced in the United States. Unfortunately, we have in the past been consuming less than half this meal on the farms of the South and have been selling the remainder to other sections and other countries. All the cottonseed meal and hulls produced in the South should be used on Southern farms as feed for livestock.

The cotton seed contains practically all of the fertility that is removed from the soil in growing a crop of cotton. If this seed, in the form of by-products from the oil mills, were all fed on the farms where the cotton is grown, *cotton would be the least exhaustive cash row-crop produced in America.*

At one time cottonseed was considered worthless. For decades it was dumped into streams and its value completely lost. Then we learned that it had many com-



Cottonseed Is a Valuable Livestock Feed

Cottonseed meal is one of the most valuable livestock feeds produced in the United States. Unfortunately, the South feeds less than half the seed produced and sells the greater portion to other sections and other nations. This is unwise since the cottonseed contains practically all the fertility that is removed from the land in the production of cotton. Through the production of cottonseed meal, legume hays, and sorghum silage, the South can profitably produce enough livestock to maintain a better balanced farm program. The chart above shows the relative merits of cottonseed as compared with wheat and corn.

mercial uses. Even then farmers thought that cottonseed meal was not a good feed for livestock. They thought it was poison. But as more knowledge was acquired, it was discovered that cottonseed meal, like white corn and many other valuable feeds, was lacking in *Vitamin A*. When Vitamin A is supplied, through the feeding of high quality legume hay with bright green leaves or in some other way which is available to every efficient southern farmer, cottonseed meal has been found to be one of the best feeds produced in the nation. One leading Southern authority recently said, concerning the feeding of cottonseed meal, "It is as great folly for southern farmers to fail to feed cottonseed meal and hulls today as it was a generation ago for the ginners to dump cottonseed into the streams and thus allow millions of dollars worth of valuable plant food to be washed into the sea."

SUGGESTIONS FOR STUDY

Questions and Problems

1. Why is cotton one of the most important crops grown in the Nation?
2. Where is cotton produced in the United States? What other countries produce cotton?
3. What was the world production of cotton last year? What part was produced in the United States?
4. Where does your state rank in cotton production? in acreage? and in yield per acre?
5. What should be taken into consideration in determining the place of cotton on a given farm?
6. How can the cost of production per pound be decreased?
7. What changes have taken place in cotton production in your community within ten years which have reduced the requirements of human labor in cotton production? What changes have taken place in other sections?
8. How does the yield per acre in your state today compare with the yield per acre of ten years ago?
9. What are the cost items that enter into the production of cotton? Can these be changed in any way?
10. How is cotton seed used?
11. Why should cottonseed meal and hulls be fed on the farm?
12. What is lacking in cottonseed meal as a feed? How can this be supplied?
13. What does it mean to say, "Live stock completes the cycle of fertility?"

Selected References

U. S. Department of Agriculture

See chapter 2 on "Agricultural Adjustment."

Agricultural Statistics (annual) Yearbook Separate.

Crops and Markets, Bureau of Agricultural Economics.

Outlook Material (annual) Bureau of Agricultural Economics.

National Cottonseed Products Association (Dallas, Texas)
The Inside Story of a Cotton Boll.
Livestock Completes the Cycle of Soil Fertility.
Cottonseed and its Products.
Facts About a Great Exclusively Southern Industry.

Suggested Activities

1. Make a study of the trend in cotton production by referring to the most recent statistics either in the Yearbook Separate of the U. S. Department of Agriculture or the Year Book of the Cotton Exchange to find out (1) the per cent of the world cotton produced by the United States, (2) the world supply, (3) the world carryover, (4) the trend in total production for each of the states, and (5) the acre yield for each state.
2. Make a study of the cost of producing cotton in your community by taking the items given in the table in this chapter and getting the cost on each for as many farms in the community as possible. Figure also the cost per pound at the various yields per acre.

Chapter 9

COTTON
PROCURING AND TESTING SEED

DAVID R. COKER

THE first step in procuring cotton seed is selecting the variety.

A variety of cotton, or any other plant, is a strain that combines a number of characteristics in a definite way.

The following characters are among those which are important in the selection of a variety of cotton for any farm or community:

Characters of Cotton Varieties

1. Yield
2. Quality of lint
3. Earliness
4. Disease resistance
5. Size of boll
6. Storm resistance
7. Lint percentage
8. Prolificacy
9. Type of plant growth
10. Shedding
11. Lint index
12. Size of seed

Varieties are compared on the basis of these and other characteristics. The importance of each may vary with the community and conditions. In some sections, for example, resistance to cotton-wilt may be the character given first consideration. In every community there is one variety that may be regarded as *standard*. When new varieties are considered, they should be compared with the one regarded as most desirable for the locality.

In general it may be said that yield, earliness, disease resistance and the length of staple are major considerations in selecting a variety of cotton to grow. A variety must yield well to be profitable; it must be early to reduce injury from insects; it must have a staple of $^{15}/_{16}$ of an inch or better to meet market requirements.

The importance of the length of staple cannot be over emphasized. As competition from foreign countries

COTTON VARIETY TESTS

Every College of Agriculture in the South conducts cotton variety tests the results of which anyone may secure on request.

increases, we must depend more and more upon staple and grade to maintain our markets. The cotton mills of America, as well as those in other countries, prefer cotton with a staple length of 1 inch or $1\frac{1}{16}$ or $1\frac{1}{8}$ inches.

—Courtesy David R. Coker

WILT RESISTANCE MAY BE THE MOST IMPORTANT FACTOR IN CHOOSING A VARIETY OF COTTON IN SOME SECTIONS OF THE SOUTH

Cotton Varieties.—There are hundreds of cotton varieties. The variety, as such, does not remain fixed in all characteristics very long. Varieties come and go rather quickly. There are very few varieties that are popular today which were grown twenty years ago. To select a variety to grow is difficult. As an aid to cotton growers, variety tests are carried on by the experiment stations in every state where the crop is of commercial importance. The results of these tests are published each year. Such reports are available to all who request them. As a general rule, it may be said that these tests constitute the best guide to the selection of a variety.

On page 148 is given a typical cotton variety study published by the Mississippi Agricultural Experiment

Station which was based upon the results of test plats located at one of the branch stations:

Cotton Varieties

Variety	*Per Acre*		*Rank in Value*	*Lint Data*		*Bolls per Lb.*
	Pounds Lint	*Total Value*		*Percentage*	*Staple Inches*	
Delta Pine (D & PL 11)	429.6	67.75	1	40.3	1 3/32	94
Half & Half	425.8	58.05	10	45.3	7/8	84
Stoneville 2B	382.8	63.63	3	37.9	1 1/8	88
Delta Pine (D & PL 11A)	380.9	62.44	4	40.1	1 1/8	93
Stoneville 5	378.1	60.33	6	38.5	1 3/32	97
Stoneville 2A	369.5	62.33	5	35.8	1 1/8	91
Stoneville 3	358.5	57.60	12	37.5	1 3/32	94
Farm Relief	357.7	57.89	11	36.5	1 3/32	79
Ambassador	355.3	57.54	13	36.4	1 3/32	81
Cleveland 54	354.1	56.24	14	35.7	1 1/32	86
Delfos 531A	343.7	63.99	2	35.8	1 7/32	95
Acala	333.4	52.53	17	38.5	1 1/16	87
Miller	327.2	52.25	18	36.7	1 1/16	75
Washington	327.2	56.00	15	37.1	1 5/32	80
Missdel WR 1	325.4	58.63	8	33.9	1 3/16	80
Delfos 531B	321.3	59.86	7	35.7	1 7/32	100
Cleveland 884	309.8	50.25	21	36.2	1 3/32	96
Suttle #1	302.7	54.98	16	32.9	1 3/16	80
Delfos 9252	298.6	58.55	9	32.6	1 1/4	92
Rowden 5031	295.4	46.95	24	35.6	1 1/32	77
Missdel 7	289.1	51.67	19	35.0	1 3/16	71
Missdel 4	282.4	50.36	20	35.3	1 3/16	107
Stoneville 5A	279.6	46.38	25	38.2	1 1/8	97
Express Lightning	276.3	50.04	22	33.2	1 3/16	106
Webber, Deltatype	259.6	49.25	23	33.2	1 7/32	89
Missdel 1-0539	242.2	42.20	26	34.6	1 5/32	88

On the basis of such testing, and on the experience of growers, certain varieties become popular. To give some idea of the varieties grown, but not as specific recommendations, the following generalizations may be made:

Popular Varieties

In the Coastal Plain section east of the Mississippi River where much of the land is infested with wilt, the varieties with 1 inch and 1 1/16 inch staple most generally recommended are dixie triumph and clevewilt. Staples of less than one inch (7/8) are Cook 307 for Georgia and Alabama, and in Georgia, Petty's Toole and Perry's Toole.

Varieties recommended for non-wilt land in Georgia are Stoneville 2-B, D & P. L. 11-A, Farm Relief, College 1, and

Piedmont Cleveland. In Alabama, Stoneville 5, D & P. L. 11-A, Cook 144, and Cook 912. In South Carolina, Farm Relief, Cleveland 884. In North Carolina, Mexican Big Boll, Cleveland 884 and 885. In Tennessee and Virginia, Trice and Stoneville 2-B and 5.

In Mississippi, Stoneville 2-B and 5, D. & P. L. 11-A, and in the delta, Delfos.

In Louisiana and Arkansas, Rowden, Acala, and Wilson-type Cleveland Big Boll.

In Texas, Oklahoma, and most of the western territory, Acala, Mebane, Qualla, and Lone Star.

There are a number of strains of cotton which have been bred to meet particular conditions. These bear the same varietal name but are designated by a *number*.

A Bushel of Cotton Seed

Before and after delinting. Many advantages are claimed for delinting cotton seed. These are (1) planting at regular intervals so that chopping is eliminated; (2) a saving of fifty per cent in seed; (3) the reduction of loss from disease; and (4) improved germination.

In some instances instead of a number the name of the person making the selection is given along with the name of the variety. These numbers, or other designations, are very important, therefore the grower must become familiar with the *full* name of the variety recommended.

While there are hundreds of varieties of cotton, most of them are selections from a much smaller number. The smaller number are the more important for the reason that they represent the *standard variety types.* The cotton breeders of the experiment stations in the Cotton Belt and the U. S. Department of Agriculture have agreed upon these types and have published a description of each.

STANDARD VARIETAL TYPES

Approved by the Agronomy Section of the Association of Southern Agricultural Workers

Acala 5	Express 121
Acala 8	Half and Half
Arkansas Rowden 40	Kasch
Cleveland 5	Lone Star
Cleveland Piedmont	Mebane
Cleveland Wannamaker	Mexican Big Boll
Cleveland 884	Missdel
Cook 306-7	New Boykin
Delfos	Oklahoma Triumph 44
Delta & Pine Land 4-8	Pima
Delta & Pine Land 10	Stoneville
Delta Type Webber	Station Miller
Dixie Triumph	Toole
Dixie 14	Trice
Express Lightning	Wilds

All strains of cotton worth considering belong to one of these types. No variety of cotton is subject to registration until it has passed through a period of trial at one or more experiment stations. The grower having a list of registered strains need not consider the many so-called varieties for which superior claims may be made.

One Variety Communities.—Only one variety of cotton should be grown in a community. If many are grown, they will soon become mixed, and as a result, the cotton of the locality will be of a nondescript quality which will be discriminated against by the buyers. The quality of American cotton can be improved, for the Cotton Belt as a whole, only through one-variety production programs. E. C. Westbrook, cotton specialist, Agricultural Extension Service, State of Georgia, lists the following advantages of One-Variety Community Cotton Production:

Some Advantages of Growing Only One Superior Variety of Cotton in a Community or Gin Territory

1. Mixing of varieties in the field by bees and other insects will be prevented.
2. Mixing of varieties in picking and in handling the seed cotton and seed will not occur.
3. By ginning where no other variety is ginned mixing of the seed and plating of the bales with other varieties will not result.
4. In regulating the gins for the one kind of cotton, a better turnout and better sample will result.
5. Pure planting seed of the best quality and variety will be available every year at a minimum of trouble and cost.
6. Production per acre will be increased at least 10 per cent at practically no extra expense or trouble.
7. No trouble will be experienced with the pickers as all the cotton in the community will pick alike.
8. Cotton of uniform length and character of staple will be produced in accord with market demand.
9. Quality cotton is always in demand at a relatively good price and it is never penalized if properly marketed.
10. Buyers will seek quality cotton wherever it can be obtained in sizeable and even-running lots.
11. A reputation for producing good cotton in a community or gin territory can be established and maintained in no other way.
12. Pure seed of the better varieties is also better for oilmill purposes and the mills are now ready to pay more for it.
13. All production and marketing problems are more easily solved in an organized community.

14. The cooperation and assistance of government, state and other agencies are utilized to the best possible advantage.

In the bulletin, *One-Variety Community Cotton Production,* (Georgia Extension Service 440) Mr. Westbrook suggests that to organize and to maintain a *One-Variety Community,* an organization be formed with the following rules and regulations:

Rules and Regulations

1. Beginning with the crop of 19....., the entire crop of the members which is located within the .... community area will be limited to the .... variety, which is included in the recommendations of the State Institutions for this territory and which meets with the approval of the majority of the members of the association.

2. Members will grow the adopted variety exclusively in the community area from year to year until some other variety has been found by the State Institutions to be superior for the local conditions and such variety is adopted by the membership as a unit upon the approval of the majority of the members of the association.

3. Seed stock of the adopted variety will be obtained direct from the originator and breeder in the beginning and as often thereafter as deemed necessary by the executive committee. The seed stock will be multiplied for the use of all the members by two or more members selected for this purpose.

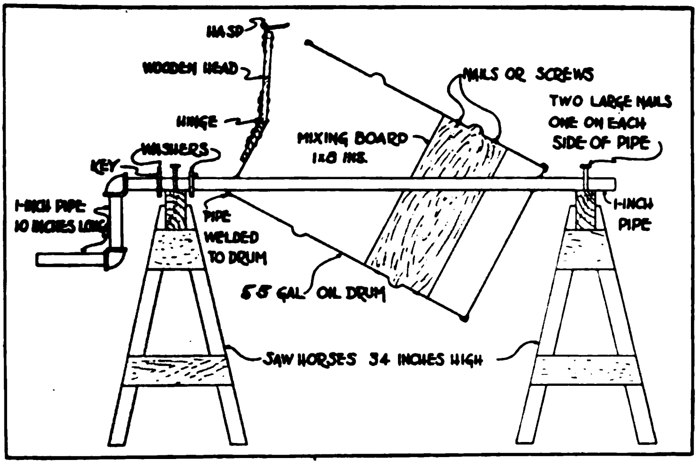
4. Members multiplying the seed stock will receive from the other members for this service compensation sufficient to cover any extra expense they have borne in its performance, that is, this seed will be distributed among the members at a price including only the current or seasonal oilmill rate for seed and the extra expense just mentioned.

5. Proper ginning arrangements for the entire crop of the community variety grown within the community area will be made by the executive committee, subject to the approval of the majority of the members of the association.

6. The cooperation and assistance of the county agent, and specialists of the State and Government will be used to the best possible advantage.

7. Additional rules and regulations as deemed necessary will be decided upon and promulgated by the executive committee, from time to time, subject to the approval of a majority of the members of the association at its next meeting.

Any of these rules and regulations may be amended at any time by the approval of a majority of the members of the association.



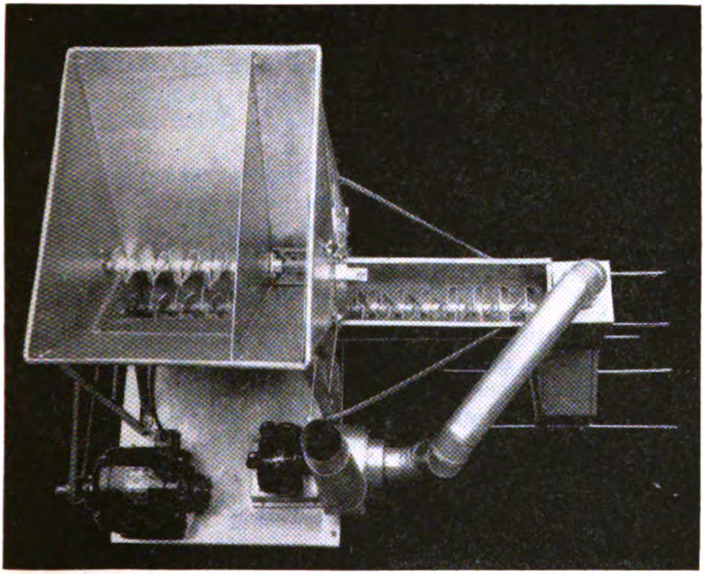
MACHINE FOR TREATING SEED WITH DUST

This machine is made from a 55-gallon oil drum and is designed for mixing disinfecting dusts with cotton, small grains, sorghums, and other seed to control certain seed-borne diseases. The machine is filled half full of seed and the dust added. As the machine is turned, the seed and dust are thoroughly mixed. Such a machine may be made on any farm or in any school shop.

It is recommended that the seed stock be obtained from an established breeder of recognized standing and that some new seed, obtained from the breeder, be brought into the community each year. It is advisable, if there are many growers in the community, that one or more members of the association be selected for multiplying or increasing the seed obtained from the breeder. But it is essential that seed, coming direct from the breeder, be brought into the community either a little each year or an entire new supply once in every three or four years.

Breeding cotton is a specialized business. Few persons are equipped to engage in it successfully. One of the mistakes often made in community cotton production is that an association, as soon as organized, attempts to engage in the selling of cotton seed for planting. This is a mistake. It is far better to depend upon a seed breeder as a source of supply, and for the members of a community association to consider the advantages listed as sufficient benefits to be derived from the one-variety effort. This does not mean that it is unwise for an individual grower or an association to secure the best seed that can be obtained in small quantities and increase or multiply this seed for planting the entire acreage or community.

Testing Cotton Seed.—Cotton seed should be tested for germination and freedom from disease, if there is any doubt about these matters in the mind of the grower. In many states such a service is rendered by the college of agriculture or the state seed laboratory. The testing for germination may be done at home or at the schoolhouse. The rag doll method, the incubator, or the soil test may be used. As to disease, it is advisable to get the aid of a plant pathologist, if possible. Some growers follow the practice of delinting seed for planting. This has the advantages of reducing the volume and quantity of the seed, of permitting it to plant more evenly and germinate more quickly, and of preventing some of the diseases of cotton. This practice would probably be quite generally followed if all growers felt that they could delint seed without danger of injuring its germination qualities. The lint is removed from cotton seed by the use of sulphuric acid. One bushel of seed may be placed in a tub into which is poured nine pounds of sulphuric acid. This is stirred until the lint is removed. The seed is then washed thoroughly with



—*Courtesy Ben Gustafson Seed Grain Machinery Co., Fargo, North Dakota*

A MACHINE FOR TREATING PLANTING SEED

water and spread out to dry. If there is danger of blight, the seed may be treated with organic mercury dust at the rate of four ounces per bushel. The two may be mixed in a revolving drum for fifteen or twenty minutes.

SUGGESTIONS FOR STUDY

QUESTIONS AND PROBLEMS

1. What are the more important *characters* of cotton varieties? Which are regarded as the most significant in choosing a variety for your community?

2. What is meant by *length of staple?* Is this a variety character? What length is desired?
3. What are the most popular cotton varieties in your section? How long have they been grown?
4. What is the significance of a number or name in connection with a variety of cotton?
5. What is meant by a standard varietal type? From what standard type is your most popular variety selected?
6. What is meant by one-variety cotton production? What are the advantages of such a plan? What are the disadvantages?
7. What rules and regulations should one-variety communities adopt? Give the reason for each.
8. Where do the growers of your community secure seed? How many make field selections? How many grow seed plats? How often do they go back to the breeder for new seed?
9. Should cotton seed be delinted for planting? Should it be tested for germination? for freedom from disease?
10. What differences in the value of lint per acre were found in the Mississippi variety tests quoted in the text? How much would this amount to on your farm on the basis of the number of acres grown?

Selected References

Farmer's Bulletins, U. S. Department of Agriculture
1384—*Community Cotton Production.*
1686—*Common Errors in Cotton Production.*
State Publications (Land-Grant Colleges)
Texas—531—*Chemical Dust Treatment of Cottonseed for Planting Purposes.*
Tennessee—158—*Cotton Varieties and Related Studies.*
Georgia—440—*One-Variety Community Cotton Production.*
South Carolina—Circular 48—*Community Production of Cotton in Relation to Yield and Staple Length.*
(All states for variety tests reported annually)

Suggested Activities

1. If more than one variety of cotton is grown in your community, make a study of variety characteristics using the characters given in the text. Write a statement describing each variety grown.

2. From a farm study, if more than one variety of cotton is grown in your community, make a table using the same form and items given in the Mississippi report.
3. Make a germinator for testing seed in your school laboratory and test samples of cotton seed for planting.
4. Following the directions given in the text, delint a small quantity of cotton seed and plant to determine whether the germination of cotton seed is decreased by delinting.

Chapter 10

FERTILIZERS FOR COTTON

J. S. MOGFORD

SINCE the early development of the commercial fertilizer industry, the principal consuming area has been the South. In the 1910-1914 period, the 16 states comprising the South Atlantic and South Central regions accounted for 75.8 per cent of the total consumption. Since a somewhat more rapid increase has taken place in other areas, the ratio of consumption in the South to the national total has declined moderately, but it was still 68.3 per cent in 1936. Five states in the Southeast—Virginia, North Carolina, South Carolina, Georgia, and Alabama—used 49 per cent of the total tonnage of commercial fertilizer purchased in the United States in 1936.

The above paragraph is significant for the student of cotton production because most of the plant food purchased in the South is used under the cotton crop. More fertilizer is probably required in producing cotton than in growing all other field crops combined. Fertilizer is an essential in most sections for profitable yields.

With the exception of labor, the largest item of cost in the production of cotton, for the Cotton Belt as a whole, is fertilizer. Consequently, the cotton farmer is greatly concerned with the problem of procuring commercial plant food. He must decide what plant food is required and how much to apply per acre. He is interested, also, in the time and method of application.

Plant Food Requirements of Cotton.—Before a farmer can intelligently select a fertilizer for cotton, or for that matter any other crop, he must know something of the food requirements of the plant, and something about the soil type and the state of fertility of the soil where the crop is to be grown.

Cotton does not remove a large quantity of plant food from the soil. Indeed, no other ordinary crop makes such a slight demand on fertility as does the cotton fiber. If the seed and all other parts of the plant, except the lint, were returned to the soil there would be no appreciable reduction in fertility in the growing of the crop.

It would therefore seem that it would be unnecessary to use such large amounts of fertilizer under the cotton crop. But the food requirements of the plant do not constitute an accurate guide for the application of fertilizer. It must be remembered, also, that there is a considerable loss of plant food through leaching, soil erosion, and the sale of the seed. Also much of the phosphoric acid applied goes through a chemical reaction in the soil which makes it unavailable for the use of plants.

In the cold sections of the Northern states, the soil remains frozen for months during the winter. No change in the soil is taking place under this condition. In the South, however, bacterial and chemical action never cease. This means that plant food is being lost at all seasons of the year. There is a complete loss unless some crop is growing on the land to utilize the plant food which is being made available. This means that we should keep the land covered with a growing crop at all times so that this food may be saved. Then again, we should use all of our cottonseed at home, as a feed for livestock, so as to keep this fertility on the farm. As it is, we have for generations been selling this valuable protein feed, cottonseed, to other sections of the nation. In this way we have been selling the food from which crops are produced.

These observations do not mean that less commercial fertilizer should be used under cotton. Not at all. The

COTTON RESPONDS TO GENEROUS FERTILIZER APPLICATIONS
The relative size of the plants displayed by the vocational student in this photograph is due to the difference in the fertilizer applications on the two portions of his project area.

task of every grower of farm products is to keep the cost per unit at the lowest possible level. In the case of cotton, this means that lint and seed should be produced at the lowest possible cost per pound. The cost of production per unit is usually reduced as the application of fertilizer is increased. Of course, there is a point beyond which increased applications of fertilizer *begin to increase* the unit cost. *It is the task of the efficient producer to find that point.* The highest yields of cotton per acre are often made in North Carolina, and there is no state, on the average, that uses more fertilizer per acre.

Fertilizer Requirements of Cotton.—In most sections of the South cotton requires a complete fertilizer; that is, a fertilizer which contains *nitrogen, phosphoric acid,* and *potash.*

The amount of nitrogen used in the fertilizer usually affects yields more than any other plant food element. Generally speaking, cotton yields per acre increase in direct proportion to the amount of nitrogen applied, up to about thirty-six pounds per acre, which is the equivalent of 200 pounds of nitrate of soda.

All the needed nitrogen may be applied in the mixed fertilizer, at planting time, if properly placed with reference to the seed. Or about four per cent may be applied in the mixed fertilizer, and the balance as nitrate of soda or sulphate of ammonia at the rate of 100 or 150 pounds per acre.

Potash is important in relation to cotton fertilizers. In addition to supplying plant food which tends to make a contribution toward increasing the yield, it is necessary in the control of *rust.* It is not uncommon to talk of "potash hunger" in the case of the cotton plant. Potash is most essential on light sandy soils and in areas where the control of wilt is a serious problem.

State Recommendations.—Just as every experiment station in the South conducts test plots to determine the best varieties of cotton to grow, so they conduct fertilizer experiments to discover the best practices in supplying plant food for cotton. Every state in the Cotton Belt has conducted such tests, and in most of the more important cotton growing states reports of this work are published frequently. Let us consider a few of these recommendations.

It has already been pointed out that large yields per acre are made in North Carolina. Definite fertilizer recommendations for cotton, and all other crops, have been made for each section of that state. The entire state has been divided into areas with common climatic and soil characteristics. A study of the fertilizer recommendations for all of these areas reveals that the best yields may be expected when 600 pounds per acre of a 4-8-4 fertilizer are applied at planting time, followed with a top dressing of about 100 pounds of nitrate of soda after chopping. The recommendations for each of these areas is given below. Persons living in North Carolina will notice particularly the district in which they reside; others will observe the general uniformity in the recommendations as they apply to the entire state.

NORTH CAROLINA

Fertilizer Recommendations for Cotton

Area	*Soils*	*Fertilizer Analysis*	*Rate of Application*	*Rate of Top-Dressing*	*Estimated Acre-Yield*
1-5	Sandy loams Silt loams	4-8-4	600 lbs.	75-100 lbs.	440 lbs. lint
5-A	Sands	4-8-4	600-800	100-125	240
6-7	well-drained loams	4-10-4	500-600	75-100	480

These are rather high applications, but the yields of lint per acre are far in excess of the average production for the nation. How do these recommendations compare with those for other states?

Let us examine the fertilizer recommendation for Alabama. These are summarized in Circular 70 of the *Alabama Polytechnic Institute* as follows: "*Most of the fertilizers which have been used for cotton contained more phosphate and less nitrogen than were needed. In the light of our results, the best fertilizer for cotton on average Alabama soils is one that supplies at least 36* *pounds of nitrogen, 48 pounds of phosphoric acid, and 24 pounds of potash per acre. To supply these elements of plant food, it would require 225 pounds of nitrate of soda or the equivalent, 300 pounds of superphosphate, and 48 pounds of muriate of potash, or a 6-8-4 fertilizer applied at the rate of 600 pounds per acre.*

"This amount of fertilizer per acre may seem excessive since the average amount of low grades of fertilizer used in Alabama is about 300 pounds per acre. Tests which have been in progress at three places during 1934 and six places during the past year show that 600 pounds per acre of 6-8-4 fertilizer produced 221 pounds of seed cotton per acre more than a 300 pound application. After considering the cost of these amounts of a 6-8-4 fertilizer and the value of the seed cotton (4 cents per pound), the 600 pound application was more profitable than the 300 pound application by $5.38 per acre."

The summary of this fertilizer test work in Alabama is given in the table on page 164.

These fertilizer recommendations for cotton as given by the stations of North Carolina and Alabama are not unlike those of other states. It will be noted that the two are very similar.

Virginia recommends from 400 to 800 pounds per acre of a 4-8-6 for sandy soils, and 4-10-6 for heavier soils, and, in addition, from 100 to 200 pounds of a "quick acting nitrogen" fertilizer as a side dressing at chopping time.

Louisiana advises 4-H club members, "The fertilizer recommendations for the alluvial soils of the Mississippi, Black and Red River Valleys are: 150 to 200 pounds nitrate of soda, or 100 to 150 pounds of sulphate of ammonia per acre. On Ouachita Valley soils the following should be used: 150 to 200 pounds nitrate of soda, 200 to 300 pounds superphosphate and 50 to 75

ALABAMA

Fertilizer Recommendations for Cotton

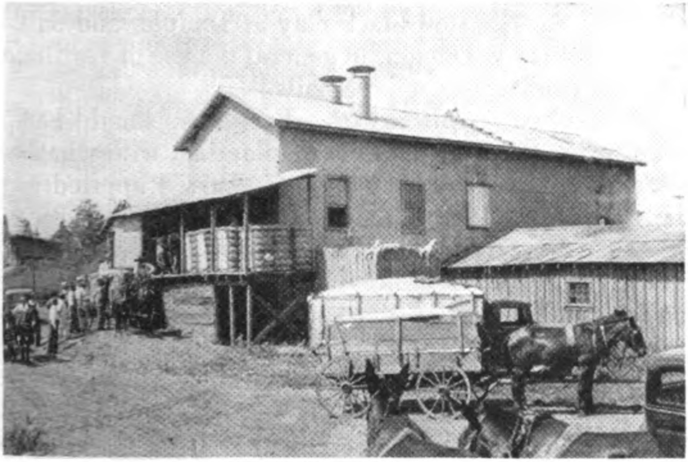
The Six-Year Average Yield of Seed Cotton and Returns When Various Grades of Fertilizers Were Applied at the Rate of 600 Pounds per Acre at Five Experiment Fields and Three Substations (1930-1935)

Plot	*Fertilizer N-P_2O_5-K_2O*	*Per Acre*					
		Yield	*Less than 6-10-4*	*Value of Cotton* [1]	*Cost of Fertilizer* [2]	*Value of Cotton Less Cost of Fertilizer*	*Loss Based on 6-8-4* [3]
		LBS.	LBS.	$	$	$	$
2	0-10-4	697	544	27.88	3.80	24.08	18.00
3	2-10-4	923	318	36.92	5.04	31.88	10.20
4	4-10-4	1086	155	43.44	6.28	37.16	4.92
Check	6-10-4	1241	...	49.64	7.52	42.12	....
11	6- 6-4	1183	58	47.32	6.32	41.00	1.08
10	6- 8-4	1225	16	49.00	6.92	42.08	....
Check	6-10-4	1241	...	49.64	7.52	42.12	....
6	6-10-2	1190	51	47.60	7.12	40.48	1.60
Check	6-10-4	1241	...	49.64	7.52	42.12	....
8	6-10-6	1347	+6	49.88	7.92	41.96	0.12
16	2-11-3	923	318	36.92	5.14	31.78	10.30
15	3-10-3	998	243	39.92	5.46	34.46	7.62
14	3- 8-5	976	265	39.04	5.26	33.78	8.30
12	4- 8-4	1064	177	42.56	5.68	36.88	5.20
Check	6-10-4	1241	...	49.64	7.52	42.12	....

[1] Seed cotton valued at 4 cents per pound.
[2] Cost of fertilizer ingredients: nitrate of soda, $33 per ton; superphosphate, $16 per ton; and muriate of potash, $33 per ton.
[3] After deducting the cost of the fertilizer, the grades of fertilizers indicated were less efficient than the 6-8-4 by the amounts shown in the last column.

pounds of muriate of potash. A home-mixed or a complete commercial mixture analyzing from a 3-7-4 to a 5-8-5 may be used at the rate of from 300 to 500 pounds per acre. Hill and upland soils should receive at least 300 pounds per acre of a 5-8-6 mixture. The fertile soils of the Bayou Macon Ridge should be fertilized as recommended for alluvial soils. The poorer soils of the Ridge should be treated as uplands.

"From the best information obtainable, it seems advisable to apply all fertilizer materials before planting. However, if the grower prefers, nitrates and sulphate of ammonia can be used as a side-dressing soon after the cotton is thinned."



A ONE-VARIETY COTTON GIN

Texas and Oklahoma use very little fertilizer, as compared with other cotton growing states. Since Texas produces such a large part of the national crop, the following summary of their fertilizer tests is of great general interest: "The sandy soils in the eastern part of the State are deficient in nitrogen, phosphoric acid, and potash. The application of 200 to 400 pounds per acre of a 4-6-4 or a 4-8-4 fertilizer, or the equivalent, is recommended for these soils.

"The Lake Charles soils in the Gulf Coast Prairie are first in need of phosphate. The use of 100 pounds of superphosphate, or 200 to 600 pounds of a 4-8-0 fertilizer per acre is suggested for cotton on these soils.

"The Lukfin fine sandy loam apparently needs phosphoric acid and potash before it does nitrogen. The 4-12-4 and 0-12-4 fertilizers gave better results on this soil than the other fertilizers used.

"Although fertilizers gave some response on the Goliad fine sandy clay loam at Beeville, on the Houston clay and the Houston black clay at Temple, and on the San Saba clay at Denton, in general the use of fertilizers was not profitable on these soils."

Method of Application.—Fertilizers should be applied prior to, or at the time of planting, with whatever additional nitrogen that may be required applied as a side application before the squares appear on the cotton. If as much as 600 pounds of a mixed fertilizer is used per acre, it should be applied in a wide stream at the bottom of the furrow marking the row. It should be mixed thoroughly with the soil, which should be bedded a week before planting. It is advisable to allow a rain to fall before planting so that the bed will be well settled.

Nitrogen stimulates leaf growth. It hastens the appearance of squares and the setting of bolls, but where applied late will tend to delay maturity. Phosphoric acid helps form the seeds in plants. It hastens the maturity of cotton, which is of great importance when produced in competition with boll weevils. Potash feeds the stems and stalks. It helps to overcome the tendency of nitrogen to make plants less resistant to disease. Whatever form of potash is cheapest should be used, but kainit has been recommended as the ideal potash carrier where the control of rust is a problem.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What per cent of the commercial fertilizers sold in the nation are used in the South? Why?

2. Why is most of the fertilizer used on Southern farms applied to the cotton crop?
3. Does cotton remove much plant food from the soil? The lint? The seed?
4. Why does the South use more commercial plant food than other sections of the nation?
5. Should we use more or less fertilizer than we do? Why?
6. What are the recommendations for fertilizing cotton in your state? How do they compare with the recommendations for North Carolina? Alabama?
7. How much fertilizer per acre is used under cotton on your home farm? How does this compare with your state recommendations? How does your acre yield compare with the average for the state?
8. Give the function of nitrogen? Of phosphoric acid? Of potash? What is meant by side dressing? When should it be applied?
9. How do the yields in your state compare with the yields in other states in the Cotton Belt?
10. How and when should fertilizer be applied?

Selected References

Circulars, U. S. Department of Agriculture

264—*Mechanical Application of Fertilizers to Cotton in South Carolina.*

Miscellaneous Publications, U. S. Department of Agriculture

126—*Fertilizers for Cotton Soils.*

Technical Bulletins, U. S. Department of Agriculture

426—*The Relation of Fertilizers to the Control of Cotton Root Rot in Texas.*

452—*Experiments with Nitrogen Fertilizers on Cotton Soils*

State Publications

Alabama—Bulletin 228—*Fertilizer Experiments with Cotton.*

Arkansas—Bulletin 255—*Cooperative Fertilizer Experiments with Cotton.*

North Carolina—Extension Circular 208—*Agricultural Program for North Carolina*

Texas—Bulletin—469—*Fertilizer Experiments with Cotton.*

Suggested Activities

1. Make a study of cotton growing in your community to learn to what extent fertilizers are used and the results obtained.

Tabulate the results of such a farm study under the heads: (1) Name of Grower, (2) Formula Used, (3) Rate of Application, (4) Cost Per Acre of Fertilizer, and (5) Acre Yield. Which rate of application proved most profitable?

2. Determine the cost of fertilizing ten acres of cotton following the recommendations of your state experiment station, using the local price for the fertilizers recommended. Compare with the cost determined for the community.

Chapter 11

COTTON
PLANTING AND CULTIVATING

H. W. BARRE

IT HAS already been suggested that cotton should not be grown on land which will produce less than one-third or one-half bale per acre. This means that cotton is to be grown only on the best land and brings out the importance of caring for such land properly.

As soon as one crop is harvested preparation for growing the next one should be started. This means that if the land is terraced, the terraces should be inspected and any needed repairs made before the winter rains. It means, too, that the stalks or crop residue on the land should be turned under. This practice destroys insect pests and incorporates needed organic matter into the soil. Turning under will add to the fertility of the land and to its water-holding capacity.

Turning under stalks and other vegetable matter is a difficult job with one- or two-horse equipment. Therefore, it is advisable to use a stalk cutter before attempting to plow. It is advisable, too, to run over the land with a disk which will aid in cutting the stalks into small pieces.

Land should be plowed, generally speaking, in the fall. The only objection to such plowing is that the land may wash or blow during the winter months. This objection can be overcome by planting a cover crop which will protect the soil from erosion and at the same time add to its fertility by utilizing plant food that would leach or be washed out of the feeding zone of the plants. When cover crops are turned under this plant food is retained and the capacity of the soil to hold water is increased. Of course, such crops may be planted without plowing.

Breaking the Land.—There are three methods of planting cotton: (1) flat, (2) in lister furrows, and (3) on beds. The first two methods are used principally in the Western states in the irrigated region or where it is comparatively dry. Throughout the major portion of the South, land for cotton is bedded. It is not necessary to break the land before preparing the beds but it is generally recommended in most states.

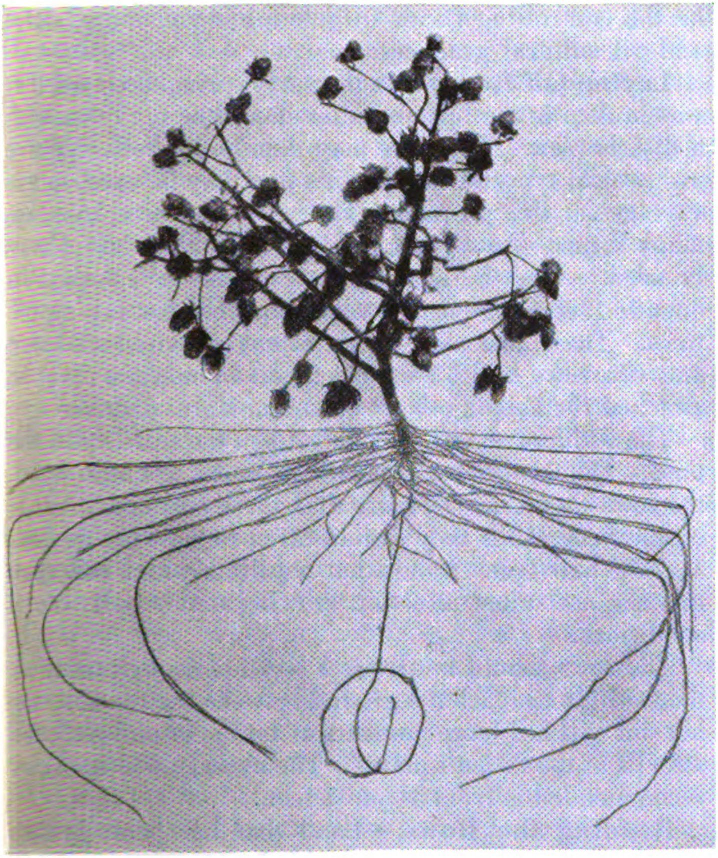
Depth to Break.—Land should be plowed deeper than it is possible to do with a one-horse plow—five inches or more. By deep plowing the feeding zone of the plants is increased and more plant food is made available.

Many experiments have been conducted which deal with the proper depth to plow. In Oklahoma a test was made in which plowing was done at the rates of five, ten, and fifteen inches. It was found that the ten-inch plowing yielded little more than the five-inch plowing. The lowest yields were obtained on the land which was plowed to a depth of fifteen inches. In general, plowing from five to seven inches deep gives the best results.

When to Break.—Cotton requires a firm seed-bed. To secure it the land should be prepared some time in advance of planting. All sod should be broken in the fall. This rule applies to all the heavier types of soil, that is, soils made up largely of clay.

One of the advantages of fall or winter plowing, in addition to increasing the fertility and improving the physical condition, is that land plowed in the fall can be prepared earlier in the season than spring-plowed land.

This, however, does not apply to light sandy soils so much as it does to clay loams. Early planting is important as it aids in controlling the boll weevil and other pests. Early maturity is the most effective means of insect pest control. As a matter of fact, since 1920, for the major portion of the Cotton Belt every possible effort



THE ROOT SYSTEM EXPLAINS WHY COTTON IS A DROUGHT-RESISTANT CROP has been made to hasten the maturity of cotton. This has been unfortunate in many ways for it has destroyed the Sea Island cotton production; it has led to the selection of early varieties regardless of the length of staple and other desirable characteristics; and it has influenced every other decision in the growing of cotton. But early maturity has been essential and for that reason it had to be the controlling factor in determining planting dates and all cultural practices.

Laying Off Rows.—In the early spring the land that was broken in the fall or winter should be run over with a disk harrow. The rows may then be laid off. There are several types of implements that may be used to advantage for this purpose. The middlebuster is used on many farms. An ordinary plow stock with a shovel may be used. A two-horse cultivator with all except the two outside feet removed is a very good tool for laying off rows. These feet may be set at any required distance and two rows laid off at one time. A marker may be attached for keeping the rows at a uniform distance.

The width of the row depends upon the fertility of the land. On the poorer soils which make a small weed, the rows should not be more than three feet apart, while on the better soils they should often be as wide as four and one-half feet. Lands that require a wider row than this are not suited to cotton growing under boll weevil conditions.

The rows should in all cases be wide enough to allow the sunlight to reach the ground between the rows, as the hot sun will kill large numbers of larvae or undeveloped weevils in the fallen squares. The average width of row recommended is from $3\frac{1}{2}$ to 4 feet.

Bedding the Rows.—Land that has been broken broadcast in the fall can be bedded up much easier and cheaper than that which has not been broken. A much better seed-bed can be prepared on land that has been broken and a better stand of cotton can be secured. This is important in the growing of cotton, or any other crop. It is impossible to make a good yield without a good stand.

The two-horse cultivator with either a disk or gangs with turn plows is a very efficient implement; one row can be prepared in a single operation. Where the soil is mellow the disk attachments are very satisfactory, but where it is a little packed the turn-plow attachments will probably do better work. The disk harrow can also be employed in the same way. Among the one-horse implements, the Planet Junior cultivator with special turning plow attachments is most satisfactory. One man and one mule can list and bed out a row in one round. This implement, however, is not adapted to rough, trashy, or stony ground. The disk harrow or cultivator does better work in such places.

The seed-bed should be raised slightly above the general surface. This gives good drainage and causes the seed-bed to warm up earlier in the spring, which is a very essential factor in securing a good stand.

The seed-bed should be thrown up at least two weeks before planting time where possible. Just before planting, the field should be run over with a spike tooth harrow, or some similar implement, to knock off the tops of the beds, thereby killing a crop of weeds and grass and forming a mulch. Where a harrow is run ahead of the planter it knocks off the top of the ridge and gets the seed down into the fresh moist soil.

Amount of Seed to Plant.—In general, it may be said that one bushel of cotton seed is planted to the acre. However, many farmers plant one and one-half bushels. In the heavier soils it is better to plant the larger amount. No satisfactory yield can be obtained without a good stand. In the case of some crops, it is not advisable to plant many seed for the reason that the land will not support and bring to maturity too great a number of plants. For the most part, the number of seed is unimportant in the growing of cotton for the reason that the crop is *chopped* to the desired stand. Of course, if the seed is delinted and planted to a stand, then the seed should be tested for germination and planted at the rate and distance desired.

Delinting Cotton Seed.—Delinting cotton seed—that is, removing the fibers that cling to the seed after ginning—is often recommended. It is a means of controlling certain diseases and permits more accurate spacing of the seed. The practice makes it difficult, however, to distribute the seed by the ordinary cotton planter. The Georgia College of Agriculture gives the following directions for delinting cotton seed with sulphuric acid:

"Because of the extremely caustic nature of commercial sulphuric acid it should be handled with great care, taking caution that none of it gets on clothing or any part of the skin.

"Three thoroughly dry tubs should be provided. Coating the inside of the tubs with melted roofing pitch will help preserve the tubs. One tub should have the bottom closely perforated with quarter inch auger holes and the entire bottom covered with 12 or 14 mesh wire screen to furnish a sieve for draining off the acid and assisting in washing the seed after treatment.

"Place the seed to be treated in one of the tubs and pour enough concentrated acid over them to wet completely. Stir the seed thoroughly, and continue the stirring until the lint is removed. Then pour the seed and acid into the perforated tub, supported over the third tub and allow the acid to drain out. Then place the perforated tub with the seed in it over a ditch or drain and quickly wash the seed by pouring water over them while stirring constantly. Be sure to wash all the acid off the seed and then spread them out to dry. (It is rather strange, but the acid diluted with water will 'eat' the seeds while the concentrated acid will not.)

"The acid may be used until it becomes too thick to pass through the sieve. From 9 to 10 pounds of acid is required for each bushel of seed."

When to Plant.—It is desirable to plant cotton as early as possible. That is the reason why the soil should be so prepared that it will warm up quickly in the spring. If the seed is planted too early, however, it will not germinate but will rot in the ground. Every effort should be made to have the ground ready for planting as soon as the temperature of the soil reaches sixty or seventy degrees. For the most part, cotton is planted in April and May. It is planted as early as the first half of March in South Texas. It is planted as late as the middle of May in Virginia and Missouri. The average planting dates will come in the period from the last week in April to the end of the first week in May.

What Tools to Use.—There is a large variety of cotton planters on the market, most of which are satisfactory. The majority plant a single row at a time, opening the furrow, dropping the seed, and covering it, at one trip. The seed should be agitated in the planter to provide for uniform planting. Cotton should never be covered deeply.

Distributing Fertilizer.—Tests show that on all but the very light sandy soils the fertilizer should be distributed before or at planting. And unless more than 600 pounds of fertilizer is used to the acre, it should be put down in the row. Side applications are looked upon with favor by many growers and are extensively practiced, but there is a tendency towards the opinion that it is best to put all the fertilizer under cotton at the time of planting and to increase the formula used, so far as the nitrogen is concerned, so that it is all put on in one application. Side applications tend to delay maturity of cotton, though it is recommended for most other crops. If side dressing is used, the application should be made early, before many squares form. The fertilizer should be put down in bands. This stimulates root growth.

—*Courtesy Deere & Co.*

COMBINATION CORN AND COTTON PLANTER WITH FERTILIZER DISTRIBUTER

Thinning.—The cotton planter literally sows the seed in the drill, and naturally the plants, if any considerable number of the seeds germinate, are so thick that they would never be able to make much growth unless thinned. The thinning is called *chopping*.

The general practice in preparing cotton for chopping is to leave the cotton on a ridge by the operation called *barring off*. Such a practice is not advisable for the reasons that it leaves the young cotton plants on narrow high ridges that dry out quickly, or, in the case of a heavy rain, the ridges crumble and pull down the plants. When barring off is done at all, the disk cultivator which straddles the row does good work and leaves only a slight ridge. When the weeder has been used previously, a spring tooth cultivator with a fender attachment is the best implement to use for thinning. This leaves a narrow strip that can easily be chopped out.

Under boll weevil conditions it has been found that leaving the cotton fairly thick in the row results in slightly earlier maturity and higher yield. The distance between the plants should vary from eight inches on poor soil to eighteen inches on the richer soils.

Spacing.—The spacing of cotton is a problem in which there is great interest. Every state experiment station in the Cotton Belt has conducted tests dealing with this subject. In general, the results indicate that thick spacing is desirable, but the results vary widely. The variance in results is due, in part, to the type of soil on which the crop is grown, the fertility of the land, the amount and the distribution of the rainfall during the years in which the work is done, and on the extent of boll weevil infestation.

The results of some of the work on spacing, as published by the experiment stations is given below:

Louisiana (Bulletin 246)

"Close spacing increases earliness as measured by rate of blooming early in the season and by the per cent of the crop harvested at the first picking.

"Closely-spaced plants do more blooming early in season and wider-spaced ones later. A spacing of 2 stalks, 10 inches apart, gave the largest number of blooms for the season.

"A spacing of 2 stalks, 20 inches apart, in 4-foot rows, gave best yields on both types of soil, but the differences between the yields of the spaced plants were not significant."

Oklahoma (Bulletin 209)

"Single plants spaced 18 inches apart in 44-inch rows produced the largest average yields of lint for a period of seven years. . . . Thick spacing hastened the maturity of the crop."

Texas (Bulletin 340)

"Results show that the cotton plant has the ability to adjust itself to produce satisfactory yields within a comparatively wide range of spacing."

South Carolina (Extension Circular 140)

"The results of close spacing of rows and plants in the row again (in the State Cotton Contest) showed the wisdom of this practice. As a whole, the contestants—and farmers in general—had more plants per acre than ever before. This was a large factor in the high average yield obtained throughout the state.

"The width of the row used in the contest fields has been materially reduced since the beginning of the contest, as shown in the following table:

WIDTH OF ROW

Row Width (inches)	*First Year* (%)	*Ninth Year* (%)
30-34	.0	12.95
35-37	4.8	22.93
38-40	4.0	25.47
41-43	28.9	20.38
44-46	12.7	11.04
47-49	43.6	5.09
50-60	6.0	2.12

"This decrease in row width has also been carried into general cotton production and no doubt has been a large factor in the greatly increased average yield per acre for the past five years."

Cultivating Cotton.—After the cotton is planted, if a heavy rain occurs before the cotton plants get through the soil, the field should be cultivated with a spike tooth harrow or weeder to break the surface crust. The cotton should be cultivated in the same way before chopping.

As soon as the chopping has been done, the field should be cultivated. The first cultivation should be fairly deep, those that follow, shallow. The first cultivation throws soil toward the plants to help support them. They may be left somewhat exposed after chopping.

For many years frequent cultivations were advocated in order to keep a mulch on the surface. This mulch was supposed to prevent the evaporation of moisture. Now scientists tell us that such frequent cultivations, and the dust mulch that results, does not serve this purpose. This conclusion may be correct. But the same scientists who have drawn this conclusion have learned too that weeds and grass must be kept down in order to make a good crop yield. Since cultivation is the most practical way to destroy weeds and grass, the "discovery" with respect to the conservation of soil moisture will probably not affect the best farming practices with respect to frequent cultivations.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Do you agree that cotton should not be grown on land which, under normal conditions, will produce less than half a bale?
2. When should terraces be checked for repairs and the needed work done?
3. Why should stalks be turned under? How can this best be done?
4. What is the advantage of fall plowing? What are the disadvantages?
5. What would you call deep plowing? How deep do you plow on your home farm?
6. Why should cotton have a firm seed-bed? How is it secured?
7. What is meant by bedding? Describe.
8. How much cotton seed is required per acre?
9. What does delinting mean? Why is it desirable? Why is it undesirable? Tell how seed may be delinted.

10. When should cotton be planted in your locality?
11. How and when should the fertilizer be applied?
12. Why is cotton thinned?
13. What spacing is recommended? on poor land? on rich land?
14. How is spacing related to the width of row?
15. Why are crops cultivated? When should cotton be cultivated? How often?

Selected References

Farmers' Bulletins, U. S. Department of Agriculture

1686—*Common Errors in Cotton Production.*

State Publications

Louisiana—Bulletin 246—*Cotton Spacing in Southern Louisiana in Relation to Certain Plant Characters.*

Oklahoma—Bulletin 209—*Cotton Experiments.*

South Carolina—Circular 140—*The Cotton Contest.*

Texas—Bulletin 526—*Calibration of Cotton Planting Mechanisms.*

Bulletin 340—*The Effect of Spacing on the Yield of Cotton.*

Suggested Activities

1. At the rate of spacing which you decided is best for your locality, determine the number of plants you will have on an acre if you have a perfect stand. Now, on the basis of the number of bolls per pound for the variety you select, how much may you expect as a normal yield? If each plant has five bolls what would be the yield?
2. Make a study of all the implements required for growing cotton. Tabulate the results of your study under such headings as (1) name of implement, (2) cost of implement, (3) annual depreciation, (4) number of days in use annually, (5) cost of use per day, and any other headings that are of interest to you. What do you regard as essentials for growing cotton? What would you regard as an ideal list of equipment.
3. Make a study of the practices of your community with respect to (1) methods of preparing land for cotton planting, (2) time of planting, (3) rate of seeding, (4) methods and time of thinning, and (5) practices with respect to cultivation.

Chapter 12

COTTON
CONTROLLING INSECTS AND DISEASES

WILMON NEWELL

OF ALL insect pests which attack cotton, the boll weevil is the most destructive. The annual loss to cotton growers from weevil infestation is estimated to be in excess of three million dollars.

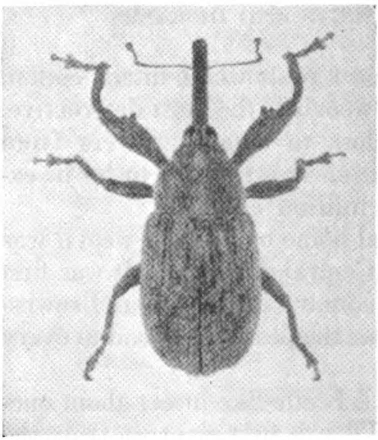
The original home of the boll weevil was in Mexico or Central America. It was first found in this country in 1892 near Brownsville, Texas. Since that time the pest has spread to every part of the Cotton Belt.

The boll weevil is a small beetle-like insect about one-fourth of an inch long. When it first emerges from the cotton plant, it is light brown in color but gradually becomes darker. In a few weeks it is grayish black. It has a long snout with which it punctures the squares and bolls. There are many weevils similar in appearance, but the falling and flaring of squares gives an unfailing method of determining the presence of the cotton boll weevil.

There are four stages in the life history of the boll weevil—(1) the egg, (2) the larva, (3) the pupa, and (4) the adult. All insects, generally speaking, pass through these stages.

In the spring and throughout the fruiting season of the cotton plant, the eggs are deposited by the female weevils in cavities formed by eating into the fruit of the plant.

Three or four days after the egg is deposited it hatches, and the grub immediately begins to feed. At this stage the weevil is called the larva. The larva, or feeding, stage lasts from seven to twelve days and is followed by the pupa stage. This period of development, which lasts about five days, corresponds to the cocoon in the life history of the moth. It emerges from the pupa stage a full grown adult weevil, and, in four to eight days, is ready to begin producing another generation. The complete cycle, it will be observed, covers only about three weeks. This short cycle, together with the fact that a female weevil lays about 100 or 150 eggs, accounts for the rapidity with which the weevils multiply.

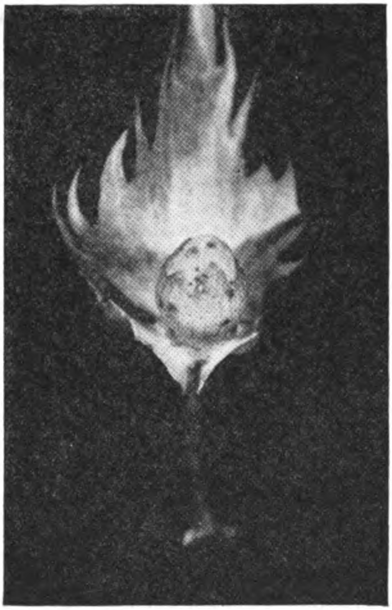


Cotton Boll Weevil

The adult weevil in the summer lives only about fifty days. During the fall and winter it lives for a much longer period. It is a matter of great importance in the control of the weevil to know that the insect passes over the winter in the adult stage. This period of hibernation is passed under the bark of trees, in stumps, trash, and in other dry places near cotton fields. Only a small per cent of the weevils that go into hibernation in the fall survive the winter.

Controlling Boll Weevils.—Two methods of controlling the boll weevil are now generally practiced. One method which is practiced early in the season, before the squares form, is that of mopping, using a mixture of one gallon of molasses, one gallon of water, and one pound of calcium arsenate. The other is that of dusting with calcium arsenate which is applied at the rate of four to six pounds per acre. The dusting should be done when the air is reasonably calm and the plants are moist. Only equipment designed for cotton dusting should be used.

Dusting should begin when 10 per cent of the squares show weevil injury. This may be determined by picking 100 squares from each of the four corners of a field and 100 from the center of the field; that is, 500 squares in all. If as many as 50 of these squares are infested, it is time to begin dusting. Dusting should be repeated often enough to keep infestation below 10 per cent.



WEEVIL-FEEDING PUNCTURES

Cotton Flea-Hopper.—The cotton flea-hopper is a serious pest in Texas and other sections of the Cotton Belt. The failure of the plants to produce blooms is an indication of the presence of this insect. Failure to bloom is due to the destruction of the very tiny squares by the punctures of the hopper. Later the plant often appears to be abnormal in growth characteristics. The flea-hopper breeds in weeds and trash. These should be destroyed. Earliness in planting also is an aid in controlling the hopper. When infestation becomes serious, the young cotton should be dusted with finely ground sulphur at the rate of ten pounds per acre. When weevils are also present, use a mixture of eight pounds of sulphur and four pounds of calcium arsenate.

Important Cotton Insects.—The following table gives the most important cotton insects, the nature of the injury they bring about, and measures of control which should be applied:

INSECT COTTON PESTS OF GREATEST IMPORTANCE

Name of Insect	*Nature of Injury*	*Methods of Control*
Boll Weevil	Punctures squares and young bolls to feed or lay eggs.	Dust with calcium arsenate as soon as 10% of squares have been punctured, using 4 to 6 pounds per acre. Repeat at 5-day intervals until infestation is reduced to less than 10 per cent. Get cotton as early as possible.
Leafworm	Destroys leaves which prevents bolls from maturing.	Calcium arsenate for boll weevil effective when worms are young. Later apply 12-14 lbs. of poison containing 1 part Paris green, 1 part flour, and 5 parts lime.
Bollworm	Eats squares, bolls, and cuts off growing tips of plants.	Hasten maturity of crop. Plow in fall. Turn under cotton stalks. Use boll weevil control methods.
Flea-hopper	Punctures tiny squares and prevents flowering.	Destroy weeds and old cotton stalks. Dust with finely ground sulphur at rate of 10 lbs. per acre. Repeat, if necessary. When weevils are present use mixture of 8 lbs. sulphur and 4 of calcium arsenate.

INSECT COTTON PESTS OF GREATEST IMPORTANCE (*Continued*)

Name of Insect	*Nature of Injury*	*Methods of Control*
Cotton-aphid	Stunt, deform, or kill seedling cotton. Suck sap from plants.	Dust with nicotine dust. May be mixed with lime or calcium arsenate.
Pink bollworm	Eat out seeds of cotton. Damage seed and lint.	Government regulations for control will be sent to any section where the pink bollworm is found. THIS IS IMPORTANT. Early crops and destruction of stalks and gin trash essential.
Leaf-perforator	Destroy foliage. Make perforations in leaves which gives them a lace-like appearance.	Dust with lead arsenate at the rate of 5 to 7 pounds per acre. Repeat, if necessary.
Red Spider	Injures young plants.	Dusting with finely ground sulphur at the rate of 10 lbs. per acre recommended.

Other pests of cotton include the cotton square-borer, the cotton-stainer, the armyworm, the cotton-dauber, the garden webworm, May beetles, grasshoppers, cutworms, and wireworms. These are not so important as those for which more detailed information is given. Many of these insects also attack other crops, and methods of control are given in other sections of the text. The state and Federal agencies in agricultural education are anxious to be of service to farmers in controlling insects. If you find any insect which you cannot identify, the Bureau of Entomology of the U. S. Department of Agriculture or entomologists at your Land-Grant College will be glad to tell you what it is if you will mail them a specimen. They will also be glad to send you an outline of the control methods to follow.

As a general plan for controlling insects of the cotton plant, the United States Department of Agriculture has made the following recommendations:

Controlling Cotton Insects

Best Measures for Early Spring

1. Keep down weed growth around the farm.
2. Plow in the winter to destroy hibernating insects.
3. When necessary, set poison baits to trap cutworms, grasshoppers, May beetles, and other pests.
4. Plant as early as possible.
5. Select the best variety for your locality which has the qualities of rapid and prolific fruiting.
6. Space the rows in accordance with local experience.
7. Cultivate frequently, but not deeply.

Best Measures to Follow During the Summer

1. Continue cultivation until the crop is made.
2. Watch for the first appearance of worms.
3. Dust with lead arsenate to kill worms.
4. Keep down weeds.

What to Do in the Fall

1. Pick the cotton as soon as possible.
2. Destroy the plants by plowing under.
3. Where practical, plant a cover crop.
4. Where feasible practice a rotation with cotton following some crop other than corn.

Practical Measures for Winter

1. Clean up all turn rows and fence rows.
2. Cut and burn all weeds.
3. Plow under all stubble fields not to be used otherwise.
4. Grub up old stumps.

Diseases of Cotton.—The most common diseases of cotton are: (1) Root-rot, (2) cotton-wilt, (3) verticillium-wilt, (4) root-knot, (5) anthracnose, (6) bacterial blight, and (7) rust. These diseases, together with the most evident symptoms, and the recommended control measures are given in the following table:

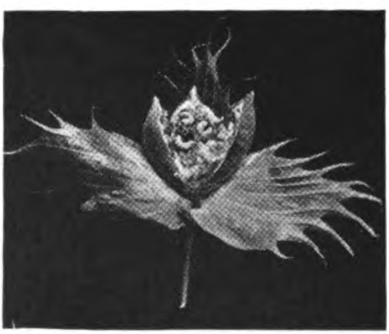
Important Cotton Diseases

Disease	*Symptoms*	*Control Measures*
Root-rot	Yellowing of foliage, followed by wilting and death of plant. Noticeable first in warm spells following rain.	Rotate with grain crops and subsoil land after grains are harvested. Disinfect isolated centers of infection with ammonia or formaldehyde solution, or ammonium compounds. Construct barriers to prevent spread.
Fusarium wilt (Black-Rot) (Cotton-Wilt)	Wilting of plant, stunted appearance, and partial defoliation.	Use wilt resistant varieties. Fertilize to produce more vigorous plants. Add humus to soil. Rotate to reduce root knot.
Verticillium-wilt	Mottling of leaves with yellowish areas which finally turn brown.	Rotate with alfalfa or grain crops.
Root-Knot	Dwarfed or stunted plants with leaves and stems pale yellowish green. Galls or cysts on roots.	Rotate with immune crops. In irrigated valleys of Southwestern States maintain clean fallow with deep summer tillage.
Anthracnose	Causes poor stand; "pink boll rot"; renders fiber pink, rotted and worthless.	Avoid susceptible varieties. Select seed from disease-free plants. Rotate crops.
Bacterial blight (Angular leaf spot)	Water-soaked appearance of leaves. Bolls shed. Stems turn black.	Use disease-free seed. Treat seed with organic-mercury dust disinfectants.
Rust (Yellow leaf blight)	Plants small, lack healthy color.	Add humus. Drain wet land. Use potash fertilizers.

Control Measures.—A careful analysis of the control measures given in the above table reveal that the following are of general value in the controlling of disease: (1) the careful selection of seed and varieties, (2) the rotation of crops, (3) the improvement of the soil, and (4) the providing of liberal supplies of plant food. If all these practices, which embody nothing but safe and efficient farming methods, are followed, the loss from disease in the production of cotton is likely to be small under normal conditions. There are specific requirements which merit special consideration.

LARVA OF BOLL WEEVIL IN SQUARE

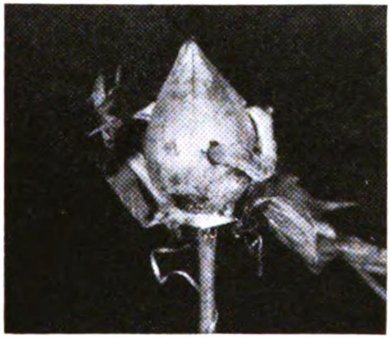
Root-rot, or "nematodes" affect many crops. Immune crops should be planted for two years in succession before a susceptible crop is returned to the land. Some of the crops recommended are: barley, corn, cowpeas, (Brabham, Iron, Victor), crotolaria, grasses, Kafir, winter oats, peanuts, rye, sorghum, velvet beans, and wheat.



BOLL WEEVIL LARVAE

Bacterial blight may be controlled by delinting seed, or by using the dust or organic mercury compounds, which can be purchased at any seed supply house. The seed, one bushel to four ounces of the dust, should be agitated in a drum for 15 or 20 minutes. It may be planted immediately after treatment, or kept in the drum indefinitely without injury.

Fusarium-wilt, commonly called black-rot or cotton-wilt, is controlled primarily through the selection of wilt-resistant varieties which have been developed primarily for this purpose. Wilt is common on the light sandy soils of the Coastal Plain, extending from Virginia to New Mexico. It is less prevalent on the clays and heavier soils, but it may be found in soils of any type. Cotton-wilt is caused by a fungus which lives in the soil and infects the plants through the roots. By its growth, it produces toxic substances which finally accumulate in sufficient quantity in the plant to cause wilting and death. The wilt fungus lives in the soil for several years. For this reason a rotation of crops is not effective as a control measure.



Bollworm Feeding in Cotton Boll

In an effort to make cotton production more profitable for the grower, higher yields per acre and per worker must ever be the goal. This means that insect pests and diseases must be controlled. In one state, for example, the treating of cotton seed increased returns six dollars per acre. Entomologists and plant pathologists tell us that our losses from these enemies of the cotton farmer are not less than $8,000,000 annually. The control measures outlined in this text will greatly reduce these losses.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What is meant by the term *life history* of an insect? What are the stages in a normal life history? How is a knowledge of the life history essential in controlling an insect pest?
2. What are some of the more important insect pests of cotton?
3. Give the life history of the boll weevil. How does the weevil injure cotton?
4. When did the boll weevil first enter the Cotton Belt? How has the weevil influenced cotton production? What changes have taken place in the areas where cotton is grown? In the methods of production?
5. How is the boll weevil related to the selection of a variety? to the application of fertilizers? to cultivation?
6. How is the boll weevil controlled?
7. What is meant by an infestation of 10 per cent? How is the rate of infestation determined?
8. What are some of the other insect pests of cotton? Discuss each.
9. What are some of the general control measures that apply to many insects?
10. What is the most important cotton disease in your community?
11. Name three important cotton diseases and suggest methods of control.
12. What is meant by the term *fungus?* How is this related to the disease of cotton-wilt? How is wilt controlled?
13. Summarize the control methods that apply, generally, to cotton diseases. How does each aid in the control of disease?
14. What is the extent of the cotton loss sustained annually from insect and disease damage? What would you estimate as the annual loss on your farm?

Selected References

Farmers' Bulletins, U. S. Department of Agriculture

501—*Cotton Improvement Under Weevil Conditions.*
739—*Cutworms and Their Control.*
752—*The Fall Army Worm and Its Control.*

831—*The Red Spider on Cotton and How to Control It.*
1329—*The Boll Weevil Problem.*
1345—*Root-Knot: Its Cause and Control.*
1595—*The Bollworm or Corn Ear Worm as a Cotton Pest.*
1688—*Insect Enemies of the Cotton Plant.*
1729—*Machinery for Dusting Cotton.*
1745—*Cotton Diseases and Methods of Control.*

Suggested Activities

1. In the laboratory, or at your home, collect insects for the purpose of observing the complete *life history.*
2. At the proper time, make a count of squares, following plan given in the text, to determine the per cent of boll weevil infestation.
3. Make a study of the insect pests attacking cotton in your community. Tabulate the material, or data, obtained under the following headings: (1) insect, (2) description, (3) nature of injury, and (4) methods of control based upon local practices.
4. Make a study of the cotton diseases found in your community and tabulate the data obtained under the following heads: (1) diseases found, (2) means of identification, and (3) methods of control.

Chapter 13

COTTON
HARVESTING AND GINNING

H. B. BROWN

SO FAR as labor is concerned, harvesting has always been the most expensive operation in growing cotton. The reason for this is that cotton has always been picked by hand.

More than one-third of all the hours of human labor required to produce a cotton crop are normally used in harvesting the seed cotton. In the eastern part of the Cotton Belt, where it is estimated that 150 man-hours are required to grow an acre of cotton, about 60 hours are allowed for picking. On many farms the controlling factor in determining the number of acres to be planted to cotton is the amount of labor available for gathering the crop.

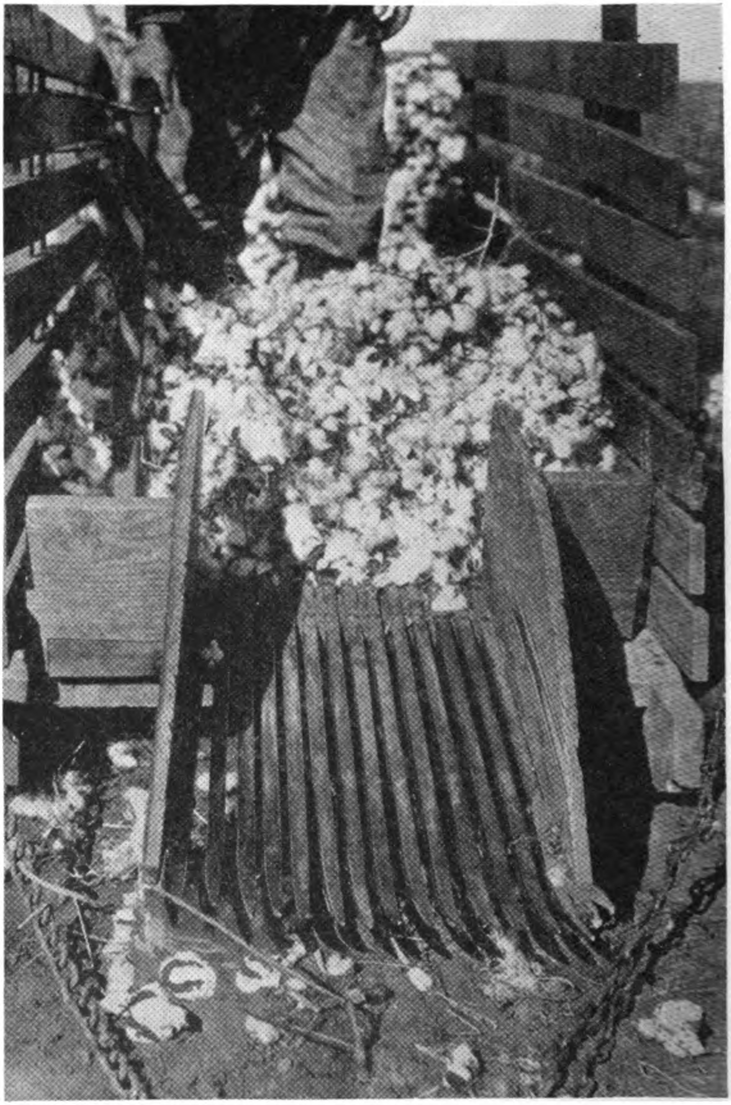
In his book on *Farm Management*, Dr. W. J. Spillman states that the reason the "one horse" method of farming is practiced so extensively in the South is that one mule supplies all the power required to grow the amount of cotton one Negro family can pick.

The growing competition American cotton must meet because of increased production of cotton in foreign countries, has led to very serious consideration of ways in which the cost per pound can be reduced. Any improved methods which will reduce the hand work, and consequently the labor requirements, will reduce costs. Such methods will also increase the income of individual farmers because the acreage and production, per worker will be much larger. Naturally, a consideration of such methods has centered in ways of harvesting the seed cotton.

While picking by hand is still the accepted means of gathering cotton in the Southeast, other sections have been increasing the percentage of their crops harvested by more rapid methods. In some districts cotton is *snapped* by hand workers; in others it is *stripped* with implements designed for such work; and more recently several types of *mechanical pickers* have been used successfully.

Many attempts have been made to invent a machine for picking cotton. Literally hundreds of patents have been granted by the United States Patent Office to inventors of cotton pickers and of parts for cotton-picking machines. Most of these inventions have been complete failures. It is difficult to invent a practical, efficient, and economical machine for picking cotton because of the number of bolls on a plant, the distribution of the bolls, and the difficulty of removing the lint from the burs, and because of the fact that not all bolls are ready for picking at the same time. "But we will have a cotton picker," said the president of one of the leading implement companies of America, "just as soon as the cotton growers decide that they want and will use one." This is probably correct. Already several cotton pickers are available. These include the one invented and manufactured by the Rust Brothers of Memphis, Tennessee, and one designed and built by the Division of Agricultural Engineering of the Texas Agricultural and Mechanical College.

When cotton is picked by a machine, the hours of work will be reduced so that the production of cotton will be comparable to the production of corn and other cultivated row crops. This will tend to reduce the cost of production. It will reduce the number of persons



A Cotton Sled

required on Southern farms. It has been estimated by the Works Progress Administration of the Federal government that the universal use of a mechanical cotton picker would release from the farms of the South not less than two million workers now required. Other

RUST BROTHERS COTTON PICKER

anticipated changes in the farm program will, doubtlessly, provide additional employment however.

Picking Cotton.—Cotton picking usually starts in September; the major portion of the work is done in October; the task is completed in November. Pickers are paid by the pound. The rate of pay varies with the section and the general economic condition, including the price of cotton. Before the World War pickers generally received from 40 to 60 cents for picking 100 pounds of seed cotton. Since that time the pay has been higher, usually from 75 cents to one dollar during the first part of the season and from $1.25 to as much as $2.00 near the close of the season. In a field of cotton that will yield one-half bale or more per acre, a good picker can average 200 pounds of seed cotton per day.

Under less favorable conditions an average day's work will be nearer 100 pounds.

Snapping Cotton.—It is the practice in some sections to snap cotton by hand. This means that the pickers *snap off* the entire boll without removing the locks from the burs. Snapping is a faster method of harvesting than picking. In Mississippi, where a study of both methods was made, it was determined that snapping was 2.11 times as fast as picking in the early part of the season and 3.91 times as fast by the last harvest.

It has been found in Mississippi, Oklahoma and other states that snapping increases the dirt and trash, increases the cost of ginning, lowers the grade of cotton, and, at times, decreases the staple classification. A study to determine the relative economic advantages of the several methods of harvesting cotton in Oklahoma led to the following conclusions:

RELATIVE ADVANTAGES

A higher price can be secured from cotton picked by hand, but there are advantages which may more than offset this added return. Cotton can be harvested more rapidly by snapping. Snapping enables a smaller labor force to harvest a given amount of cotton and get the work done with less danger of weather damage to the cotton. This factor is especially important in western Oklahoma where the average amount of cotton produced per farm is relatively large. Other factors which may be important are, the variety of cotton grown, the condition of the bolls when mature, the amount of rainfall during harvest, and the influence of gin managers who sometimes prefer to gin snapped cotton because of the higher ginning rate they are allowed to charge for it.

Stripping Cotton.—In Texas a method of harvesting known as *stripping* or *sledding* is practiced. This is a mechanical method. It is done with a sled or stripper which is pulled down the row. The fingers or rolls of the machine strip off the bolls and other parts of the plant.

Stripping has the same advantages and disadvantages as snapping, the main difference being the added speed which is possible with this machine method. Strippers are made for one, two, and even four rows of cotton. The size is limited only by the power available to pull the machine.

The relative cost of the three methods of harvesting is given by the Texas Experiment Station as follows:

COST OF HARVESTING AND GINNING

Method of Harvesting	*Pounds Required to Make 500-pound Bale*	*Harvesting Cost per Bale*	*Ginning Cost per Bale*	*Total*
Picked.............	1400	$21.00	$ 5.60	$26.60
Snapped...........	2100	15.75	10.50	26.75
Sledded............	2900	2.55	14.50	17.05

The most notable facts in the above table are the speed of harvesting cotton by sledding as indicated by the comparative costs, and the added trash collected by methods other than picking as shown in the pounds required to make a 500-pound bale.

Improving Grade.—With the increased competition in cotton growing from foreign countries, America must strive to retain some advantage in the quality of the cotton produced. The length of fiber must be produced which the mills of America and other countries require. The grade must be as high as possible.

The length of the fiber is a variety characteristic, although it is influenced to some extent by the season and other conditions. The grade is determined by the amount of trash and other foreign matter, by the color, and by conditions associated with harvesting and ginning. Hand picking can control the factors which influence grade so much better than other methods of harvesting that, if cotton is sold strictly upon the basis of grade, this method of harvesting has advantages difficult to overcome.

Cotton should be picked as soon as enough bolls are open to justify the labor. This will prevent weather damage. If the cotton is not picked within a reasonable length of time after the bolls open some of the lint is blown out by the wind. Cotton left exposed to rains and heavy dews becomes stained. It also loses some of its oil content and becomes light and fluffy. Such lint lacks strength and quality and, in normal times, is cut heavily in price.

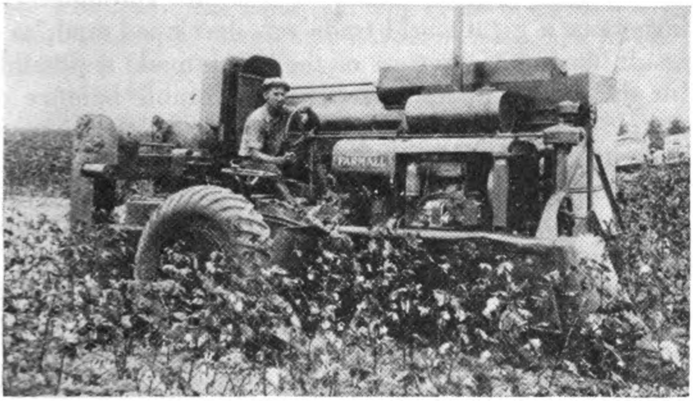
Moisture presents the greatest difficulty in proper ginning. The drier the cotton when ginned, the better the results obtained. Most cotton is ginned with too much water in it. This results in cut fibers and other objectionable features.

After cotton is picked it should be allowed to dry thoroughly before being taken to the gin. When the weather is dry and all conditions favorable, cotton should be held at least one week before ginning. During this time it should be kept so that it will dry out as much as possible. When the weather is less favorable, cotton should be held for a longer period before ginning.

Many cotton gins now have *cotton houses* where the seed cotton may be stored for an indefinite period of time before ginning. Also some gins have driers in which the cotton is dried at a temperature of 150 degrees. Experimental tests have shown that cotton dried in this manner was improved in quality so much that the selling price was raised as much as $2.50 a bale.

In sections where there is much wet and damp weather during the harvesting season, some farmers have constructed drying houses. Such a practice is too expensive for general use, but some means must be provided on the farm or at the gin for drying the seed cotton.

Cotton Ginning.—It is said that every industry can trace its development to some invention. In the case of



INTERNATIONAL COTTON PICKER

cotton, this invention was the cotton gin which was made by Eli Whitney in 1793. A patent was granted to him the following year and was signed by George Washington, then president of the United States. Mr. Whitney was a native of Massachusetts. After completing his education he came to the South to secure a position as a school teacher. He failed to find a position immediately, so we are informed, and, while having little to do, visited the plantation of Mrs. Green, widow of General Nathaniel Green of Revolutionary fame. Here, near Savannah, he observed the slow, painstaking labor involved in separating the lint from the cotton seed. One worker could separate but one pound of lint per day. We are told that Whitney made his first gin in ten days. Crude as it was, the gin was remarkably successful.

Following this invention the growing of cotton expanded rapidly. The limiting factor in cotton production had been removed. Lint could be made readily available; the seed at that time was regarded as of little or no value. Cotton spinning machinery was developed in England. A great industry was born. Through these inventions a great world trade was developed, and, as a result, the cotton growers of the South made it possible for the United States to secure a favorable balance of trade. This contributed greatly to the development of America. Cotton was king.

Cotton gins are now located in every community in which cotton is grown. They perform the service of separating the lint from the seed, baling the fiber, and, in many instances, disposing of the seed. They will play an important part in the future trends in cotton production. If the cotton can be dried as soon as picked, the labor of harvesting will be reduced and a better grade produced. When the way has been found to clean perfectly the cotton that is harvested mechanically, mechanical cotton pickers will be the means of changing the harvesting methods and of lowering production cost. This is vital to the future of the South.

The Agricultural Adjustment Administration has sought to improve the income of the Southern farmer by limiting production and thus raising the price. But in raising the price, the competition of other cotton producing countries results in some loss of foreign markets. There are those who think that the future hope for American cotton lies in greater efficiency on the part of American growers so that we can produce a better cotton at a lower price than other countries. If this is done it will involve the greater use of machinery. Improvement will come mainly through better and more efficient methods of harvesting and ginning.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What part of the labor requirements of growing cotton are represented by harvesting? What part of the cost?
2. Do you agree with the statement of Dr. Spillman as to the reason for "one horse" farming in the South?
3. What are the methods of harvesting cotton now in use?
4. What are the advantages and disadvantages of each method?
5. Why has it been difficult to invent an efficient cotton picker?
6. If a cotton picker were used generally, how would it affect labor on Southern farms?
7. What determines the grade of cotton?
8. How can the farmer contribute toward a better grade through the harvesting of his crop?
9. How did the invention of the cotton gin influence American business and Southern agriculture?
10. How can ginning influence the future trends in cotton production?

Selected References

Farmers' Bulletins, U. S. Department of Agriculture
1748—*Ginning Cotton.*

State Publications

Mississippi—Bulletin 316—*Effects of Delayed Harvesting By Picking and Snapping.*
Oklahoma—Bulletin 227—*Relative Economic Advantages of Harvesting Cotton by Picking and Snapping.*
Texas—Bulletin 452—*The Mechanical Harvesting of Cotton.*

Suggested Activities

1. Make a study of the farms of your community to determine the methods of harvesting cotton, the time of harvesting, and the cost.
2. Visit a gin for the purpose of studying its construction and method of operation including the turn-out, the method of

cleaning, the baling equipment, the method of marking bales. Secure advice as to the best way from the viewpoint of the gin operator to insure a good grade of cotton.
3. Interview a cotton buyer and discuss with him the relation of grade and staple to ginning practices.

Chapter 14

MARKETING COTTON

WILL CLAYTON

THE problems of farming fall naturally into two broad groups: *first*, the problems of production; *second*, the problems of marketing. Those in the second group merit as much consideration as those in the first. Marketing plays an important part in determining the farmer's income.

In the selling of cotton, the producer is primarily concerned with (1) the grade and staple of his crop, (2) the agency through which he sells, and (3) the time when he disposes of his product. This information and these decisions are important elements in success or failure in cotton farming.

Grade and Staple.—The price of a bale of cotton on any one day at a given market is based upon the *grade* and *staple*. Grade is determined by the quality and condition of the cotton. Staple refers to the length of the fiber.

In the price quotations published by the ten important spot markets—Norfolk, Augusta, Savannah, Montgomery, New Orleans, Memphis, Little Rock, Dallas, Houston, and Galveston—there are 32 grades of cotton. These are given on page 204.

In any classification of cotton on the basis of staple, there can be as many groups as there are fiber lengths varying by $\frac{1}{32}$ of an inch. Thus we have such staple lengths as follows: $1\frac{3}{16}$; $\frac{7}{8}$; $\frac{15}{16}$; 1; $1\frac{1}{32}$; and $1\frac{1}{4}$.

Grades and Colors of Cotton According to the Universal Standards of American Upland Cotton

White Standards

No. 1—Middling Fair
No. 2—Strict Good Middling
No. 3—Good Middling
No. 4—Strict Middling
No. 5—Middling
No. 6—Strict Low Middling
No. 7—Low Middling
*No. 8—Strict Good Ordinary
*No. 9—Good Ordinary

Extra White

No. 3—Good Middling Extra White
No. 4—Strict Middling Extra White
No. 5—Middling Extra White
No. 6—Strict Low Middling Extra White
No. 7—Low Middling Extra White
*No. 8—Strict Good Ordinary Extra White
*No. 9—Good Ordinary Extra White

Spotted

No. 3—Good Middling Spotted
No. 4—Strict Middling Spotted
No. 5—Middling Spotted
*No. 6—Strict Low Middling Spotted
*No. 7—Low Middling Spotted

Tinged

No. 3—Good Middling Tinged
No. 4—Strict Middling Tinged
No. 5—Middling Tinged
*No. 6—Strict Low Middling Tinged
*No. 7—Low Middling Tinged

Yellow Stained

No. 3—Good Middling Stained
*No. 4—Strict Middling Stained
*No. 5—Middling Stained

Gray

No. 3—Good Middling Gray
No. 4—Strict Middling Gray
*No. 5—Middling Gray

* These grades are not acceptable for delivery on future contracts.

A consideration of both grade and staple enter into the determination of the price of a given bale.

Grade No. 5—middling with a staple length of 7/8 inch is the basis for cotton prices.

The value of other cottons are expressed as so many points "on" or "off" middling price. *A point is one-hundredth of a cent.* "On" means above the price of middling; "off" means below the price of middling. Thus, 100 points *on* means one cent above middling; 75 points *off* means ¾ of a cent under the price of middling.

The table on page 206 gives the *Spot* cotton quotations for November 30, 1937 on the Norfolk market. The price of middling cotton on that day was 8.15 per pound.

On the Norfolk market on the day for which prices are given, a 500 pound bale of middling ⅞ inch cotton sold for $40.75. A bale of the same *grade*, but with a staple of 13/16 sold "off" 100 points, which means that it sold for $.0715 per pound, or $35.72. A bale with a staple of 1 inch sold "on" 65 points, and brought a price of $.0880 per pound, or $44. Thus we see that a difference in staple, from 13/16 to 1 inch, made a difference of almost $10 per bale. But on this same day a bale of No. 7—low middling tinged, staple 13/16, sold "off" 410 points and brought the seller $20.25. These prices give an appreciation of the importance of grade and staple.

Local buyers do not always buy cotton on the basis of grade and staple. This has been reported in many studies that have been conducted in all parts of the Cotton Belt.

A report of *Cotton Marketing Studies* made in South Carolina (Bulletin 270) states: "Study in the local markets indicates that the buyers too often ignore staple, do little accurate grading, and do not buy on a strictly quality basis. There is a tendency to grade low. In a market typical of several studied, official classifications placed 82 per cent of the cotton above middling grade, yet the buyers placed only 36 per cent above middling."

A portion of the summary of a similar study made in Alabama contains the following conclusions:

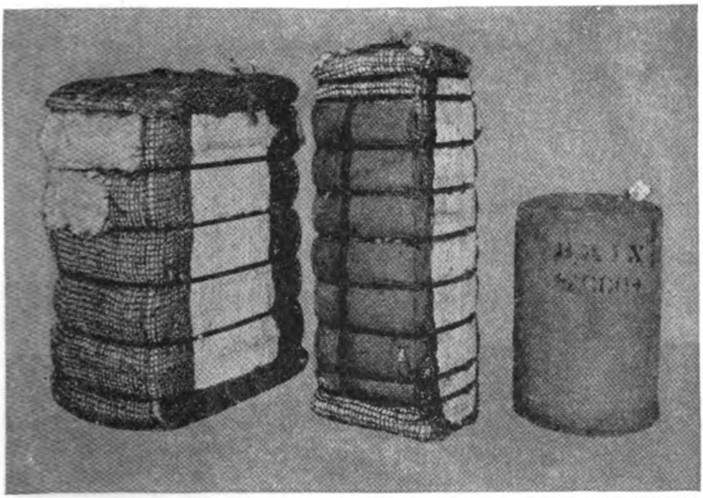
"Prices paid to farmers for given grades and staple lengths sold in the same town on the same day were char-

Spot Cotton Quotations

Grade	Norfolk			
	1 3/16"	7/8"	15/16"	1"
White Standards				
No. 1 or Mid. Fair	30 Off	70 On	110 On	135 On
No. 2 or St. Good Mid.	40	60	100	125
No. 3 or Good Mid.	50	50	90	115
No. 4 or St. Mid.	65	35	75	100
No. 5 or Middling	100	8.15	40	65
No. 6 or St. Low Mid.	215	75 Off	45 Off	20 Off
No. 7 or Low Mid.	290	150	120	100
No. 8 or St. Good Mid.*	340	200	200	190
No. 9 or Good Ord.*	390	250	250	250
Extra White				
No. 3 EW or G. M. EW	50	50 On	90 On	115 On
No. 4 EW or S. M. EW	65	35	75	100
No. 5 EW or M. EW	100	Even	40	65
No. 6 EW or S.L.M. EW	215	75 Off	45 Off	20 Off
No. 7 EW or L. M. EW	290	150	120	100
No. 8 EW or St. G. O. EW*	340	200	200	190
No. 9 EW or G. O. EW*	390	250	250	250
Spotted				
No. 3 Sp. or G. M. Sp.	125	10 On	40 On	75 On
No. 4 Sp. or S. M. Sp.	125	Even	30	65
No. 5 Sp. or M. Sp.	230	45 Off	45 Off	20 Off
No. 6 Sp. or S.L.M. Sp.*	310	155	130	100
No. 7 Sp. or L. M. Sp.*	360	225	225	215
Tinged				
No. 3 T. or G. M. T.	225	40	15	Even
No. 4 T. or S. M. T.	225	80	40	25
No. 5 T. or M. T.*	305	155	140	125
No. 6 T. or S.L.M. T.*	360	225	225	225
No. 7 T. or L. M. T.	410	275	275	275
Yellow Stained				
No. 3 St. or G. M. St.	325	115	100	90
No. 4 St. or S. M. St.*	325	175	165	165
No. 5 St. or M. St.*	400	250	250	240
Gray				
No. 3 G. or G. M. G.	220	50	25	Even
No. 4 G. or S. M. G.	215	75	45	20
No. 5 G. or M. G.*	290	150	120	100

acterized by wide ranges indicating serious imperfections in local markets. Prices of the same qualities varied widely from town to town.

"One dollar more per bale was received by farmers selling in round lots than by those selling in single bales.



—*Courtesy Anderson, Clayton & Co.*

COTTON BALES

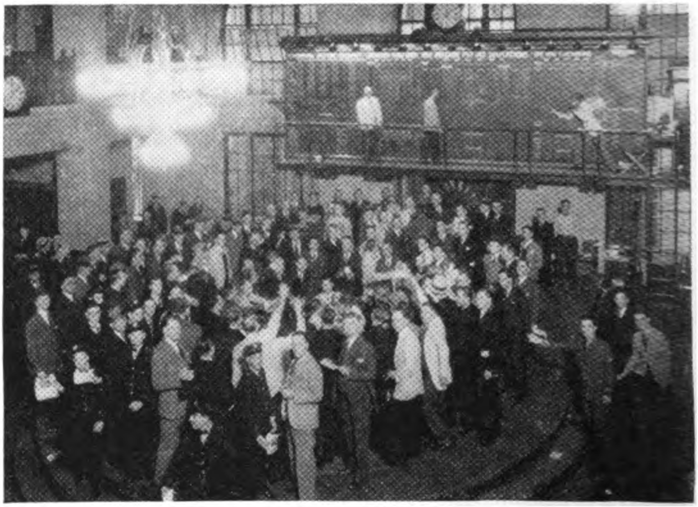
Left, an ordinary square bale as it comes from the gin (12 pounds per cubic foot); next, a high density bale condensed to 38 pounds at the port; and, on the right, an Acco round bale which was compressed to approximately 35 pounds by the Clayton press at the gin.

"The economic reward for high yields per acre was a more important factor influencing the variety of cotton grown by farmers than the reward for staple length.

"The payment of staple premiums and discounts for individual bales is necessary before farmers will select varieties on the basis of staple length instead of only on the basis of yield of lint per acre and gin turnout."

Cotton Markets.—There is a ready market for cotton. It may be sold on any business day of the year.

Farmers may sell to a local buyer, or they may sell through their own cooperative marketing association. There is a local buyer in every trading center in the South who will pay cash for cotton. Or, if the grower should decide not to sell immediately after ginning, he



THE COTTON EXCHANGE
Here supply meets demand and cotton is contracted for at world prices.

may place his cotton in a Government Bonded Warehouse. There is such a warehouse in practically every cotton-growing county. Cotton stored in such a warehouse may be used as collateral. It is like having money in the bank. The farmer must decide whether he will sell or hold his cotton, and, if he sells, through what agency he will dispose of his crop.

Marketing Services.—After a crop has been made, the distribution of that crop is a complex process. There are a number of "marketing services" that must be performed before the product reaches the consumer. Collectively, these services constitute marketing.

In his book on *Farm Management*, Dr. W. J. Spillman lists the following marketing services, not all of which are necessary in the case of every product: (1) assembling, (2) grading, (3) packing, (4) storing, (5) transporting, (6) financing, (7) risk-taking, (8) processing, (9) selling, and (10) dispersing.

When one realizes that so many services must be performed in getting farm crops into the hands of the ultimate consumer, it is easy to understand why marketing is both complicated and expensive.

The fundamental principle back of cooperative effort is that the farmer can perform some of these services for himself, and thus secure a larger portion of the ultimate selling price of the product which he produces.

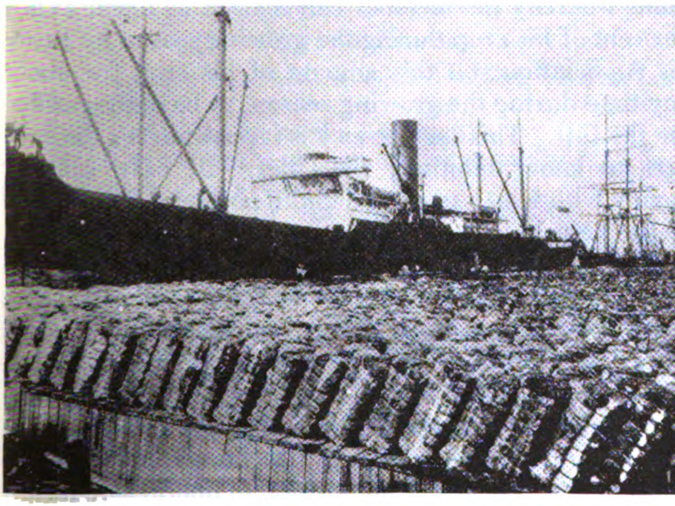
Farmers in many communities have their own cotton gins. In some of the Cotton Belt states such gins render many cooperative services, as evidenced by the following statement relative to such activities in Oklahoma: "During the 1933-34 ginning season there were 95 cooperative cotton gins in Oklahoma. These associations operated 11.5 per cent of the active gin plants, and ginned 21.1 per cent of the cotton crop of the state. The gross sales of these associations amounted to approximately $8,310,000, or an average of nearly $87,000 per association. These associations ginned 260,717 bales of cotton, and sold over $400,000 worth of farm supplies."

Cooperative Cotton Marketing Associations.—There has been organized, in practically every state where cotton is grown, a farmers' cooperative cotton marketing association, so that the grower, if he desires, may sell his cotton through his own organization. In order to market his cotton through these associations, a farmer must sign a membership card, or a contract, stating that for a certain period of years he will market all or part of the cotton he grows through the Association. During the early years of the operation of the associations, all members were required to sign an ironbound contract, which forced them to deliver all of their

Cotton Classing

cotton to the association for a period of years. The present contracts, however, are very liberal and delivery by the member is practically voluntary in every state.

"As soon as cotton of such a member is ginned, he is expected to deliver it to the Association. He can use any one of several methods of marketing through the associations. In most states, the associations have Government licensed classers located in his community. These classers properly grade and staple his cotton and advise him that he can draw from the Association a certain amount, based on that day's market. This advance is generally equal to the full market price of the cotton,



COTTON FOR SHIPMENT TO FOREIGN COUNTRIES

which means that by using this Pool, which is commonly termed the Immediate Fixation Pool, the member can secure from his Association the full market price on the day of delivery.

"In the event the member desired to carry his cotton, he can draw from the Association approximately seventy per cent of the market value and have his cotton properly classed by a Government licensed classer and carry his cotton until such time as he decides to make a sale. As the Association can make advantageous contracts with warehouses and can also borrow money much cheaper than the individual farmer, the member can in this way generally carry his cotton considerably cheaper than he would be able to carry it individually. The member has the right to order his cotton sold at any time he desires and receive payment in full for same.

"Some of the Associations have recently worked out plans whereby the member can market as much as fifty per cent of his crop during the growing season by having his Association sell this amount of his crop for him at any time during the growing season, to be delivered during the fall. This service makes it possible for the members to know definitely that they will have sufficient money with which to meet definite obligations in the fall of the year.

"As the members sell their cotton through the Association, the Association either immediately sells the cotton to mills, or hedges it, in order to prevent taking any risk as far as an advance or a decline in the market is concerned. The cotton is put in even running lots, according to grade and staple, and sold to mills in this manner. Due to the volume handled by the Cooperative Associations, they are generally in position to obtain satisfactory premiums for both better grades and staples and these premiums are passed back to the members. The Associations have, therefore, been instrumental in encouraging their members to produce cotton of better grade and staple.

"A number of the cotton cooperative associations have been successful in having their members acquire warehouses, ginning facilities, and even oil mills, which have to do with processing and storing of cotton or its products. It is felt that through the ownership of these local facilities by members of the Association, the members will understand more fully the principles of cooperative marketing and take more interest in the development of the Association. The trend at present is to develop local associations, which are federated into State Associations and, in my opinion, this trend in the cooperative movement will mean a great deal to its future success."

SUGGESTIONS FOR STUDY

Questions and Problems

1. What is meant by *grade* as applied to cotton marketing? By *staple?*
2. Why is *middling* 7/8 cotton important?
3. What is meant by the term *points on? points off?*
4. How much is a point?
5. What is meant by the *classification* of cotton?
6. Is cotton bought in your community on the basis of grade and staple?
7. Through what agencies may a farmer sell cotton?
8. What is meant by a *round lot?*
9. What is meant by the term *marketing services?*
10. What is the fundamental principle back of the cooperative effort of farmers?
11. Have you a farmers' cooperative marketing association in your state? Do you have any cooperative gins?
12. What are the advantages of cooperative marketing? What are the disadvantages?

Selected References

Circulars, U. S. Department of Agriculture

144—*Farmers Experiences and Opinions as Factors Influencing Their Cotton-Marketing Methods.*

Department Bulletins, U. S. Department of Agriculture

457—*Relation Between Primary Market Prices and Qualities of Cotton.*
476—*A Study of Cotton Market Conditions in North Carolina with a View Toward Their Improvement.*
1056—*Marketing Cotton Seed for Planting Purposes.*
1392—*Cooperative Marketing of Cotton.*
1444—*Cotton Prices and Markets.*

American Cotton Cooperative Association (New Orleans)

Development and Organization of Cooperative Cotton Marketing Associations.

Suggested Activities

1. Make a study in your community to find out how the cotton crop is marketed, including: the number of farmers who sell through local buyers or private agencies, the number who are members of cooperative marketing associations, the time of year when cotton is sold by those selling locally, where cotton is stored, the methods used in borrowing money on the crop, the grades made by the local buyers, the staple, the difference in price for grade and staple, and any other information dealing with handling any of the market services.
2. If possible visit one or more cotton warehouses and find out how cotton is handled in the warehouse, when it is stored, how withdrawn, the cost of storing, etc., the kind of receipts given, and other information bearing on the problem of handling cotton in your community.
3. Get in touch with all the cotton buyers you possibly can and find out how cotton is graded, the difference in price in the several grades and staples, the method of handling and shipping.
4. If possible visit a cotton mill and find out how the trash and dirt are separated from the cotton, the relation of staple to the product made in the mill, the kind of staple the mill prefers, and the premium they can afford to pay for the kind of cotton that best meets their needs.
5. Visit a local bank and ascertain how loans are made on cotton and cotton warehouse receipts, the manner in which notes are drawn, the length of time they run, and other information dealing with the financing and marketing of cotton.
6. Reproduce in your notebook a government bonded warehouse receipt, and a classification card for a bale of cotton as furnished by a cooperative marketing association.

Chapter 15

CORN AS A SOUTHERN CROP


C. M. MEACHAM

CORN is one of the most important crops grown in the United States. It is produced in all parts of the nation. Four out of every five farmers grow some corn.

In 1866, about 30 million acres in the nation were devoted to corn production. Since that time the acreage has increased until today it is approximately 100 million acres. This is so vast an area that it is difficult to get any conception of how large it is, but it may be helpful to say that it represents a greater territory than all the cultivated land in the Southern states, excluding Texas.

It becomes apparent, from these facts, that every farmer must give consideration to the place that corn is to occupy in his farming program.

The Advantages of Growing Corn.—Why do the farmers of the United States grow corn so extensively? Why are twice as many acres planted to corn as are planted to wheat? These, and like questions, are worthy of careful consideration.

Perhaps the most important reason for the almost nation-wide interest in corn growing is that the crop is the basic livestock feed of the United States.

Forty per cent of our corn crop is fed to hogs, 20 per cent to horses and mules, 15 per cent to cattle, and almost 5 per cent to poultry. This, you will note, accounts for four-fifths of the crop. Another 5 per cent is used as human food on farms. Thus, it becomes apparent that corn is a *supply crop.* It is used, for the most part, on the farms where it is grown. It is not sold for cash, except to a very limited extent.

Another reason why corn is grown so extensively is that it costs less to produce it than it does to produce other staple crops. The average cost of growing corn in the South is about $12.50 per acre.

The cost of growing corn is reported by the Mississippi Experiment Station as follows:

COST OF GROWING CORN

Rent on land	$4.00
Fall plowing	1.00
Harrowing and planting	1.00
Seed	.50
Six cultivations	3.00
Hoeing	1.00
Harvesting	2.00
Total cost	$12.50

It will be noted that most of this relatively small cost represents labor, not cash outlay. No cost for fertilizer is included, but even if it were, the total sum would be much less than that involved in the production of most cash crops in which Southern farmers are interested. It is worth while to remember, too, that corn can be grown without the use of any special implements or machinery. These considerations, in large measure no doubt, account for the extensive acreage devoted to corn growing.

Disadvantages of Growing Corn.—Growing corn in some of the Southern states is not without its disadvantages. The most important of these is the very low cash value per acre. Corn is worth less per acre than any other major crop. The comparative value of corn is indicated in the table on page 217.

VALUE PER ACRE FOR VARIOUS CROPS

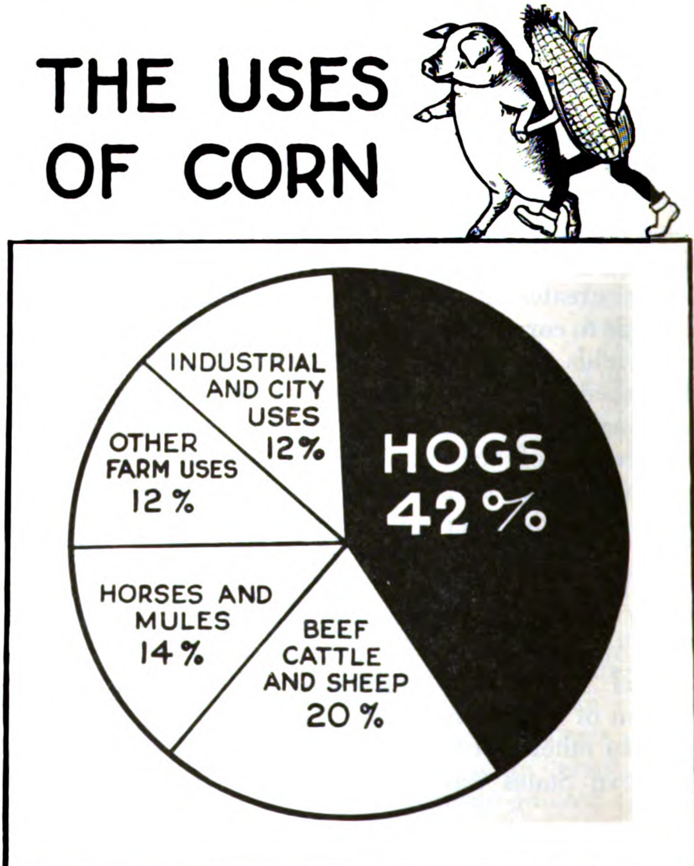
Corn	$ 29.60
Sweet Potatoes	112.55
Cotton (lint)	42.55
Tobacco	205.22
Rice	65.37
Peanuts	47.50

The figures given, which show the relative cash value of several of our more important crops, represent average values for the nation as a whole. If we were to give the cash value for corn in some of the Southern States, the figure would be much lower.

The greatest disadvantage of devoting so large an acreage to corn in some of the Southern States is that the acre-yields are so low that the farm income is materially decreased as a result. Naturally, the yield of corn per acre varies from year to year. But, we may say with a fair degree of accuracy, the average for the nation is normally about 25 bushels per acre. Yet in the Southern States, the average is much lower. Some of the states seldom produce more than an average of 10 or 12 bushels per acre.

For one five-year period recorded by the U. S. Department of Agriculture, the average yield for the North Central States was 29.6 bushels, while the average production of the South Atlantic States was only 15.8 bushels. In other words, the average yield in the group of Southern States was only about half that of the Corn Belt.

Of course, the cost of producing corn per acre in the South is lower than the cost in the Middle West because of the lower price of land and the lower cost of labor. *But it may be said in general of the South that it requires a production of not less than 15 bushels per acre to "break even" in growing corn.* Any farms producing less should either discontinue the growing of corn or find ways to increase acre-production. With the expansion of livestock production in the South, corn yields



per acre take on added importance. No farm can engage successfully in livestock production with a lower corn yield per acre, if much corn is used, than that made in the section where livestock is a major source of income. The importance of this statement cannot be overemphasized.

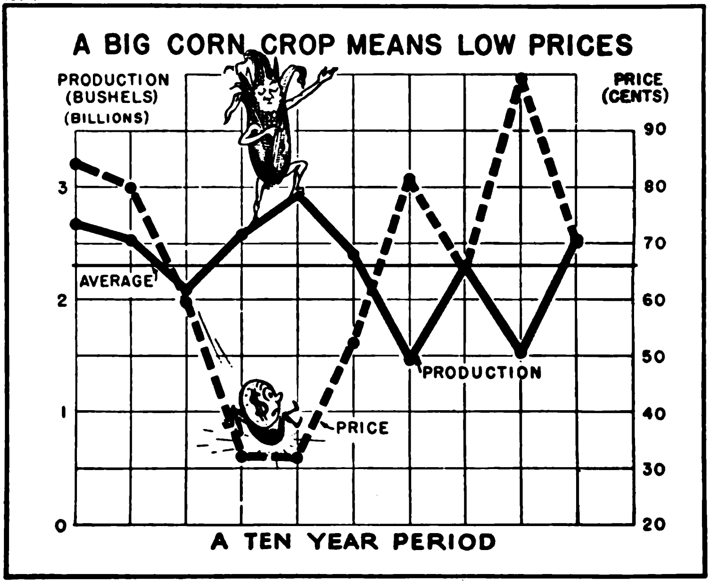
While it is true that the average corn yields for the South are, on the whole, lower than those in other impor-

Corn and Legumes

"Never plant an acre of corn in the South without a legume," is the advice of a prominent agronomist. "This practice accounts in some measure for our reduced corn yields per acre," he states, "but it is the best way to produce the largest quantity of feed per acre, either for cattle or hogs."

tant agricultural regions, it is also true that the highest yields per acre have been made in the South. Many national corn production contests have been won by Southern farm boys. Yields of 100 bushels per acre have been attested in many Southern contests. Of course, such yields cannot be expected under normal field conditions, but good farmers may certainly set for themselves a production yield of 40 bushels per acre. If such a yield, with good practices, cannot be attained, then perhaps crops other than corn should be grown.

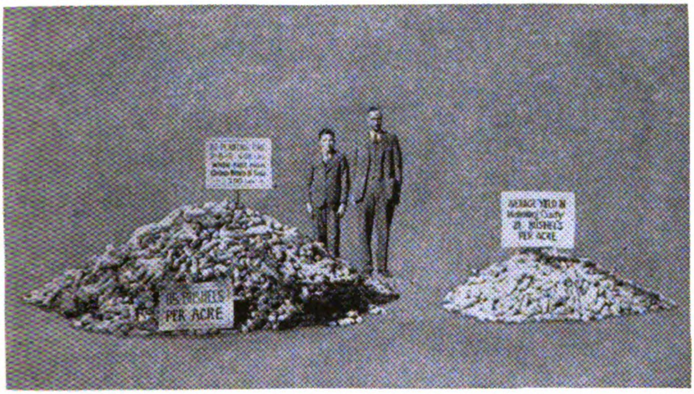
Corn Substitutes.—When the low average corn yields in the Southern States are under consideration,



the question naturally arises: Are these low yields due to poor farming methods, or are they due to conditions over which the farmer has no control? The answer is that in some sections and in some years the low yields are due entirely to a lack of rainfall at the proper time.

In the Corn Belt it is said that the total corn crop can be predicted by the amount of the rainfall in July. This means that July, in that section of the country, is the critical period in corn production, and that the crop must have ample moisture at this stage of its development. If this moisture is not available, a low yield results.

The Southeast has an ample supply of rainfall in normal years, but that rainfall is not always evenly dis-



115 Bushels of Corn per Acre

Some of the best corn yields per acre have been made by vocational and 4-H Club boys in the South, and yet the average yield for the Region is far below that of the Corn Belt.

tributed. It is not uncommon to have periods of drought during which most crops suffer for the lack of rain. This is the principal reason for the low corn yields in many parts of the South. This is also one of the reasons why cotton is so well adapted to the southern part of the nation, for it can withstand a period of limited moisture and then resume growth and development when conditions become favorable.

For some sections of the South, particularly the Lower South, thought should be given to crops which may be more profitable than corn. There are a number of such crops; let us consider a few of them.

Grain sorghum is the most important corn substitute. It has been grown for years most successfully in Texas, Oklahoma, and other sections of limited rainfall. It deserves a more important place in the farm program of the entire South than it now occupies.

In the South we are interested in swine production.

CORN AND SOY BEANS

No other part of the country consumes so much pork per capita as the inhabitants of the Cotton Belt. We have a market for much more pork than we have ever produced. Forty per cent of the corn produced in the nation, you will recall, is fed to hogs. Corn and tankage is the basic hog ration of the country. Perhaps no crop is so desirable for fattening hogs as corn, yet there are other crops which may be substituted for corn. The most important of these crops is peanuts. This feed produces what is called "soft pork." Although soft pork is not so desirable from the standpoint of the packer, the use of peanuts is doubtless more profitable for many Southern farmers than the use of corn. Sweet potatoes may also be grown for feeding hogs.

Barley is a good corn substitute. This is a crop which can be produced successfully only on good land. But where it can be grown, more feed can be produced per acre with this grain crop followed by summer hay than in any other way that the land can be utilized.

Oats in the sheaf make an excellent feed for wintering work stock and cattle. It would doubtless be profitable to increase materially the production of oats in the South and follow the crop with a summer legume.

There are many ways to use land more profitably than in growing corn with an average production of less than twenty-five bushels per acre.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What per cent of the American farmers grow corn?
2. How much land is normally planted to corn? How does this acreage compare with that devoted to wheat, cotton, and other staple crops?
3. Why is such a large acreage devoted to corn growing?
4. Give five advantages of growing corn.
5. Why is corn called a *supply* crop?
6. Tell how the corn crop is used.
7. What is the cost of growing an acre of corn? How does this compare with cotton? tobacco? sweet potatoes?
8. How do the returns from corn compare with that from other crops?
9. What is the average corn yield per acre for the South? for the Corn Belt? for the nation as a whole?
10. Why are the corn yields in the South lower than those in other parts of the country? Can this condition be corrected? Why?
11. What is meant by the term *corn substitute?* What are some of the corn substitutes that may be grown on your farm? What are the advantages and disadvantages of each?
12. Do you think corn occupies too large or too small a place in the present cropping plans of your state?

Selected References

U. S. Department of Agriculture, Washington, D. C.

Farmers' Bulletins

1714—*Corn Culture.*

State Publications:

Alabama—Bulletin 143—*Corn Production.*
Louisiana—Bulletin 253—*Corn and Soy Bean Production.*
Mississippi—Bulletin 83—*Corn Production in Mississippi.*
South Carolina—Extension Circular 89—*Corn Production.*
Texas—Leaflet 7—*Important Steps in Growing Corn.*

Suggested Activities

1. From the statistics given in the most recent Yearbook of the U. S. Department of Agriculture, make a tabulation showing the average acre corn yields for the several sections of the nation and for your own state. Compare on a percentage basis the yields in the South with those in the Corn Belt.
2. Determine the cost of growing corn on your home farm, using as a guide the figures given in the text; and on the basis of the average yields and prices for five years, calculate the net returns from your corn crop.
3. Make a list of the possible corn substitutes that might be grown on your home farm and list the advantages and disadvantages of each.

Chapter 16

SEED CORN

R. FLAKE SHAW

A CONSIDERATION of corn production involves (1) the selection of a variety, (2) the procuring of seed, and (3) the maintenance of practices that will sustain yields. Making decisions incident to these jobs suggests such questions as the following: What variety of corn shall I grow? Where can the seed best be procured? Should I test my planting seed? Can I improve my own corn by field selection? Of course, there are many other questions, but it is logical to begin with a consideration of varieties.

Varieties of Corn.—All dent corn grown in the Southern States may be classified either as a one-ear or as a prolific variety. A prolific variety is one which produces two or more ears to the stalk. Generally speaking, prolific varieties are preferred for the Lower South. The one-ear varieties predominate in the Corn Belt.

All varieties may again be divided into white and yellow corn. Yellow corn contains vitamin A; white corn does not. White corn is used almost entirely for the making of meal; yellow corn is preferred for mixed livestock feeds. Tests have shown that white corns, on the average, produce larger yields in the South than yellow varieties.

There are ten varieties of corn in the South for every one found in the Corn Belt. The varieties of the Middle West are rather definitely fixed in their characteristics;

they can be identified by one familiar with corn. The varieties of the South, especially the Lower South, are not so distinctive. The varieties grown in a given community or section may be identified by those persons living in the area where these corns are grown, but, with few exceptions, they are not known over an extensive territory. The breeding and improvement of corn represents one of the needs of the South.

The variety of corn to select is the one which does best in the locality. The yields obtained by the farmers of the community are the most valuable guides in attempting to make a choice.

Each agricultural college conducts corn variety tests. The results of these tests will be sent to anyone on request. These tests will reveal the names of the more popular varieties, but rarely ever do they point to one variety as being outstanding for use throughout the entire state.

Seed corn should not be purchased from a breeder who lives a long distance from the grower; for example, it would not be wise to buy seed corn from the Middle West to be planted in the Gulf Coast Region. The best seed corn for meeting your individual needs is to be found in your state, your own section of the state, and probably in your own community. Again it may be said that in the selection of a variety of corn to grow, the safest guide is the choice that has already been made by the best farmers of the community.

The varieties of corn that have been grown rather extensively in the Southern States include the following: *Prolific Varieties*—Albemarle, Biggs, Cocke, Hastings, Marlboro, Mosby, Sanders, and Whatley; *Large-Ear Varieties*—Tennessee red cob and St. Charles white; *Early-Maturing Varieties*—hickory king, Blount, and St. Charles. Jarvis golden prolific is one of the most pop-

Prolific Corn

ular of the yellow corn varieties. The varieties given are just a few from a very long list which will be found in the test plats of any state college of agriculture.

Hybrid Corn.—During recent years it has been demonstrated that corn yields can be increased fifteen or twenty per cent by the growing of hybrid corn. Naturally, this success has stimulated interest in seed corn of this type. Hybrid corn bred in the Corn Belt has been advertised and sold at a high price throughout the entire nation.

What is hybrid corn? How is it developed? Should Southern farmers grow hybrid corn? These are some of the questions with which students and farmers are concerned. To answer these questions, and to understand the advantages and the disadvantages of hybrid corn, one must know how corn breeding is done.

Hybrid, of course, means a cross. But to understand the term in relation to corn, it is necessary to know how a corn kernel is formed.

Every fruit (a kernel of corn) is produced as the result of a fertilized flower. The corn plant bears the male, or *staminate* flowers, at the top of the plant in the tassel; it bears the female, or *pistillate* flowers, on one or more hardened spikes which are produced from the nodes about midway along the stalk. The spikes develop into the cobs of the ears.

The female flowers are fertilized when the pollen from the tassel falls on the "silks" extending from the end of the cob. When not fertilized, there are no kernels. Perhaps no other crop is cross-fertilized so easily as corn.

One may readily understand that the pollen from one field may be carried by the wind and insects to another. It is easy to comprehend that each kernel in an ear of corn might be fertilized from a different stalk. Thus, each kernel in one ear might have a different parent. For this reason, it becomes somewhat futile to select seed corn from the field, for the heredity of any ear is not known, except within very broad limits.

Hybrid corn has been defined by law in some states as the first generation of a cross between different strains of corn of which at least one is an inbred strain.

What is meant by the term *inbred strain?* It means a corn that has been self-fertilized; that is, the pollen from the stalk was used to fertilize the "silk" on the same stalk. When this is first done, a very inferior corn may result. But, if continued, improvement will be shown. In practice, corn breeders self-fertilize a strain for several generations and secure a high degree of uniformity. They secure, too, in this way, a corn that will "come" true to parental characteristics. It is from such inbred strains that the best hybrid seed is produced.

Hybrids corns may be produced in several ways. The cross of two inbred strains is known as a *single cross.* The cross of a third inbred strain with the hybrid of two others is a *three-way cross.* The cross of an inbred strain with an ordinary variety is a *top cross.* The cross of two single crosses to combine four inbred lines is a *double cross.*

It is the so-called double cross that has produced the hybrid seed corn that has brought the greatest increase in yields. Such corn sells for a very high price, but one can well imagine that the producer of such seed has a great investment in labor in the product. And one can well understand, too, that such a product should be purchased only from the most reliable of sources.

The full value of hybrid seed corn exists only in the first generation. This means that the man who plants such corn must buy new seed from the breeder each year. After the first year the hybrid "breaks" up into all the strains that have entered into its creation. This is very important to the purchaser of such seed. It cannot be used for planting a second time.

"Hybrids are just as definitely adapted to various localities as are varieties," according to Farmers' Bulletin 1744, "and hybrid seed corn should be used only when it is known that the particular hybrid is adapted and productive in the particular locality."

Germination Tests.—For years agronomists in the Corn Belt have advocated germination tests for seed corn. This is not so important in the South as in the Middle West. A lack of maturity is the usual cause of the failure of corn to germinate. In the section of greatest corn production, the seasons are short, as compared with the South, and consequently the crops sometimes failed to become sufficiently mature before the first frost. If it does not mature sufficiently, the germinating quality of the seed is impaired.

Should one wish to test seed corn for germination, he will find the process is a very simple one. Either the "rag doll" or the sawdust box may be used. The first is merely a strip of cloth on which grains from the ears to be tested are placed in a space designated by some mark of identification. After the grains are placed, the cloth is moistened and rolled up and put in a box where it can be kept warm and damp. The same general plan is followed in the case of the sawdust box. A shallow box is partially filled with wet sawdust. On the sawdust is placed a cloth on which squares have been marked and numbered with a soft pencil. Six grains from each ear to be tested, two from near the butt, two from near the tip, and two from the center, are placed on the cloth. Over this another cloth is placed and another layer of sawdust is sprinkled on top. The sawdust should be kept slightly warm and damp for about five days. At the end of this time, the top cloth may be removed and

Those Ears Are Most Desirable Which Have Long, Thick Shucks Which Cover the Tip of the Ear the germination "reading" made. Of course, some method of identifying the ears from which the kernels were taken should be provided. There is no better way, perhaps, than that of putting a number—which corresponds to the number on the cloth—on a small piece of pasteboard and, with a nail, fastening it on the butt of the ear by pushing the nail into the pith of the cob.

The germination test, it may be re-stated, is not so important in the South as in the Corn Belt. But it is far more essential in the Southern states than it is the Middle West to test the seed for freedom from disease. Disease is one of the causes for the low yields of corn in the warmer portions of the nation.

Freedom from Disease.—As has been stated, field selection of seed for the purpose of getting the ears that are true to type is not so important as has sometimes been believed. This is due to the fact that corn is cross-fertilized so easily. But field selection may be a very good thing if the choosing of disease-free stalks and ears is the major objective.

Ears should be selected from the best-bearing stalks—that is, best-bearing in relation to the variety characteristic. The ears should be of medium height on the stalk and should be borne on shanks of medium size which are sound and free from all evidence of disease. The shank is one of the places where disease may most easily be detected. The husk should cover the tip well, so as better to protect the ear from insect injury. The stalk should have good brace roots and be growing under normal conditions. Ears should not be selected near barren stalks; it may be that the barren stalks did not produce ears because they are diseased.

Storing Seed Corn.—After seed corn has been selected, it must be stored carefully and protected from mice, rats, and weevils. Until thoroughly dry, it may be suspended from rafters in sacks. If attached by wires, mice and rats will not be able to destroy it. After the corn is thoroughly dried, it may be placed in boxes or bins lined with tins, wire, or hardware cloth.

Examine the seed at frequent intervals. If weevils are found, the seed corn should be treated with carbon bisulphide. To apply this treatment properly the corn must be placed in an air-tight container. The carbon bisulphide may be placed in a saucer on top of the corn. The fumes will penetrate to all parts of the container and destroy the weevils. The saucer should be allowed to remain in the box or container for about one day, after which it may be removed. Fire must be kept away from carbon bisulphide.

Corn Improvement.—Mass selection is probably the best method of maintaining the productivity of corn, so far as the average grower is concerned. This means using the best possible field selection and continuing this practice year after year. The grower should decide, in terms of the characteristics of the variety being grown, just what type and size of ear he is seeking. If not many such ears can be found, perhaps the fields may be planted to the best corn available, while the few superior ears may be multiplied in a special seed patch that is as far removed from other corn as possible.

The breeding of seed of any kind is a specialized business. It is complicated; it requires study and painstaking attention to detail. Rarely ever should the general farmer attempt to become a seed or plant breeder. But there is a field for corn breeders in the South. There is no reason why, out of the thousands of boys now studying agriculture in the South, a few might not be found to whom such work would appeal. Such young men should make a study of genetics and apply the principles to the improvement of corn for conditions in the South.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Give two ways in which varieties of corn may be classified.
2. What is meant by the term *prolific corn?*
3. What valuable property is contained in yellow corn? Why is it not grown more extensively?
4. Which has the larger number of varieties of corn, the South or the Corn Belt? Why?
5. What is the best guide in the selection of a variety of corn?
6. If you must buy seed corn, would it be a good idea to send to the best corn breeder in the Corn Belt to secure it? Why?
7. How many varieties of corn are grown in your community? In your section of the state? How many varieties are grown in the variety tests conducted by your state college of agriculture?
8. What do you regard as the best variety of corn for you to grow? Why? Where can seed be secured?
9. What are some of the most popular varieties grown in your state?
10. What is meant by hybrid corn? How is it produced?
11. How is corn pollenated?
12. How many ways are there in which corn hybrids may be produced?
13. What advantage is claimed for hybrid corn? Are there disadvantages?
14. Explain how the *double cross* is produced.
15. What is meant by inbred corn?
16. Suppose you plant hybrid seed corn, how many years may this same seed be used? Why?
17. What is meant by a germination test? Is it important? Why?
18. How can you make a germination test? Describe two ways.
19. Should seed corn be selected from the field? Why? If so, what should be the chief consideration?
20. How can you identify corn that is disease-free?
21. How should seed corn be stored?
22. How may weevils be controlled?
23. How much seed corn is required to plant an acre?

24. How may farmers maintain the quality of corn? What is meant by mass selection?
25. Discuss the need for corn breeding work and the problems involved in it.

Selected References

U. S. Department of Agriculture, Washington, D. C.
Farmers' Bulletins
1744—*The What and How of Hybrid Corn.*

State Publications

Corn Variety Tests, annual reports of each state college of agriculture

Suggested Activities

1. Make a collection of all the varieties of corn grown in your community. Write a short description of each and learn to identify each. Decide on the basis of the available evidence which is the most desirable variety to grow.
2. Write to the state college of agriculture and secure the latest annual report of the corn variety test work. See how your local varieties compare with those given in the report for the state.
3. At the proper season of the year, make a field trip for the purpose of selecting seed corn in the field. Prepare a statement in which you will list in part 1 the characteristics and conditions to look for in field selection, and in part 2 the things to avoid.
4. Make a study of disease conditions in corn. List all the ways of detecting diseased corn and determine from the available facts how disease is related to yield.
5. Make a seed corn germination test, using both methods described in the text. Report your readings in your notebook. No corn should be planted that does not germinate at least 90 per cent.
6. If you have a state seed laboratory, send a sample of corn to the laboratory to be tested for germination and freedom from disease. Study the report very carefully. Make a check test on the same sample in your school or home laboratory.

7. Find out from what sources you can secure hybrid seed corn and secure data as to price, yield claims, experience of growers in your section, and the strains from which the hybrid was produced. Secure a small amount of hybrid seed, if you decide not to use the seed for planting a crop, and test its value for use in your locality.

Chapter 17

PREPARING THE LAND FOR PLANTING CORN

R. W. ROYSTER

LAND is plowed to (1) loosen it, (2) to destroy weeds, and (3) to cover organic matter. One of the principal objects of loosening the soil is to allow water to enter it in greater quantity, to be absorbed to greater depth, and to remain in it for a longer period of time. The corn crop requires a very large quantity of water. It takes about sixty gallons of water to produce one pound of dry corn stalk, so one may readily understand how the amount of water available to the plants can become the determining factor in making a large crop. There are approximately six thousand pounds of dry corn stalks produced on an acre of corn which yields forty bushels of grain. It can easily be seen that any practices which will increase the water-holding capacity of the soil are to be recommended in most sections. In general it can be said that there are two ways in which the water retaining capacity of a soil may be increased: (1) by early plowing, and (2) by incorporating, or turning under, organic matter.

The Decisions to Be Made.—In connection with the job of plowing land for corn, there are three principal decisions to be made: (1) whether to plow in the spring or fall; (2) when to begin plowing, with respect to the condition of the soil; and (3) what kind of plow, and what power to use.

Fall or Spring Plowing.—Unless there is some special reason which makes it undesirable, corn land should be plowed in the fall or winter. The following advantages may be given for fall plowing:

—*Courtesy Caterpillar Tractor Co.*

BREAKING BOTTOM LAND FOR CORN

Heavy-duty disc tiller working eight to ten inches deep, covering two acres an hour for a cost in fuel of seven and one-half cents per acre.

(1) It loosens the soil so that it can absorb larger quantities of water.

(2) Organic matter turned under has a chance to decay.

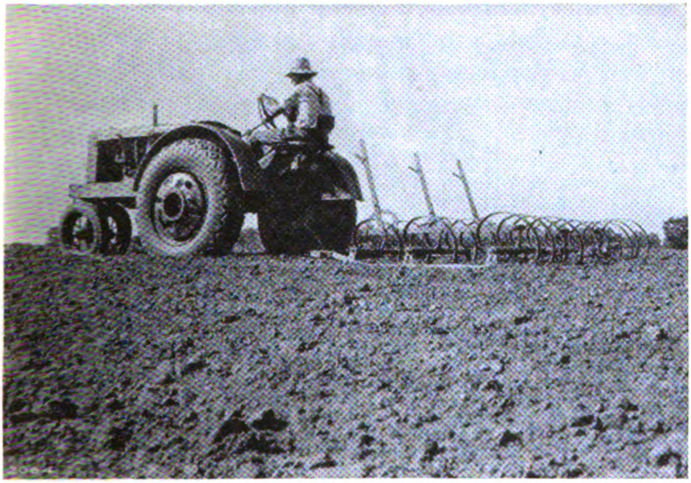
(3) The winter homes of many insect pests are destroyed.

(4) In sections where freezing and thawing take place during the winter months, plant food is made available.

(5) Plowing requires more time than most other farm operations, and often fall or winter plowing makes for a better distribution of labor on the farm.

(6) Farm manure applied and turned under in the fall gives better results than when applied in the spring.

(7) The fall plowed land gives the seed-bed a better chance to settle firmly and permits the re-establishment



A Spring-Tooth Harrow

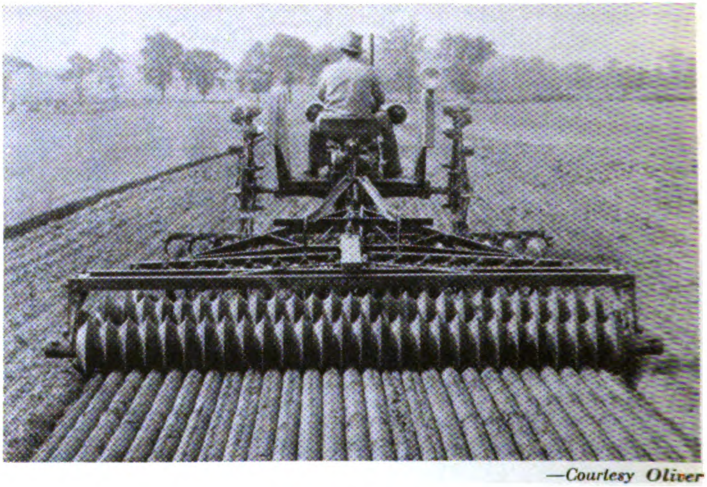
A good implement to use after plowing, especially in rough land. Used also for weed eradication.

of the capillary water "tubes" through which plants obtain their water and food supply.

(8) When the depth of plowing is increased, "raw" soil turned over in the fall has a chance to go through physical and chemical changes which make it more adaptable for plant growth.

Spring Plowing.—In spite of the many advantages set forth for fall plowing there are some soils, and some conditions, where it is not advisable. When soils wash badly, as on hilly land, spring plowing is, of course, best. Heavy clay soils, especially level sod land, should be plowed in the fall or winter; but sandy soils may be plowed in the spring.

The greatest agricultural problem of the South, or for that matter the entire country, is the maintenance and



—Courtesy Oliver

CULTI-PACKER
Used for firming the seedbed.

improvement of soil fertility. This problem can only be solved by the adoption of a system of farming which will put back into the soil the plant food removed by the crops that are grown. In sections of the country where livestock is raised extensively, returning plant food to the soil is done to a great extent by applying barn yard manure to the soil. But in the Southern part of the United States where livestock farming is not so highly developed, the fertility of the soil must be maintained in some other way. The most satisfactory method is the establishment of a definite crop rotation which includes some "soil improvement" crops. For the most part, such crops will be chosen from the legume family and will be grown simply to be turned under as "green manure" crops.

Fall plowing for corn often makes it difficult to grow cover or green manure crops. However, the long growing season in the South makes it possible to produce a good corn crop after turning under a crop of vetch or crimson clover. The Alabama Experiment Station has found that the yield of corn is greatly increased, often doubled, by planting corn after a crop of hairy vetch, which was sown the previous fall. Such soil improvement crops should be grown more extensively.

When to Begin Plowing.—The time to begin plowing, whether in the spring or fall, will depend upon: (1) the previous crop grown on the land, (2) the type of soil, (3) the moisture content of the soil, (4) the labor schedule for the season, (5) the area to be planted, and (6) the date of planting.

The importance of each of these factors depends upon the problems of the individual farm and the system of farming used; but probably the most important, from the viewpoint of the farmers everywhere, are the type of soil and the moisture content of the soil. Great care should be used in plowing heavy, clay soils. If plowed when too wet the soil will "puddle" and the clods will be hard to pulverize. This is especially true of soils with such a small amount of organic matter in them as is found in many sections of the South. Plowing should be done only when the soil will pulverize easily in the hand.

What Kind of a Plow to Use.—If possible for them to do so, the corn roots will extend into the soil at least three feet in every direction from the crown of the plant. It is desirable that the soil be in such a condition that the roots can penetrate it easily. This necessitates deep plowing. It is recommended for those soils that have had only shallow surface plowing, that the depth be increased a little each year.

It is apparent that for the preparation of such a seed bed a plow is needed which will turn the soil to a con-

THIS FINE CROP OF CORN IN THE COASTAL PLAIN FOLLOWED AUSTRIAN PEAS

siderable depth. The size of the plow to use will depend more than anything else upon the power required and the power available to pull it. The draft will vary from four to ten pounds to each square inch of cross section of the furrow slice. Thus a sixteen-inch plow, running six inches deep, will have a furrow with a cross section of ninety-six square inches. If the draft is four and one-half pounds per square inch, the total draft will be four hundred and thirty-two pounds, an easy load for three horses.

Aside from the cultural needs of the crop, the decreased labor supply in the South makes it necessary to use better implements, so that the labor available may be more effective. In no operation on the farm is this more important than in plowing.

Pulverizing the Soil.—Every seed-bed should be well prepared. This not only means that the plowing should be deep, and done at the right time, but also that the soil should be well pulverized after plowing.

Fall plowed land should not be harrowed until the following spring, just before planting time. Spring plowed land should be pulverized immediately after plowing.

There are many kinds of implements that may be used to pulverize the soil in preparation for planting. Among those more commonly used are the following types of harrows: (1) spike-tooth, (2) drag, (3) spring-tooth, (4) disc, and (5) cut-away.

The disc harrow is one of the most useful and practical implements to have on the farm. In many soils no tool except the plow need be used in the preparation of the soil for planting. It not only may be used effectively in pulverizing clods, but it is the most effective implement to use after turning under a green manure crop.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What are the reasons for plowing land?
2. Why should the seed-bed be loosened?
3. How much water is required to produce a twenty bushel yield of corn per acre?
4. How can the capacity of the soil to retain water be increased?
5. What is meant by turning under organic matter? Give examples.

6. What are the decisions to be made in connection with the job of plowing land for corn?
7. Should corn land in your community be plowed in the spring or in the fall?
8. What are the advantages of fall plowing? Of spring plowing?
9. What is the relation of the crops grown to the time when plowing should be done? Give examples.
10. When should barnyard manure be applied? Why?
11. When should plowing be done in order to control the boll weevil?
12. What is meant by re-establishing the capillary movement of water in the soil? Why is this important?
13. What type of land should be fall plowed? spring plowed?
14. How can the fertility of the soil be improved?
15. When should land be plowed when vetch and crimson clover are sown in the fall?
16. What is the relation of vetch to the corn earworm? When should vetch be turned under?
17. What should be the condition of the soil at the time of plowing?
18. What happens when land is plowed when it is too wet?
19. What kind of a plow is used in your community in the preparation of corn land?
20. What type of plow, in your judgment, is the most satisfactory? Why?
21. After corn land is plowed, what is the next job to be done?
22. What implements may be used in pulverizing the soil?
23. How much land can a man plow in a day with a team? with a tractor?
24. How much land can be harrowed in a day?
25. Why should the land be pulverized for corn planting?

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U. S. Department of Agriculture, Washington, D. C.

Farmers' Bulletins

1121—*Factors That Make for Success in Farming in the South.*

State Publications

Alabama—Bulletin 65—*Time of Turning Legumes and Planting Corn to Avoid Injury from the Southern Corn Root Worm.*

Arkansas—Bulletin 222—*Effects of Planting Dates on Corn Yields.* Bulletin 219—*Cultivation Experiments with Corn.*

Louisiana—Circular 43—*Lessons for Members of Boys' Corn Clubs.*

Kentucky—Circular 56—*Farm Crops.*

Suggested Activities

1. Make a study of the practices of your community to determine whether land is plowed in the spring or in the fall; from the yields obtained decide which is preferable.
2. In the laboratory make a study of the water in soils—that which runs off or through the soil, that which moves upward, and that which must be driven off by heating. Study the effect of organic matter on the water retaining capacity of the soil by pouring water through sandy soil in a tube, and then the same amount of water through soil containing a large quantity of organic matter. Study the rise of capillary water in soils of different types by using long soil tubes. Record the results in the notebook. What are the relations between these experiments and the preparation of a seed-bed for corn?
3. At a local implement dealer's, make a study of the plows which he has for sale, of the different types of planters which may be used for planting corn, and of the implements used for pulverizing the soil.
4. Calculate, using the experience of farmers in your community, the cost of plowing per acre with mules, and contrast this with the cost of using a tractor.
5. As soon in the fall as possible, the members of the class who will conduct corn projects should make the fall preparation which seems desirable, including sowing cover crops, spreading manure, and plowing. As an experiment, one-half of a five-acre project should be planted to some other crop such as vetch or crimson clover, and the other half unplanted. Comparison of the yields will be valuable in determining future practices.

Chapter 18

PLANTING AND CULTIVATING CORN

C. B. WILLIAMS

WHEN the job of planting corn is carefully analyzed it will be discovered that there are six major decisions to be made before the farmer can be certain that he is doing the work in the way which will produce the largest and most profitable yield.

These problems, or decisions, are: (1) when to plant, (2) what method of applying fertilizer to use, (3) whether to drill or check the corn, (4) whether to plant on a ridge, in a water furrow or on the level, (5) what distance and thickness to plant, and (6) what depth to plant.

When to Plant.—The time for planting corn varies with the (1) latitude, (2) the altitude, and (3) the seasonal conditions. In the Southern States, due to the long growing season, the period in which corn may be planted extends over more than two months.

From March fifteenth until the first week in April is considered early planting, and from May first until July first, late planting. In general most of the Southern States recommend early planting.

The Mississippi Agricultural Experiment Station published the data given in the table on page 247 showing the results with early and late planting.

Between early and late planting, there is a period in many of the Southern States when the budworm is likely to cause severe damage. This period of medium-early

EARLY VS. LATE PLANTING
(*Bulletin 170*)

Plat	*Yield in Bushels 1st Year*	*Yield in Bushels 2nd Year*	*Average Yield in Bushels*
March planting	56.7	43.00	49.8
June planting	39.2	30.00	34.7

planting is to be avoided, especially on low wet land.

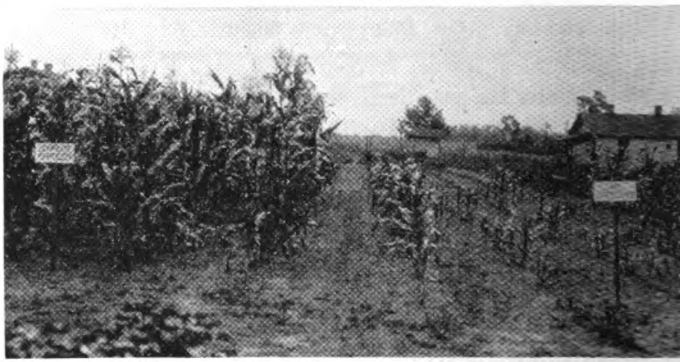
Another very important thing to think about in connection with the time of planting corn is the kind of weather that is likely to prevail at the time of silking and tasseling. This is a critical period in the development of the crop, when it requires lots of water, and when extremely hot weather is very injurious.

How to Apply Fertilizer.—It will perhaps be recalled that in the part of this text where soils adapted to cotton growing were discussed, it was stated that much of the land planted to cotton would not produce good yields of corn. This is just another way of saying that profitable yields of corn cannot be made on poor, worn out land.

It would, therefore, seem logical that large applications of fertilizer should be used in growing corn, but generally speaking such is not the case. In many states no fertilizer is applied directly to the corn crop. Many authorities on corn growing believe that the best way to increase corn yields is not by applying fertilizer directly to the corn crop, but simply by allowing corn to use the residue of the fertilizer which has been applied to crops previously grown in a rotation. This viewpoint is expressed clearly by the Virginia Agricultural Experiment Station as follows (Bulletin 214):

"The results of various experiments lead us to believe that the best method for fertilizing the corn crop is to establish a good rotation and fertilize the crops which precede it, applying no fertilizer directly to the corn crop itself.

"Corn seems very erratic in its response to fertilizer treatments. Some years fertilizers give good paying re-



Corn Responds to a Complete Fertilizer

sults, while in other years on the same type of soils these same fertilizers give no returns. Consequently, it is the policy of this Station to build up the soil by a good cropping system and a judicious application of plant food elements to the crops which precede corn."

In the Southeastern States, including North and South Carolina, Georgia, Florida, and Alabama, commercial fertilizer should be applied directly to corn. A complete discussion of this subject will be found in Farmers' Bulletin 1149, published by the United States Department of Agriculture. In this bulletin it is recommended that fertilizer be applied on the line of the row at the time of planting.

Whether to Drill or Check Corn.—In the Corn Belt proper, where fifty per cent of the crop of the entire United States is produced, all the corn is "checked";

that is, it is planted so that it is in rows regardless of the position from which one views the field. This makes it possible to cultivate up and down and also across the rows.

In the Southern States most of the corn is drilled.

—*Courtesy Allis-Chalmers*

A Two-Row Tractor Cultivator

With such equipment twenty-five or more acres may be cultivated in a day.

Experiments show that drilling produces just as satisfactory yields as checking.

What Manner Planting to Use.—There are three methods of planting corn: (1) on a ridge, (2) below the surface in a "water furrow," and (3) on the level.

On soils that are poorly drained or subject to excessive moisture, planting on the ridge is the best method. Corn that is planted very early, before the soil has a chance to warm up, will do better planted on a ridge, where conditions are more favorable to an early growth. Corn planted on a high ridge will, however, suffer from drought in dry weather.

On warm, well-drained soils, it has become very common to plant corn in the water furrows left by plowing the land into beds. This method is somewhat similar

Cow Peas Planted at the Time of the Last Cultivation

to the "listing" which is practiced in the states of the West, where the conservation of moisture is an important factor in growing corn. The advantages of water furrow planting as listed by the United States Department of Agriculture are (1) the rate of growth is easily controlled, (2) injury to the roots in cultivation is hardly possible, and (3) weeds and grass are easily covered.

Most of the corn grown in the Middle West is planted on a level seed-bed. This eliminates all hand work and makes it easy to use implements such as the two-row cultivator. The danger of level planting is that if the early season happens to be rainy the corn is likely to suffer from insufficient drainage and the ground may become set with weeds and grass before cultivation can be given.

What Distance and Thickness to Plant.—The planting rate and spacing of corn will depend upon: (1) the natural fertility of the land, (2) the quantity of fertilizer used, (3) the method of culture practiced, (4) the time of planting, (5) the evenness of the distribution of plants, (6) whether other crops are grown with the corn, (7) the variety, and (8) the season.

Usually the rows are from three and one-half to four and one-half feet apart and the kernels are drilled, usually one kernel to the hill at distances of 12, 18, 24 or 36 inches apart in the drill. In planting, most farmers use the one-horse cover planter which is provided with planting plates that drop the kernels definite distances apart. When velvet beans and other companion crops are planted with corn, the number of plants per acre are materially reduced.

How Deep to Plant.—The seed should be covered just deep enough to have sufficient moisture in which to germinate promptly. The depth can be regulated by adjusting the planter.

Cultivating the Corn.—Cultivation is practiced for three reasons: (1) to conserve moisture, (2) to make plant food available, and (3) to destroy grass and weeds. The chief value seems to be keeping down weeds.

The principal problems in cultivating corn are: (1) what implements to use, (2) when to give the first cultivation, (3) how often to cultivate, and (4) how deep to cultivate.

What Implements to Use.—The first cultivation of the field after planting can best be given with a weeder or spike tooth harrow. Later any type of one or two-horse cultivators available may be used. The cultivation of corn does not differ from that given any other crop.

When to Give the First Cultivation.—If after planting and before the corn is up, there should come a rain and a crust be formed on the surface of the soil, cultivation should not be delayed simply because the corn has not made its appearance above the ground. Cultivations at this time and when the young plants are very small will not injure the stand if done with a weeder or section harrow. Such cultivations will make it impossible for grass and weeds to get established.

How Often to Cultivate.—No definite number of cultivations can be recommended, but the crop should be worked frequently enough, up to the time of tasseling, to keep down the weeds. This means that corn should, as a general rule, be given a cultivation every ten or twelve days.

How Deep to Cultivate.—While the corn plants are small, and the roots have not extended far into the feeding zone, corn can be cultivated deeply and closely without injury to the root system. All later cultivations should be very shallow.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What are the six major decisions that must be made in connection with the job of planting corn?
2. Upon what does the time of planting corn depend?
3. What is considered early planting in the South? late planting?
4. Which gives the better results, early or late planting?
5. How does the budworm affect the date of corn planting?
6. When is the most critical period in the growth of the corn plant?
7. Should corn be fertilized in your community?

8. Why is the corn crop not fertilized as heavily as cotton?
9. What indirect methods of fertilizing corn are practiced?
10. What is the recommendation of the Virginia Station with respect to fertilizing corn?
11. What is the recommendation for fertilizing corn given by the North Carolina Station as reported in Farmers' Bulletin 1149?
12. What is meant by checking corn? By drilling?
13. Discuss ridge, water furrow, and level planting.
14. What is meant by listing corn? Where is this method practiced?
15. Discuss the spacing of corn.
16. How many plants should be grown on an acre?
17. How many square feet of space should each plant have?
18. How deep should corn be planted?
19. Why is corn cultivated?
20. What implements should be used in cultivating corn?
21. How and when should the first cultivation be given?
22. How often should corn be cultivated?
23. What is meant by "laying by"?
24. How deep should corn be cultivated?
25. What is the main reason for cultivating corn?

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U. S. Department of Agriculture, Washington, D. C.

Farmers' Bulletins

1149—*Growing Corn in the Southeastern States.*

State Publications

Arkansas—Bulletin 229—*The Effect of Interplanted Legumes on the Yield of Corn.*

Tennessee—Bulletin 124—*Planting Rates and Spacing of Corn.*

Texas—Bulletin 184—*Fertilizer Experiments with Corn.*

Virginia—Bulletin 214—*Corn Culture.*

Suggested Activities

1. Make a study of the methods practiced in your community in planting and cultivating corn. Secure information dealing with all the problems suggested in the test.

2. Visit one of your local implement dealers and study corn planters. Be sure to learn how the rate and depth of planting can be controlled.
3. In connection with your class discussion of spacing corn, calculate the number of stalks per acre when corn is planted in four foot rows 24 inches apart in the drill. How many square feet does each plant occupy? (There are 43,560 square feet in an acre.)

Chapter 19

CONTROLLING INSECT PESTS AND DISEASES OF CORN

W. N. HENDERSON

THE most injurious insect pest of corn in the South is the weevil. It is estimated by the United States Department of Agriculture that the average weevil loss of Southern corn is not less than ten per cent of the crop. Weevils attack the corn both in the field and in the crib. Since the damage is most severe when corn is stored, many farmers have formed the habit of selling their corn crop in the fall when it is cheap, and later in the year buying back what they need for feed, even though it is higher in price.

Life History of the Weevil.—There are two kinds of weevils which do more injury to corn in storage than all others combined: the rice or "black weevil" and the "fly weevil" or grain moth. The nature of the injury and the habits and life history of these two pests are so similar that for all practical purposes no distinction need be made between the two.

The mother of the black, or rice weevil lays her eggs in the kernels of the corn. She then covers the eggs with a secretion which makes it difficult to tell where the eggs have been laid. From each egg a small grub hatches and begins to burrow into the kernel. It feeds upon the kernel until well grown, then it changes to the pupa stage of development, and finally to an adult weevil. The insect, upon becoming an adult, eats its way out of the kernel, leaving behind a small irregular hole. This entire cycle of development may require less than one month. The female weevils lay so many eggs that if unchecked they multiply very rapidly.

Control Measures.—The first, cheapest, and most satisfactory method of controlling the weevil is to grow a variety of corn that has a long thick tight shuck. When the corn is protected in this way the adult weevil cannot reach the grain, but unfortunately, such shucks are often penetrated by the corn earworm, and an opening is made through which weevils enter. The danger from the earworm can be overcome to some extent by selecting for seed those ears that have a very long shuck.

Use Trap Rows.—Since the outer rows of a field are often injured most seriously, it is recommended that a few rows be planted on the outer edge of the field two or three weeks earlier than the balance of the crop. The weevils will first be attracted to these trap rows. As soon as mature, the corn on these rows should be gathered, leaving the shucks on, and this corn should either be fed out at once or fumigated.

Fumigate Stored Corn.—Weevils cannot enter ears that are protected with a tight shuck, provided it has not been injured by other insects. For this reason, when gathering the crop, it may be advisable to divide it into two parts: that which may be considered "weevil proof" and that which was exposed to the weevil attacks. But since often the labor used in gathering corn cannot be relied upon to distinguish properly between the two, it may be cheaper to gather and shuck all of the corn in one lot, and treat it with carbon bisulphide.

Carbon bisulphide is a heavy liquid that can be poured like water. When exposed to the air it evaporates, forming a foul smelling gas that is heavier than air. This gas will kill weevils. Great care should be used in handling carbon bisulphide, for it burns like gasoline.

The proper way to kill weevils in stored corn is to enclose the corn to be treated in an air-tight crib, or container, and subject it to carbon bisulphide fumes. The liquid may be poured over the corn, or placed in a pan on top of the pile. The gas is heavier than air and will soon permeate all parts of the fumigatorium. If the corn is stored in a gas-tight, or nearly gas-tight, crib or container, four to six pounds of carbon bisulphide per 1,000 cubic feet of space is enough for thorough fumigation. It is not likely that all of the weevils will be killed at one time, and probably a second or third fumigation may be necessary. If the corn is dry at the time of treatment it will not be injured for planting or for food.

Other Insect Pests of Corn.—There are a number of other insect pests of corn which should be mentioned briefly. Among these are: the budworm, the corn earworm, the chinch-bug, the corn stalk-beetle, and wireworms, cutworms, and grubworms. For the most part, these insects are controlled by cultural practices, and no direct attack, which will constitute a "job" in growing corn, is necessary to keep them in subjugation.

The Budworm of Corn.—The Southern corn rootworm, or budworm, is the larva or worm stage in the life history of the twelve-spotted cucumber-beetle. The principal injury is caused by the worm boring into the tender stalk of the corn, usually just above the junction of the tap root and the stalk. The greatest damage is done to corn planted on low wet land. The best way to avoid the injury caused by this pest is to plant at a time when the insect is in the pupa, rather than the larva, stage of development. This time will vary in the different states. Information relative to the proper time to plant corn to avoid the budworm can be secured from your experiment station.

The Corn Earworm.—This pest is also known as the cotton bollworm. It eats not only corn and cotton, but tobacco, tomatoes, and most of the other crops grown in the South. The adult of this pest is a brownish-yellow moth which flies around at dusk and after dark. The eggs are laid on the corn silks. After the eggs hatch, the worms work down the silk and bore directly through the shuck to the forming ear, where they feed on the kernels until full grown. Very few practical methods of control are known. The insects pass the winter in the pupa stage in the soil, and many of them can be destroyed by fall and winter plowing.

The Chinch-bug.—The chinch-bug is perhaps the most serious insect pest of corn in the Middle West, but is not of great importance in the Southern States. It is a migratory insect, and can be kept from entering corn fields after emerging from wheat by plowing a furrow around the field and keeping a dust mulch in it, by growing resistant varieties, and by cleaning up places where the insect hibernates during the winter.

The Rough-headed Cornstalk Beetle.—This pest is found in the Southeastern States. The adult beetle injures the corn by boring into the outer wall of the stalk immediately below the surface of the ground, and destroying the tender growing parts. It injures only small plants. The control measures are early planting, generous application of fertilizer, and fall plowing of sod land.

Diseases of Corn.—The most injurious corn diseases are those known as root, stalk, and ear rots. It is said that these diseases are reducing the yield of corn in Illinois at least fifteen per cent and that they are increasing throughout the Corn Belt. The United States Department of Agriculture reports that they cause greater losses in this country than all other corn diseases combined; that in one year the losses may be conservatively estimated at 125,175,000 bushels, or four per cent of the crop. These rots have been found to be one of the chief causes of poor stands; of large numbers of weak and stunted plants; of stalks that are leaning, down, and broken; of barrenness and nubbins; of chaffy, immature ears; and of reduced yields.

These rots are the diseases referred to in the preceding chapters which deal with the selecting and testing of seed corn. So far as the present information is concerned, the planting of disease-free seed is the most effective method of control.

Other diseases of corn which perhaps should be mentioned are molds, rusts, smut, and blight.

Black and Yellow Mold.—Texas reports (Bulletin 270) that the loss in their corn crop each year due to the injury from two fungus diseases, black and yellow mold, is more than one million bushels. To control yellow-mold one has only to plant those varieties of corn that have pendant ears. The black-mold is more difficult to check. It is very closely associated with the injury done by the corn earworm, consequently any method that will check the earworm will at the same time reduce the loss from the mold.

Smut.—Everyone who has seen corn growing is familiar with smut. It is indicated by smooth, silvery outgrowths on any part of the plant. These membranes break and liberate a mass of black spores. New infection takes place continuously during the season as old spore masses break. The control measures are crop rotation, the destruction of litter in the field, and burning of all smut masses before the membrane breaks.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What is the most injurious insect of corn in your community?
2. Where and how do weevils attack the corn crop?
3. What is meant by the life history of an insect?
4. What are the stages in the life history of a true insect?
5. Give the life history of the corn weevil.
6. What are the control measures recommended for weevils?
7. Should corn be shucked when stored? Why?
8. What is meant by planting trap rows of corn?
9. What is the liquid used to kill weevils?
10. Why is a gas-tight crib or box necessary?
11. How can a crib be made gas-tight?
12. How much liquid is required for treating the corn in 1,000 cubic feet?
13. How do you determine the number of cubic feet in a bin or crib?
14. Is one fumigation enough to kill all the weevils?
15. Why is it necessary to be careful about fire when handling carbon bisulphide?
16. What are the other insect pests of corn mentioned in the text?
17. Is the control of these insects a "job" in growing corn? Give the reason for your answer.
18. What is meant by a direct and an indirect attack on an insect pest or disease?
19. How is the budworm controlled?
20. Give the life history of the corn earworm, and tell how it is controlled. Upon what does the corn earworm feed in addition to corn?
21. Is the chinch-bug a pest in your community?
22. What are diseases of corn that are important?
23. Tell how each is controlled.
24. What is meant by a fungus? by a spore?
25. Tell how to secure disease-free seed corn.
26. To what extent do insect injuries and plant diseases decrease corn yields in your community?
27. To what extent is corn in storage in your community damaged by weevils?

Selected References

U. S. Department of Agriculture, Washington, D. C.

Farmers' Bulletins

915—*How to Reduce Weevil Waste in Southern Corn.*
950—*The Southern Corn Rootworm and Farm Practices to Control It.*
1025—*The Larger Corn Stalk-Borer.*
1029—*Conserving Corn from Weevils in the Gulf Coast States.*
1206—*The Corn Earworm as an Enemy of Vetch.*
1548—*The European Corn Borer.*
1562—*Farm Practices Under Corn-Borer Conditions.*
1651—*The Corn Earworm as an Enemy of Corn in the Eastern States.*
1662—*Husker—Shredders in Corn-Borer Control.*

Suggested Activities

1. Make a study of the community practices with respect to the treating of stored corn for weevil control, ascertaining the per cent of farmers who treat corn for weevil, the method used, the construction of cribs, the extent of control, and the number of times treated.
2. Using the method outlined in Farmers' Bulletin 1029 for killing weevils, treat the corn grown by the members of the class.
3. If possible, with all the members of the agricultural class working together, construct at the home of one of the farmers in the community, a weevil-proof corn crib using the plans furnished by your agricultural college. Also make an old crib gas-tight for treating weevils.
4. Make a study of the life history of the insect pests of corn and preserve specimens of the various stages of development for further use in the laboratory. Also study crops damaged by these insects.
5. In the same manner as suggested above, collect specimens showing as many of the diseases of corn as are found in your community.

Chapter 20

HARVESTING AND UTILIZING CORN

E. A. O'NEAL

THE corn crop may be harvested in the following ways: (1) by allowing hogs to harvest the crop; (2) by cutting the entire plant and putting it into a silo for ensilage; (3) by shredding; (4) by stripping the leaves before the ears are thoroughly mature, later harvesting the ears; (5) by cutting off the top of the stalks just above the ear and later gathering the ears, as is done when stripping the stalks; (6) by removing the ear and shuck, but leaving the stalk in the field; (7) by removing the ears only, leaving the shuck and the stalk in the field; (8) by cutting the entire plant and shocking in the field.

The method of harvesting which the grower should select will depend upon many things, including (1) the amount and kind of livestock to be fed, (2) the available labor, (3) whether the character of the soil makes it possible to turn livestock out in the field, (4) the capital with which to buy machinery and equipment, and (5) the total value of the crop when harvested by these various methods.

"Hogging-off" Corn.—It is a common practice in the Middle West to turn hogs into the corn fields and to allow them to harvest the crop. In this way the expense of gathering is saved and a large part of the plant food which was removed by the crop is returned to the soil. This method of utilizing corn is satisfactory if weather conditions permit. The hogs should not be allowed to run in the fields when the ground is wet, as this will cause injury to the soil, and may result in the grain being wasted. For the best results, the hogs should be limited to small areas rather than allowed to range

"Hogging-off" Corn and Soybeans

through a large field. Where large areas are to be "hogged-off", a temporary fence should be constructed, confining the hogs to a few acres. The fence can be moved as soon as the first area is pastured down, and the process continued until the whole field has been utilized.

This method of harvesting is especially adapted to utilizing fully all the feed grown when such companion crops as peanuts, beans, and peas are planted with corn; it will doubtless become more generally practiced as hog raising increases in importance.

Corn as Ensilage.—When the principal purpose of growing corn is to produce feed for cattle, the most satisfactory way to harvest the crop is to cut the entire plant and store it in a silo. The crop should be put into the silo at the time when it has stored up all the food ingredients and dry matter possible without becoming too dry. This is about when the kernels of the ear have become glazed and are fairly hard. A good rule to follow is to put corn into the silo when the fodder is ready for pulling.

Shredding Corn.—Perhaps one of the most satisfactory methods for harvesting large areas of corn, and one which should be more generally practiced in the South, is known as shredding. The corn shredder is a machine which snaps the ears from the plant and tears up or "shreds" the stalks so that a much larger portion of it is eaten by stock. This operation is similar to threshing small grain, for the whole stalks are fed into the shredder; the ears are delivered at one place and the stover at another. The shredded stalks are either blown into a barn loft or hay mow, or are baled.

In harvesting corn in this way it is the usual practice first to cut and shock the corn in the field. It requires about the same amount of labor to shred corn that it does to thresh grain. The principal advantage of shredding is that a larger part of the fodder can be used for feed, and if the coarser parts and refuse are used for bedding the stock, much valuable plant food in the manure is saved.

Pulling Fodder.—A very common method of harvesting corn in many parts of the South consists of stripping the leaves from the growing plants just as they begin to turn brown, and later gathering the ears. This operation of stripping the leaves is called "pulling fodder." After being pulled the leaves are bound together in small bundles and usually tied to the stalks.

The agricultural colleges and experiment stations have tried to discourage this method, by pointing out the fact that stripping the leaves reduces the yield of corn at least three bushels per acre, and that feed to replace the fodder can be more economically produced.

—Courtesy International Harvester

CORN FOR SILAGE

A one-row corn binder elevating bundles to wagon to be cut for silage.

The same criticism may be made of that method of harvesting called "topping" in which the leaves and top of the stalk are removed for feed before gathering the corn.

Gathering from Standing Stalks.—If corn is to be gathered from the standing stalks in the field, either with or without the husks, it should be snapped and thrown into a wagon, rather than in piles.

When the stalks are left in the field any plan of handling them is satisfactory which returns the vegetable matter they contain to the soil. Burning the stalks, as is too often practiced, destroys organic matter which should be incorporated in the soil.

Shocking.—In the Middle West, which is commonly spoken of as the "Corn Belt," practically all of the corn is cut and shocked. That is, the stalks are bound together and left in the field. Later either the shocked corn is hauled to the barn and shredded or the corn is gathered from the shock by hand. This method of handling corn is becoming more popular in the South.

For shocking, the corn may either be cut by hand or with a corn binder or harvester. One man can cut and shock only about an acre of corn by hand in a day. A corn binder will cut from six to eight acres in an equal length of time. The corn harvester cuts the stalks and ties them in bundles which must be shocked by hand. Whether to cut the corn by hand or with machinery will depend largely upon the acreage grown and the labor available.

In the South, shocks should not be very large but should contain between 150 and 200 plants. They should be securely tied with binder twine.

Storing the Crop.—There are three things to consider in constructing a corn crib in the South: (1) proper ventilation, (2) prevention of injury by rats and mice, and (3) minimizing the injury from weevils.

The proper ventilation may be secured by the construction of slatted ventilator flues at intervals through the crib. Rats and mice can be kept out by setting the crib on pillars covered with tin. Often a tin or galvanized pan turned upside down on top of each pillar will render a crib rat-proof. A double-walled construction with a covering of building paper between will make a crib for fumigation of the corn tight enough to kill weevils.

Marketing Corn.—The principles of marketing which were discussed in connection with cotton apply equally as well to corn. Before the crop can reach the consumer, and bring in a return to the grower, a number of "marketing services" must be performed. The most important marketing service in the case of corn is that of *processing* or *manufacturing*. This service the farmer performs for himself when he feeds his corn to hogs and cattle.

In no part of the United States is more than thirty per cent of the corn shipped out of the county where it is produced. In the Southern States less than ten per cent, and in some states less than five per cent, is sold outside of the county. This reaffirms the statement made in the opening chapter that corn is a *supply crop*. "The practice of shipping corn off the farm," according to Bowman and Crossley in their book, *Corn*, "is to be seriously criticised, considered from the standpoint of permanent maintenance of agricultural prosperity."

Until the yields of corn in the South can be greatly increased and the acreage extended, the marketing of corn will remain a relatively unimportant job for the average farmer. Probably as the production increases the livestock development will keep pace with it, for most farmers believe that the best way to market corn is on four feet.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What are the methods of harvesting corn mentioned in the text? What are the methods used in your community?
2. Upon what will the method to be used depend?
3. What is meant by "hogging-off" corn?
4. Where is this method practiced extensively?
5. What is its chief advantage? What is the chief disadvantage?
6. How should corn be harvested when velvet beans are grown with the crop?

7. What is meant by silage or ensilage? Why is it a good feed for cattle?
8. How much silage is used in your community? To what kind of stock is it fed?
9. At what stage in the development should the corn plant be cut for silage?
10. What is meant by shredding corn? Tell how it is done?
11. What are the advantages of shredding corn? How much labor is required?
12. What is meant by pulling fodder? Is this a good practice?
13. Does pulling fodder reduce the yield of corn?
14. How does topping, as a method of harvesting, compare with pulling fodder?
15. After shocking, how is the corn gathered?
16. What are the precautions to use in building a corn crib?
17. Is marketing corn an important job? Give reason for your answer.
18. What is meant by marketing corn on four feet?
19. What were the marketing services listed in connection with the discussion of marketing cotton?
20. In your opinion will co-operative marketing associations for handling the corn crop ever be developed? Why?

Selected References

U. S. Department of Agriculture, Washington, D. C.

Educational Charts

The Corn Crop.

Farmers' Bulletins

1589—*The Husker-Shredder on Eastern Corn Belt Farms.*
1701—*Corncribs for the Corn Belt.*
1715—*Methods and Costs of Husking Corn in the Field.*

State Publications

Louisiana—Bulletin 236—*Hogging-off Corn and Sweet Potatoes.*

Suggested Activities

1. Make a study of the way in which the jobs of harvesting and marketing are handled in your community; ascertain the methods used and the opinions of the farmers concern-

ing the various methods, such as pulling fodder, if this is practiced.

2. If possible, let all members of the class find an opportunity to help in, or observe, the filling of a silo, and the shredding of corn.
3. Build a rat and weevil proof, ventilated corn crib at the home of one of the members of the class.
4. Calculate the number of tons of silage in a silo thirty feet high and sixteen feet in diameter. Calculate the number of bushels of corn in a crib twenty feet long by ten feet wide and eight feet high.

Chapter 21

SWEET POTATOES AS A SOUTHERN CROP

M. J. FUNCHESS

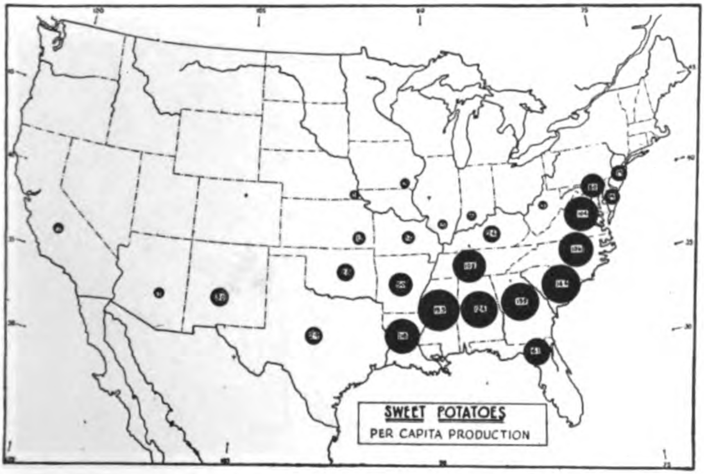
MORE than ninety per cent of the sweet potato acreage of the United States is located in the Southern States. The crop is grown commercially, however, in all the states from New Jersey to California.

The following table gives the acreage, production, yield per acre, total yield, and car lot shipments in the leading Southern States for a ten-year period:

SWEET POTATO PRODUCTION

State	*Acreage*	*Yield* (Per acre)	*Yield* (Total)	*Shipments*
Georgia	107,900	78	8,612,300	312
Louisiana	85,900	78	6,661,900	1412
N. Carolina	84,000	98	8,203,000	828
Texas	84,000	74	6,355,200	585
Alabama	80,900	86	6,923,000	374
Mississippi	67,500	99	6,638,500	135
S. Carolina	55,900	88	4,921,200	189
Tennessee	54,600	89	4,859,100	2706
Virginia	38,900	118	4,650,700	4774
Arkansas	32,600	77	2,506,000	205

It will be noted in the table given, that Virginia is the only state in the South that for a ten-year period has averaged a production yield of more than 100 bushels to the acre. In this connection it is interesting to note, however, that in New Jersey, Indiana, California, Delaware, Maryland, and several of the states producing small quantities, the acre yield is consistently over 100 bushels. For one five-year period, the producers of Georgia averaged 102 bushels. Louisiana, for another period of years, averaged 113 bushels. In a small area



near Laurel, Mississippi, for several years the average production of a selected group of growers has been more than 200 bushels per acre. A few of the Master Farmers who make a specialty of growing potatoes have produced as much as 450 bushels per acre. As for every other crop, the profits made from growing potatoes is usually determined by the acre yield.

Sweet potatoes represent one of the major food crops of the South. They are to the Southern States what Irish potatoes are to the North and East. This accounts for the fact that while the production is large in some of the states, the car lot shipments are very small. The sweet potatoes are consumed within the state for food.

In recent years the shipments of sweet potatoes to the North and East have declined. In 1936, total car lot shipments were less than half the volume of shipments in 1926. However, increased shipments were made from several states, notably Louisiana and South Carolina, and many shipments made by truck were not reported.

Commercial Brands

Some of the outstanding commercial brands and packs of Louisiana sweet potatoes.

In the main, there are two types of *food* sweet potatoes: the dry-fleshed potato of New Jersey, and the yams of the South. The yam is a moist, *sweet* potato; the other is quite dry. Naturally, the people of the South regard their own type as superior. Most of the potatoes that have found their way into the great markets have been the type produced in New Jersey and other states near the large eastern cities. The growers of the "Deep South" have said for years that if the people of the East ever had the opportunity to secure the yam-type, they would never want to buy any other. This seems to be a very logical conclusion. But changing the food habits of a people is a long-time task.

The Probable Income.—Estimating the cost of production and the probable returns from any crop is, of course, exactly like counting one's chickens before they hatch. The production figures given for one year and one farm will not apply to another year or farm. The items of cost are, in the main, the same.

The Department of Horticulture of the Georgia College of Agriculture has made the following estimate of the cost of producing and selling sweet potatoes for food:

COST OF PRODUCTION

Preparation and rent of land	$ 7.00 to	$12.00
10,000 slips or cuttings (At from 25 cents to $1.00 per M)	2.50 to	10.00
Cost of transplanting	3.00	3.00
Fertilizer	10.00 to	15.00
Cultivation	5.00	5.00
Harvesting	3.00 to	5.00
Packages	6.00 to	8.00
Storage at 5 cents per bushel (Last two items on basis of 60 bu.)	3.00	3.00
Total Cost	$39.50 to	$61.00

Of course, these costs will vary from time to time and with local conditions. The important fact is that the probable cost and return from every crop should be calculated. This may bring to light methods of reducing cost. It may prove that a crop, on the basis of local yields and conditions, cannot be grown profitably.

In the case of sweet potatoes sold for food, it must be remembered that the crop must be *graded,* and that a portion of the yield cannot be sold on the commercial markets. Those not fit for the market, in the form of "jumbos" and "strings," account for at least one-third of the crop. These must be disposed of in some other manner. They may be sold locally, which is unlikely; more frequently than otherwise, they are fed to hogs.

The probable income may be determined from a calculation of the cost of production, the average yields of the locality, and the average price per bushel. The outcome of such a calculation will determine the place of

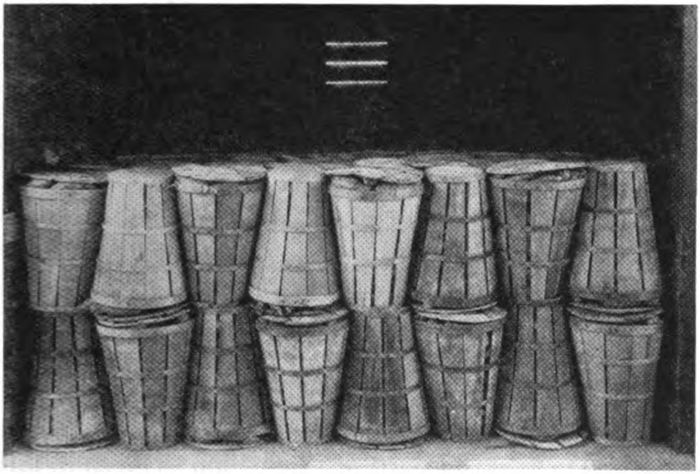
NANCY HALL SWEET POTATOES READY FOR MARKET

sweet potatoes in the program of any farm. Of course, the extent to which potatoes are grown in the locality and the extent to which there are available markets are also factors that must be considered.

Soils for Sweet Potatoes.—Sweet potatoes may be grown successfully on a wide variety of soil types. For commercial production, a well-drained, light sandy loam produces potatoes of the very best quality and shape. Deep sandy soils do not produce good yields unless fertilized very heavily. Clay loams will produce good yields, but they are more difficult to cultivate and produce potatoes of less desirable shape. Heavy, stiff clay soils are poorly adapted to the crop.

In selecting soils for growing sweet potatoes, it is most important to use land on which the crop has not been grown for three or four years. *Diseases affecting potatoes are in most cases spread through infected soil and* *for this reason it is always wise to plant sweet potatoes in a four-year rotation or on different soil each year.*

A rotation, such as the one given below, is recommended.



A LOADED CAR
Sweet potatoes packed in hampers.

SWEET POTATO ROTATION

First Year: Sweet Potatoes.
Second Year: Winter oats, followed by peanuts or cow peas.
Third Year: Cotton.
Fourth Year: Corn, with velvet beans or cow peas between the rows.

This example is merely suggestive. It is given primarily to show how crops may be rotated to prevent disease in sweet potato production.

New Uses for Sweet Potatoes.—The possibilities of sweet potato use for food are at present limited. A greatly extended market waits upon a change in the food habits of people.

Sweet potatoes may be fed to hogs quite profitably. In the major hog-producing sections of the South, many acres of sweet potatoes are grown for this purpose.

Potatoes for Starch

Triumph sweet potatoes, illustrating various grades which can be sold for starch making that are otherwise unmarketable.

When fed to hogs, the costs of production as given in this chapter are greatly reduced.

Experimental work conducted at Laurel, Mississippi, has shown that an excellent quality of starch may be made from sweet potatoes. For many years starch has been made from American-grown corn. Also starch used in this country is made from crops that are imported from India. Starch-making is a great industry and there is opportunity here for a new market for the sweet potato.

It is hoped that a great sweet potato starch industry may be developed which will provide an outlet for the production of many acres of sweet potatoes. The growing of potatoes for this industrial use has many advantages. First of all, the large and small potatoes may be sold at the same price as the ones that are acceptable for the food market. Second, the cost of storing and providing packages is eliminated, since for starch, the crop may be hauled to the plant in a truck and dumped into a bin. Third, the cost of harvesting is reduced for the reason that it makes no difference whether the potatoes are cut and bruised or not.

It is apparent that there are many advantages in growing for industrial use. A farmer may be better off—that is, make a larger net return—by growing potatoes for a starch plant even if at half price than by producing for the commercial food market at full price.

Experience at Laurel has shown too that we may double, and triple, the present yields per acre.

Engineers are designing planters and diggers which will reduce the labor costs. As a result, a new level of efficiency is being developed in sweet potato production in the South.

SUGGESTIONS FOR STUDY

Questions and Problems

1. In how many states are sweet potatoes grown? In what part of the country are these states located? What per cent of the sweet potato acreage is located in the South?
2. How do the Southern states rank in sweet potato production? In car lot shipments?
3. What are the average yields per acre? What is the average for your state? What states stand at the top? at the bottom? Why?
4. What are the items of cost that enter into growing potatoes for food? for hog feed? for starch?
5. What is the average cost of growing potatoes in your state? What was the selling price last year? What yield would be required to make a profit? How does this compare with the average production in your locality?
6. What are the soil preferences of potatoes? Does your section have the soil types required? Why are all types of soils not suitable?

7. What are the major types of sweet potatoes? Discuss.
8. Why should sweet potatoes not be grown on the same ground year after year? What rotation is recommended?
9. What uses, other than human food, are outlets for potatoes?
10. What do you think of sweet potatoes as a crop for your locality? Should the acreage be increased?
11. What are the important jobs in sweet potato production? At what season in the year do these jobs come? Do they fit into other farm work? How do the hours of labor compare with other crops?
12. What are the factors that enter into determining the place that potatoes will occupy on your farm?

Selected References

U. S. Department of Agriculture, Washington, D. C.

Farmers' Bulletin 999—*Sweet Potato Growing.*

State Publications

South Carolina—Agricultural Education, Vol. 14, Nos. 7 & 8. *Sweet Potato Production.* (This bulletin gives the results of all research work in the growing of sweet potatoes.)

Suggested Activities

1. From the data given in the Yearbooks of the U. S. Department of Agriculture, secure and record the answers to the following questions: What state ranked first in sweet potato production last year? Where did your state rank? What was the highest yield per acre? What was the yield in your state? Has the long-time trend of sweet potato production shown an increase or decrease?
2. Make a list of all the jobs in sweet potato production.
3. Make a survey of sweet potato production in your community with respect to the jobs previously listed. After the survey has been made, prepare a statement on the following subject: *What I Think of Sweet Potatoes as a Crop for My Community.*

Chapter 22

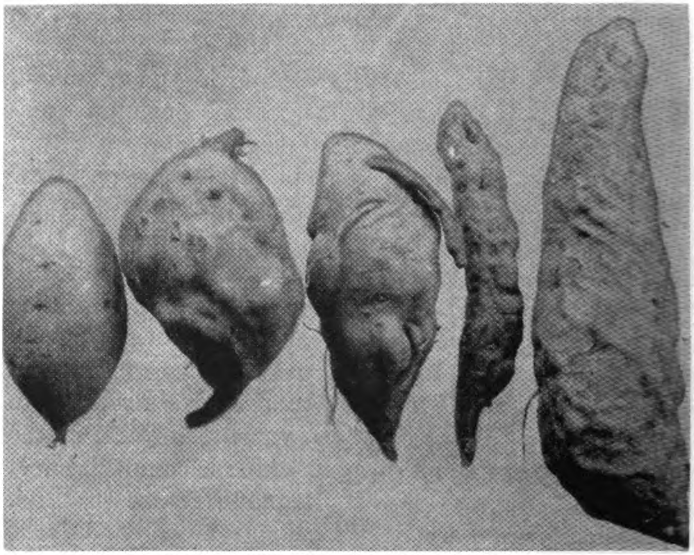
SWEET POTATOES
GROWING AND MARKETING

R. P. BURSON

THE yellow Jersey and big stem Jersey, and their strains, are the principal commercial varieties of sweet potatoes grown in Virginia, Maryland, Delaware, New Jersey and some of the Middle Western states. These varieties are of the dry fleshed type and are popular on the Northern markets. In most of the Southern States the Porto Rico is the leading variety, followed closely by the Nancy Hall variety. Southern Green, Dooley, Pumpkin Yams and Triumph are also produced, but to a lesser extent. These Southern varieties are all of the moist-flesh type except Triumph, which is somewhat dry. Triumph is being used now in the manufacture of starch because of its comparatively high starch content.

Seed.—A uniform strain of disease-free seed should be obtained from a reliable source. It is advisable to use certified seed as foundation stock. To maintain a good stock, seed should be selected at digging time from areas where diseases are not present. Hill selection will generally improve the seed stock. Seed potatoes produced from vine cuttings, if grown on healthy soils, will be free of such diseases as black-rot, scurf and stem-rot. Medium sized potatoes are recommended for bedding. North Carolina and Louisiana have developed strains of the Porto Rico variety which are greatly superior to the seed stock in common use. Seed of these strains is now available.

Seed Treatment.—The object of seed treatment is to kill the disease spores on the surface of the potatoes. If rots have already penetrated the tissue of the potato, no treatment can kill the disease organisms. Use 4



IRREGULARLY FORMED SWEET POTATOES GROWN ON HEAVY SOILS AS COMPARED WITH THE SMOOTH POTATO GROWN ON LIGHT SANDY SOIL ADAPTED TO THE CROP

ounces of bichloride of mercury to 32 gallons of warm water (the temperature of the water should be 100° F.) and soak the potatoes in this solution for 15 minutes. In preparing the bichloride of mercury solution, dissolve it in a small amount of warm water before adding to the container in which the seed are to be treated. A 50-gallon wooden barrel is a convenient container for the solution. By using bushel baskets, 2 bushels may be treated at a time in a 50-gallon barrel.

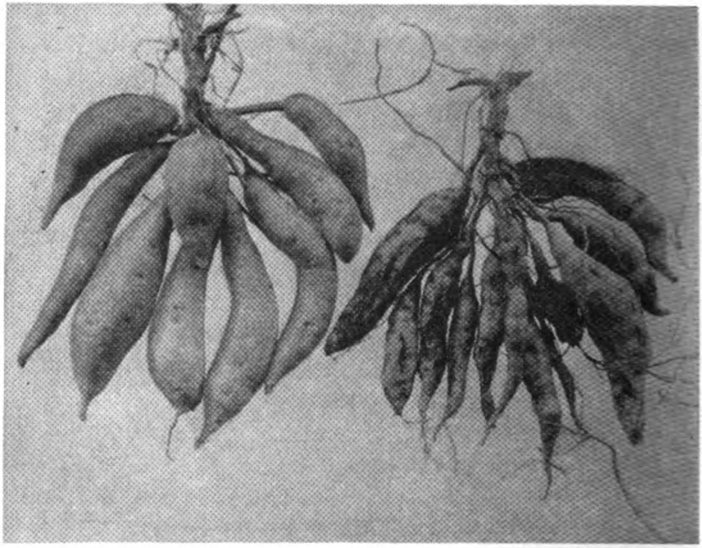
After treating 10 bushels, add ½ ounce of bichloride of mercury and bring the water up to the original level. Repeat this after each additional 10 bushels until 50 bushels have been treated, then dump the old solution and start all over again. A convenient way to add the ½ ounce of bichloride is to dissolve 2 ounces in a gal-

Badly Cracked Sweet Potatoes Resulting from Improper Fertilization and Methods of Planting. Excess Nitrogen, Low Potash and Wide Spacing Favorable to This Condition

lon of hot water and add 1 quart of this solution after treating each 10 bushels.

If the potatoes are dirty, rinse in clear water before treating in order to avoid weakening the bichloride solution. Do not wash the potatoes after treatment. They may be placed in the bed immediately after treatment, but should not be covered until they are dry. Use the solution the day it is made up, since it deteriorates rapidly. It is a deadly poison when taken internally.

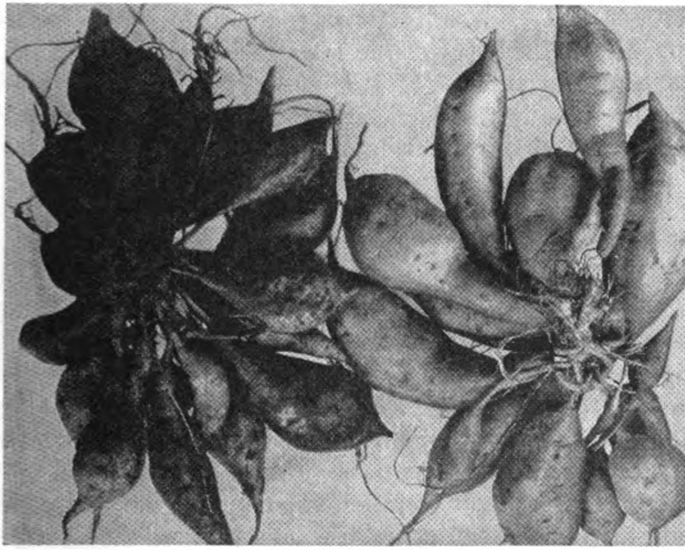
Growing Plants.—Plants for setting in the field may be obtained by bedding the potatoes and setting the sprouts, or by putting out a "mother" patch from which vine cuttings are taken to set the main planting. If the



SWEET POTATOES GROWN ON SOIL FREE FROM THE PARASITIC NEMATODE AS COMPARED WITH THOSE GROWN ON HEAVILY INFESTED SOILS

crop is to be grown from sprouts or draws, the potatoes should be bedded by April 1st in most sections of the South. The first pulling of sprouts would then be ready for setting in the field by the middle of May. About 7 to 8 bushels of potatoes will be required to produce enough sprouts to set an acre in two or three pullings.

If most of the acreage is to be set with vine cuttings, sprouts for the mother patch should be set in the field as soon as danger of frost is over. This means that the potatoes for this early patch should be bedded March 1 to 15 or earlier in some sections. If only the first planted potatoes are to be grown from slips or draws, and the rest from vine cuttings taken from these, enough potatoes to plant about one sixth of the desired acreage



SWEET POTATOES BLACKENED BY SCURF DISEASE AS COMPARED WITH HEALTHY SWEET POTATOES GROWN ON A PLANT TREATED WITH SULPHUR FOR THE CONTROL OF THE DISEASE. DUST ROOTS AND STEMS WITH SULPHUR IMMEDIATELY BEFORE TRANSPLANTING

should be bedded. For best yields, vine cuttings should be set in the field not later than June 1 to 15.

In order to secure early plants some type of hotbed will be necessary. Manure-heated beds are most commonly used, but good manure is not always obtainable. Fire or flue-heated beds are of a more permanent nature and are very satisfactory for raising sweet potato plants. The beds may be covered with glass or with treated cloth. In the warmer areas of the South it is not necessary to use heat, as plants can be grown in open beds.

The potatoes should be bedded in clean sand or light sandy soil obtained from areas where sweet potatoes have never been grown. Old sawdust has also been used successfully. Space the potatoes about ½ to ¾ inches apart in the bed. If stable manure is used for furnishing heat, it should be covered with 2 to 3 inches of sand and the potatoes bedded on the sand. Manure should never be placed on top or in contact with the potatoes. The plant-bed should be kept moist but not waterlogged.

If sweet potato plants are grown for sale and shipment, arrangements for inspection must be made with the proper state authority. Most states limit the sale of plants to those certified as being disease-free.

Preparation of the Land.—Sweet potato soils, being usually of a sandy nature, are not difficult to prepare. The land should be turned to a depth of about six inches and thoroughly harrowed. Then the rows should be laid off from three to three and one-half feet apart, the fertilizer applied, mixed with the soil, and then the bed thrown up with a turn plow to the desired height.

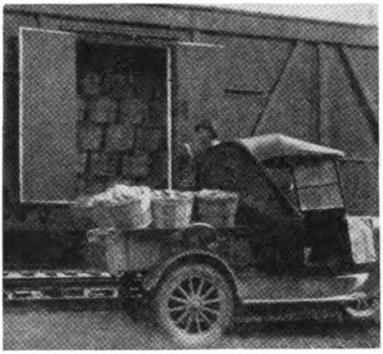
Fertilizers.—Stable manure is not recommended as a sweet potato fertilizer because it may be a means of spreading disease if animals have been fed diseased potatoes, and also because the potatoes will not be smooth if manure comes in contact with them. Commercial fertilizer mixtures will produce good crops of potatoes if used properly. The amounts of fertilizer and the formula to be used will depend on the land to be cropped. Several experiment stations have shown that a relatively high potash content will give greater yields of number one potatoes. In other tests on other soils, high potash content had no appreciable effect on yield. However, it will probably pay to use more potash in general.

The North Carolina experiment stations recommend

A Farm Storage House
Trucking Louisiana Porto Rico potatoes from a farm storage house.

a fertilizer analyzing 3 per cent nitrogen, 8 per cent phosphoric acid, and 8 per cent potash for coastal plain soils. This should be used at the rate of 800 pounds per acre for the moist-fleshed type such as Porto Rico and Nancy Hall, and 1200 pounds per acre for the Jersey type of potato. For sandy loam soils of the piedmont area, a mixture analyzing 3 per cent nitrogen, 8 per cent phosphoric acid and 6 per cent potash is recommended. The average home grower probably does not use sufficient potash in fertilizing sweet potatoes. The potash should be derived from muriate or sulphate because kainit and manure salt have often caused severe injury to the plants when applied in large amounts just before planting.

Mixtures with high percentages of nitrogen are sometimes injurious to the plants and tend to produce cracked and poor quality potatoes. Fertilizers should be applied in the drill about a week to ten days before planting. They should be thoroughly mixed with the soil and the ridge thrown up over it. Where large amounts of fertilizer are used, it is advisable to apply 800 to 1000 pounds in the ridge and to use the remainder as a side dressing after the plants become established. Lime is not generally recommended for sweet potato soils.



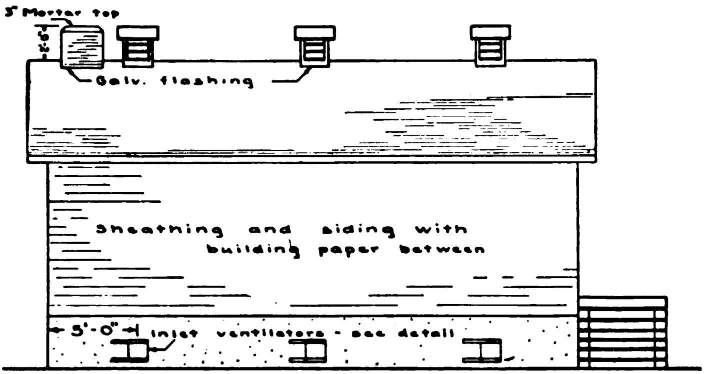
Shipping Nancy Hall Sweet Potatoes

Cultural Methods.—Tests have demonstrated that the Porto Rico and similar varieties will produce heavier yields on a relatively high ridge. The rows should be from three to three and one-half feet apart and the plants spaced 12 inches apart in the row. Close planting reduces the number of jumbo grade potatoes.

The most generally used method of setting plants in the field is by hand. Probably the most convenient device for this method of transplanting is a thin stick about 3 feet long having a slight notch in the lower end. The droppers lay the plants on top of the ridge at the proper distance and the planters place the notch on the root of the plant and force it into the soil, firming it by a second thrust of the stick. Where a large acreage is grown, transplanting machines should be used.

Cultivation should be often enough to keep down weeds until the vines interfere, then the crop is "laid by." Sometimes the vines are turned once ahead of the cultivator before cultivation is discontinued.

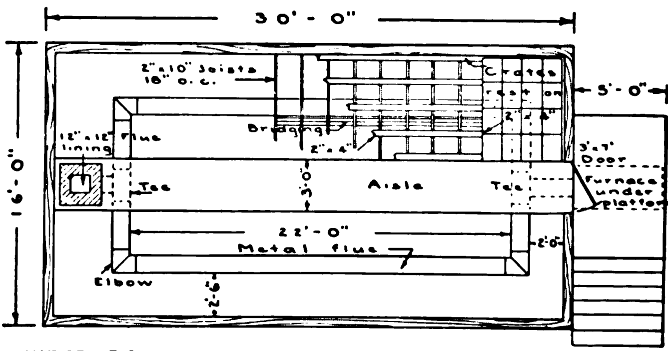
The Effect of Vine Pruning on Yields.—It is a common practice among sweet potato growers to cut vines from early plantings for the purpose of procuring



SWEET POTATO STORAGE HOUSE - *SIDE ELEVATION*
Capacity 1000 bushels

additional planting stock. Sometimes cows are pastured in sweet potato fields. Experiments were carried on in North Carolina and Georgia to determine what effect this vine pruning had on the yield of sweet potatoes. It was found in each case that there was a reduction in yield in direct proportion to the amount of vines that were cut away.

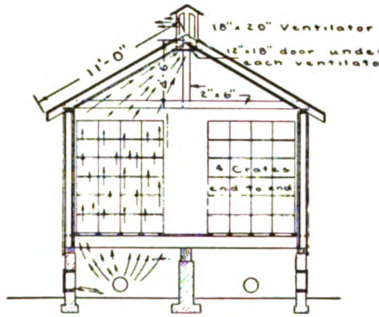
Harvesting, Curing and Storing.—Sweet potatoes should be harvested before frost if possible, and by all means before the cold rains which generally come early in November. Although the killing of the vines by frost does not always affect the tubers, there is considerable danger of cold injury in the case of heavy frosts. A cold-hurt sweet potato will not keep even under the best of conditions. In an experiment at the N. C. Agricultural Experiment Station over a period of five years, potatoes dug before a killing frost averaged from 4 to 5 per cent loss in storage, while those dug two weeks after killing frost averaged 44 per cent loss in storage. These figures tell their own story.



SWEET POTATO STORAGE HOUSE - *FLOOR PLAN*

In harvesting sweet potatoes, they should be handled with care and as little as possible, so as not to bruise the potatoes. Bruising provides favorable conditions for rots of all kinds and, even if the bruises heal up, leave unsightly blemishes on the potato. Grading should be done in the field and only marketable potatoes or seed stock ought to be taken into the storage house. Diseased potatoes must not be put in the house.

Sweet potatoes can best be kept through the winter in a well-constructed house which is provided with good ventilation and a satisfactory heating unit. Moisture and temperature are the most important factors to control for successful storage. The crop is cured by driving off excessive moisture with artificial heat. Curing should start as soon as the potatoes are brought into the house and should continue at a temperature of 80 to 85 degrees until all the potatoes are properly cured. The ventilators should be kept wide open throughout the curing process. In no case should moisture be allowed to collect on the ceiling because of improper ventilation. It usually takes from ten days to two weeks to cure sweet potatoes, depending on the amount of moisture in the roots at digging time. The appearance of sprouts on the potatoes and a velvety skin surface are fairly good indications that the roots are properly cured. At the close of the curing period, the temperature should be allowed to fall to 50 degrees and be kept as near this point as possible for the rest of the storage period. At no time should the temperature be permitted to fall below 40 degrees.

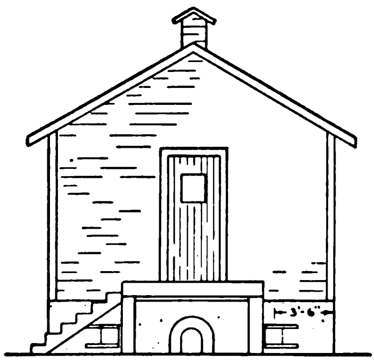


SWEET POTATO STORAGE HOUSE
SECTION

Sweet potatoes may be successfully cured and stored in houses built according to Government plans, in tobacco barns, or in renovated out-houses. The essentials are a tight house, good ventilation, and a satisfactory system of artificial heat. A system in which the heat comes up through the potatoes from below will provide the most uniform heating conditions. A supply of potatoes sufficient for the average family can be cured and stored in a small brick brooder house.

If the storage house or tobacco barn has been used for sweet potatoes before, it should be thoroughly cleaned out and disinfected by spraying with a solution made by dissolving one pound of copper sulphate (blue-stone) in 25 gallons of water. All crates and containers which have been used before should also be thoroughly disinfected. Then the fires should be started and the house dried out before storage begins. In order to avoid delays at digging time, the storage house should be ready and the crates and containers secured early.

Storage in slatted crates is preferable to storage in bins because it permits more thorough ventilation and greater convenience in handling. Also, when stock is removed, potatoes not wanted immediately are not disturbed if stored in crates. Potatoes placed in storage should not be handled again until they are taken out for market.



SWEET POTATO STORAGE HOUSE
END ELEVATION

Grading.—Proper grading is necessary if Southern growers ship to Northern markets. Grading may be done in the field or at the storage house, and regrading may be done after storage and before shipping time. The following requirements are stipulated for the various grades.

U. S. Grade No. 1 shall consist of sound sweet potatoes of similar varietal characteristics which are practically free from dirt or other foreign matter, frost injury, decay, bruises, cuts, scars, cracks, and damage caused by heat, disease, insects (including weevils) or mechanical or other means.

The diameter of each sweet potato shall be not less than one and three-quarters inches nor more than three and one-half inches and the length shall not be less than four inches nor more than ten inches, but the length may be less than four inches if the diameter is two and one-quarter inches or more.

In order to allow for variations incident to commercial grading and handling, five per cent by weight of any lot may fail to meet the requirements as to diameter and length and, in addition, six per cent by weight may be below the remaining requirements of the grade.

U. S. Grade No. 1 Medium. Any lot in which the diameter is not less than one and one-half inches and which contains a greater percentage by weight of sweet potatoes below one and three-quarters inches than is permitted in U. S. Grade No. 1, but which otherwise meets the requirements of such grade, shall be designated as U. S. Grade No. 1 Medium.

U. S. Grade No. 1 Long. Any lot in which the length is not less than six inches nor more than twelve inches and which contains a greater percentage by weight of sweet potatoes above ten inches in length than is permitted in U. S. Grade No. 1, but which otherwise meets the requirements of such grade, shall be designated as U. S. Grade No. 1 Long.

U. S. Grade No. 2 shall consist of sound sweet potatoes of similar varietal characteristics, not meeting the requirements of the foregoing grades, which are free from serious damage caused by dirt or other foreign matter, frost injury, decay, bruises, cuts, scars, cracks, heat, disease, insects or mechanical or other means, and which are not less than one and one-half inches nor more than three and one-half inches in diameter.

In order to allow for variations incident to commercial grading and handling five per cent by weight of any lot may fail to meet the requirements as to diameter and, in addition, six per cent by weight may be below the remaining requirements of this grade.

U. S. Jumbo Grade shall consist of sound sweet potatoes of similar varietal characteristics, which are free from serious damage caused by dirt or other foreign matter, frost injury, decay, bruises, cuts, scars, cracks, heat, disease, insects or mechanical or other means, and which are not less than three and one-half inches in diameter.

In order to allow for variations incident to commercial grading and handling five per cent by weight of any lot may be less than the diameter prescribed and, in addition, six per cent by weight may be below the remaining requirements of this grade.

U. S. Grade No. 3 shall consist of sweet potatoes not meeting the requirements of any of the foregoing grades.

Practically free, as used above, means that the appearance shall not be injured to any extent readily apparent upon casual examination of the lot, and that any damage from the causes mentioned can be removed without appreciable increase in waste over that which would occur if the sweet potatoes were perfect.

Diameter, as used above, means the greatest dimension at right angles to any portion of a central line running through the potato from stem end to root end.

Free from serious damage, means that any damage from the causes mentioned can be removed without increase in waste of more than ten per cent by weight over that which would occur if the potatoes were perfect.

Suggestions for Curing and Storage.—The Agricultural Extension Service of Clemson College gives the following ten rules for the curing and storage of potatoes:

1. Maintain a temperature of 80 to 90 degrees, during the curing period of from ten to fourteen days.
2. Give thorough ventilations during the day, but do not allow the temperature to fluctuate.
3. Close the floor ventilators at night, if there is danger of frost.
4. In severe weather, close all ventilators in floor and roof.
5. Examine the house during the curing period each morning, noon, and night.
6. When the curing period is over, gradually reduce the temperature, by discontinuing the fires, to 60 degrees.
7. Once each day, if weather conditions permit, open the ventilators and outside doors and windows, but close them early each afternoon.
8. During wet weather if moisture forms on the glass of the interior door and window, and the house appears damp, open the ventilators and keep a slow fire until all dampness has been driven out.
9. Have a regular time, preferably the middle of the day, to remove potatoes from the house, and do not return potatoes once removed, and let one person be responsible for the house.
10. After the house has been opened for the making of a shipment, always dry out by starting a slow fire, with the vents open.

Marketing.—Losses come about in marketing unless the crop is properly handled, cured, and stored. Grading is very important. One of the logical reasons why we know so little about grading this crop in the South is that we use more than ninety per cent of the crop of the largest producing states at home. Only 3 per cent of the crop of one recent year was shipped by carloads to the North. More and more of our potatoes are being hauled to market in trucks. This is fortunate for the many growers who have smaller quantities than are required for carload shipments.

The marketing of this, and other crops, depends in most instances upon the development of a community enterprise in which a number of growers pool their product, often under one trade name. Such cooperative effort must be encouraged. The school-community is the logical area for such an enterprise. From this district, the enterprise may grow until it composes one or several counties.

Disease and Insect Control.—It has been previously stated that the control of diseases is very important in sweet potato production. Rotations have been emphasized. Also it has been stated that disease-free seed-stock must be used. The following are the more important diseases and pests:

Diseases and Insects

Black-rot.—This disease is caused by a fungus and may affect the underground part of the plants, including the potato itself. At first the disease causes black, sunken spots on the surface of the potato, which may enlarge until nearly the whole potato is destroyed.

The infection begins on the plants as small black spots, which may enlarge until the whole stem has rotted off. Where potatoes affected with black-rot are used for seed purposes, the plants produced from the potatoes will be diseased. Do not set out diseased slips.

Sweet potatoes affected with black-rot should not be stored. Where such potatoes escape observation they should be sorted out in the spring before bedding.

Stem-rot or Wilt.—The disease may come from the soil in which plants affected with the diseases have been previously grown, or it may come from the hotbed.

The first noticeable effect in the field is that the leaves become duller in color, then yellow between the veins, and they may also become puckered. Finally the affected vines wilt. The young leaves at the ends of the runners are the first to show signs of the disease. By cutting off the ends of the vines, the stem will be found to be black on the inside.

The stem-rot also affects the potatoes, forming a black ring about a quarter of an inch below the surface of the skin. If such potatoes are used for seed purposes the sprouts grown from them may be diseased.

If wilted vines are discovered in the field they should be dug and destroyed before harvest time.

In case of black-rot, the ends of the vines will not be affected, but in case of stem-rot the ends of the vines are the first to show signs of the disease. Naturally a vine showing any discoloration or wilting would not be used to make a vine cutting. Remember that a cross-section of a stem, or runner, or a vine affected with stem-rot, will show signs of black inside.

For the control of the above diseases, seed selection; the use of clean seed-beds; 10-minute disinfection of the seed potatoes before bedding in a solution of corrosive sublimate (mercuric chloride), one ounce to eight gallons of water, and crop rotation, are about all that can be recommended.

Vine cuttings are the best sources of disease-free seed.

Plant the vine cuttings on soil where sweet potatoes have not been grown, to insure disease-free seed for another year.

The Sweet Potato Borer.—The full grown sweet potato-beetle is similar in size to the common red field-ant. With the exception of its snout, it really looks much like an ant. The head is black, the middle part of the body is red, and the abdomen or rear half is steel-blue in color.

In the worm stage the borer is a white-blue grubworm. It has no legs. The head is narrower than the body and is a pale brown. These worms which gnaw down into the tubers, hatch from eggs laid on the exposed root stalks by the adults. Sometimes they kill the plants, but most of the damage is done to the tubers. Sweet potatoes are sometimes ruined by the worms. Egg-laying also occurs on stored potatoes, and when the infestation is once started, an entire crop is subject to loss unless control methods are used.

The best known method of treating infested stored potatoes is with carbon bisulfide at the rate of three pounds per 100 bushels of tubers.

—*Oklahoma Extension Bulletin*

Other diseases of sweet potatoes are scurf, foot-rot, root-knot, soft-rot and dry-rot.

Other insects which sometimes attack sweet potatoes are cutworm, sweet potato flea-beetle, sweet potato white-fly and sweet potato plum-moth.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What are the more important varieties of sweet potatoes? Which are grown in your community? Give the characteristics of each.
2. How are potatoes propagated?
3. Discuss seed treatment. Why is seed treatment important? Describe the treatment.
4. Tell how sweet potato plants are produced.
5. Should a grower produce or buy plants?
6. What fertilizers are recommended for sweet potatoes? what analysis? what amounts? when and how applied?
7. Discuss cultural methods for potatoes.
8. When should slips be planted?
9. What is meant by vine pruning? What is the effect of vine pruning upon yields?
10. Tell how to harvest sweet potatoes.
11. How may they be kept for home use? How may they be cured for market?
12. Give the rules for operating a storage house.
13. How much does a storage house cost?
14. How are potatoes graded? Give the U. S. Grades.
15. What are the more important diseases of the crop? How are they controlled?
16. What are the more important insects? How are they controlled?
17. What are some of the factors in potato marketing? Discuss at length.

Selected References

U. S. Department of Agriculture, Washington, D. C.

Farmers' Bulletins

999—*Sweet Potato Growing*
1059—*Sweet Potato Diseases*
1442—*Storage of Sweet Potatoes*

State Publications

Arkansas—Bulletin 19—*Sweet Potato Culture*
Bulletin 198—*Curing and Marketing Sweet Potatoes.*
Florida—Bulletin 61—*Sweet Potatoes*
Bulletin 36—*Saving the Sweet Potato Crop*
Georgia—Bulletin 312—*Growing Sweet Potatoes in Georgia*
Circular 274—*Handling Sweet Potatoes to Prevent Rots*
N. Carolina—Bulletin 263—*Approved Practices for Sweet Potato Growers*
Tennessee—Bulletin 46—*Uses for the Sweet Potato*
(Every Southern experiment station has several bulletins dealing with sweet potato production and marketing.)

Suggested Activities

1. Outline the steps involved in conducting a sweet potato project.
2. Make hill selections to determine the differences that are found.
3. As a school enterprise, produce sweet potato slips for use by the members of the class, or for sale.
4. If possible, build a sweet potato storage house.
5. At the harvest season, grade potatoes according to the U. S. Grades.

Chapter 23

GROWING TOBACCO IN THE UNITED STATES

E. G. MOSS

TOBACCO is a native of the New World; it was being used by the Indians at the time America was discovered. John Rolfe, the husband of Pocahontas, was the first tobacco grower among the English settlers. In 1612, he began producing tobacco for export to the Mother Country.

In June 1619, 20,000 pounds were shipped to England. James I made an attack upon the use of tobacco and placed a heavy import duty on the commodity, but the exports of tobacco continued to increase. In 1731, the exports of tobacco from the provinces of Maryland and Virginia reached 60,000 hogsheads of 600 pounds each. The money received from these shipments amounted to $1,875,000, with an import duty of $900,000.

Tobacco warehouses were established in Virginia in 1730. These were primarily inspection centers designed to prevent the exportation of inferior grades.

From these brief statements it will be noted that tobacco has been an important cash crop from the earliest period of American history.

Present Status.—Approximately 3½ billion pounds of tobacco are now grown annually in the world. Of this total, the United States furnishes about 1¼ billion pounds. From 500 to 800 million pounds of the American crop is flue-cured tobacco.

Tobacco ranks eighth among the crops of the nation in value. The producing states include North Carolina, Kentucky, Tennessee, Georgia, South Carolina, Connecticut, Pennsylvania, Wisconsin, Ohio, Maryland, Massachusetts, Indiana, West Virginia, Virginia, Florida, Missouri, and New York. The leading states, from the standpoint of production, are North Carolina, Virginia, and Kentucky.

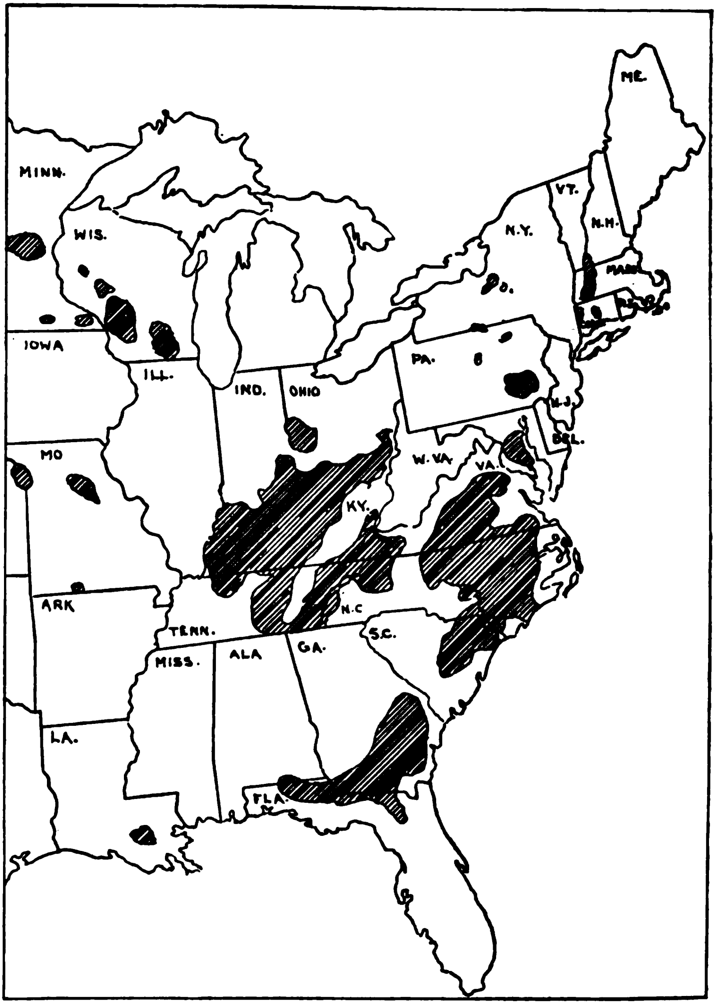
The leading tobacco-producing countries, other than the United States are Turkey, Germany, China, Union of South Africa, Australia, Hungary, Cuba, Brazil, Japan, Dutch East India, and a few others.

Tobacco is a highly specialized and intensive crop. The value of the crop comes mainly from the leaves; there are few by-products. A satisfactory income depends upon producing large yields per acre and high quality. Therefore, the best conditions for growth must be sought. These include (1) selection of soil, (2) the proper cultural practices, (3) the use of the best varieties, and (4) wise judgment in the use of fertilizers. Harvesting and curing are of vital importance.

Classes and Types.—The United States grows two classes of tobacco, the cigar class and the manufacturing and export class. The first is of course, used to make cigars; the second class is used to make cigarettes, smoking tobacco, plug, and snuff.

North Carolina, Kentucky, Virginia, South Carolina, and Georgia are the largest producers of the manufacturing and export class, while Connecticut, Ohio, Pennsylvania, and Wisconsin produce most of the cigar class.

The following types are included in the manufacturing or export class: *flue-cured* or *bright tobacco*, *white Burley* (air cured), *air-cured dark tobacco*, and *open-fire cured tobacco*. All cigar tobaccos are air-cured; some of them are grown under shade. The cigar-leaf types are grown chiefly in Massachusetts, Connecticut,



Where Tobacco Is Grown

Tobacco production is largely concentrated in the middle and lower Atlantic Coast States, where flue-cured tobacco is the principal type grown, and in the East Central States where burley, fire-cured, and dark air-cured types are grown. Tobacco production is, however, important in restricted areas of other states where climatic and soil conditions are especially favorable for the production of a specific type of tobacco.

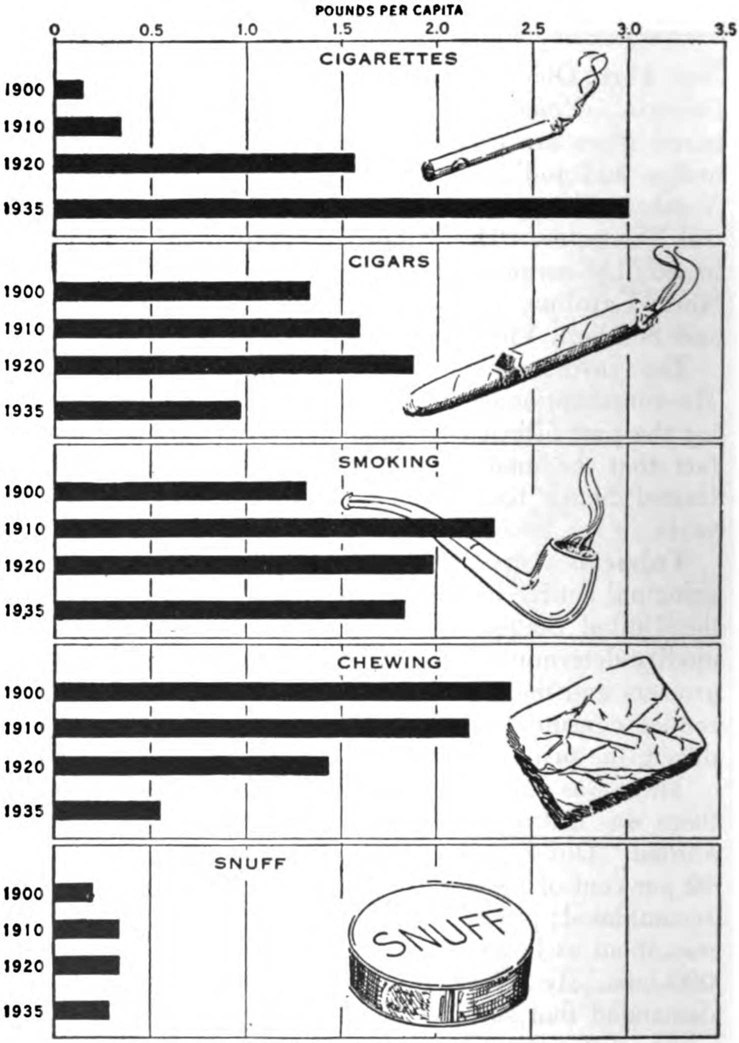
New York, Ohio, Wisconsin, Pennsylvania, Florida, and Georgia. Practically all the dark fire-cured and air-cured types are produced in Kentucky, Virginia, Tennessee and Indiana. The Burley types are grown in Northern Kentucky, Western West Virginia, and Central Tennessee. The bright flue-cured types are grown in South Georgia and Northern Florida, Northeastern South Carolina, the Coastal Plain of North Carolina, and Southern Virginia.

The favorite cigarette type is flue-cured tobacco. The consumption of this tobacco has increased more during the past fifteen years than any other type due to the fact that the manufacture of tobacco products in the United States has doubled during the last thirty-five years.

Tobacco Acreage Adjustment.—Tobacco is the principal source of income on about 375,000 farms in the United States. Naturally, the price of the commodity determines, in large measure, the income of the growers and their families. When economic conditions reduce consumption, or when too large a crop is produced, the price declines.

There was an economic collapse in 1929. As a result, there was a drop in tobacco consumption at home and abroad. Our exports, which normally amount to about 40 per cent of the total crop, declined. Tobacco stocks accumulated; prices dropped. The crop of 1931, which was about as large as that of 1929, brought $156,000,000 less. By 1933 conditions were worse and growers demanded that some of the markets be closed.

About this time Congress passed the Agricultural Adjustment Act. Under the provisions of this law the market was stabilized through the reduction of acreage. Since this reduced the amount of tobacco on the market, a higher price could be demanded. The crop of 1934



TOBACCO CONSUMPTION IN THE UNITED STATES

The tobacco product that has shown the greatest increase in recent years is cigarettes. A new record in the use of cigarette tobacco was established in 1937.

sold for more than twice as much as the crop of 1932.

The Kerr Tobacco Act was passed by Congress in 1934. A referendum was held in which the growers voted on whether or not they favored controlled produc-

—(*Picture taken at Coker's Seed Farm*)

EXAMINING THE QUALITY OF TOBACCO

tion. More than 90 per cent voted in favor of cooperative acreage adjustment.

Through the experience gained as a result of the agricultural adjustment legislation, the growers of tobacco learned that price, and consequently income and profits, is determined by supply in relation to demand, and that it does not pay to produce more than the market will absorb at a fair price.

Soil and Climatic Adaptations.—The commercial value of tobacco is influenced more by the kind of soil and the climatic conditions under which it is grown than is that of any other crop. Even the amount of rainfall, and other seasonal variations, affect very materially the quality of the leaf.

The northern climatic conditions favor the cigar types with their characteristic large leaves of thin body and weak aroma. The southern climate is productive of a more aromatic, smaller, and heavier-bodied leaf, suitable for cigarette, pipe, chewing, and export types.

The lighter and sandier soils of low water-holding capacity and low content of soluble mineral matter, produce the relatively large, thin leaf with light body, fine texture, and low nicotine content. The heavier soils produce leaves of smaller size, thicker, darker, and of more body.

Soils ranging between the extreme light and heavy types produce leaves of varied qualities. So sensitive is tobacco to certain soils that many localities produce distinctive grades which sell for different prices on the market. Therefore, selection of the field on the farm on which to grow tobacco should take into account the quality of leaf demanded by the local market.

The soils in the bright flue-cured areas are yellowish sandy loam and reddish sandy and clay loams, mostly light soils. The dark fire-cured and air-cured areas of Kentucky are brown silt loams and yellowish to reddish silt loams, often stony.

Labor.—Labor represents the major cost in growing tobacco. This is the most intensively grown field-crop produced in the South. A relatively small acreage is produced per farm, as compared to other field crops. The money value of tobacco per acre is normally higher than that of other field crops.

The limiting factor in determining the acreage to grow is the labor supply on the farm. Under ordinary conditions it requires four or five acres to fill a barn completely. It is not economical to grow less than this amount, unless curing is done in cooperation with other producers.

Tobacco fits in rather well with the other crops grown on Southern farms. The harvest season is earlier than that of cotton or corn; the plants are produced at what might be called, for many farms, an "off" season; transplanting comes a week or two after cotton planting.

Probable Income.—The income from tobacco is determined largely by quality in relation to market demands. The aim of the producer must be to grow the best quality possible. Poor grades have no friends on the market.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Where did tobacco originate?
2. How was tobacco used by the Indians?
3. What accounts for the rapid development of the tobacco industry?
4. Who was the first white tobacco grower?
5. Where, and for what purpose, was the first tobacco warehouse erected?
6. What states lead in the production of tobacco?
7. What are the types and classes of tobacco, and where is each grown?
8. What kind of tobacco is exported to the largest extent?
9. What is the relation of soil and climate to tobacco?
10. What soils are best for the production of flue-cured tobacco?
11. What is the relation of quality to profits?
12. How does the amount of labor required in the production of tobacco compare with other field crops?
13. What should determine the acreage of tobacco grown?
14. What is meant by *acreage adjustment?*
15. What do the farmers of your section think of compulsory acreage reduction?
16. What has been the trend in tobacco production over a period of years in your community? your state? the nation?
17. What per cent of our tobacco is exported?
18. How does tobacco fit into the farming program of your community?

19. What is the average cost per acre of growing tobacco?
20. What is the average price of tobacco in your section?

Selected References

U. S. Department of Agriculture, Washington, D. C.
Farmers' Bulletin 571—*Tobacco Culture*
Yearbook Separate 885—*History and Status of Tobacco Culture*
AAA Publications—*Tobacco Statistics*
Miscellaneous Publication 267—*A Graphic Summary of Farm Crops*

Suggested Activities

1. Study local conditions to determine the extent to which tobacco is grown, the average yield, average prices paid per pound, and the trend in acreage.
2. Make a study of the cost of producing tobacco in your community. Chart the results, showing the relative cost of the several items.
3. On an outline map of the United States, locate the tobacco-producing areas, giving the type grown at each. Do the same for your own state. (For data, see *Miscellaneous Publication* No. 267, U. S. Department of Agriculture.)
4. From the project records of your department, chart the labor distribution for corn, cotton, tobacco, showing the "peaks" for each.
5. Make a study of the trends in the production and consumption of the several types of tobacco, such as cigarette, cigar, smoking, chewing, and snuff.

Chapter 24

TOBACCO
VARIETIES AND FERTILIZERS

J. H. WHITEHEAD

A MARKED change has taken place with respect to tobacco varieties within the past fifteen years. With the increase in the consumption of cigarettes has come a demand for tobacco having less oil, nicotine, and body. The so-called light, thin types of fine-quality flue-cured tobaccos are in greatest demand and bring the best prices.

The old varieties once widely grown produced a leaf not so well adapted to cigarette requirements. Some of these older varieties have been bred to conform to the newer demands.

On extremely light sandy soils low in organic matter, the old heavy-type varieties produce leaves of excellent quality. However, for the average soils on which tobacco is grown, the lighter type varieties produce the highest quality leaf.

It would be wise for one to consult the experiment station of his state or section to find out the results of variety tests.

Saving the Seed.—It is advisable, under most circumstances, for a grower to save his own seed. Should a grower fail to produce the seed needed, he should purchase it from a tobacco seed grower with an established reputation.

Judgment must be used in selecting the plants allowed to produce seed. The person making the selections should have a plant of the ideal type in mind. In addition to trueness-to-type, the plants should be early-maturing and free from disease.

Pure strains of seed can be saved by covering the head during the blossoming period to prevent crossing with inferior plants. This is best done by covering the seed-head with a twelve or fourteen pound paper bag a day or two before the first flowers open. After being fitted and tied in place, the bag should be loosened and raised every two or three days as the seed-head grows. The head should also be examined occasionally in order to remove decaying flowers and any worms that may be found.

After the flowers are open and the seed pods begin to swell the bag may be removed, but it will be necessary to keep all other flowers, branches, and buds constantly picked off the plant selected to produce seed.

Only the fully matured and ripe pods should be harvested for seed. All under-ripe pods should be discarded. After the seed have been shelled out, the light and imperfect seed may be separated from the good seed by pouring all the seed into a glass of water and allowing them to stand for two or three hours. The heavy, well-matured seed will have settled to the bottom in this time, and the light, imperfect seed, which will be left floating at the top, may be skimmed off. The seed that have settled may then be dried out on blotting paper. Seed thus selected and saved should be stored in a dry place where it will be protected from freezing temperatures and from insects. Any ordinary fruit jar with cloth top to insure proper ventilation is an excellent container in which to store the seed. The mechanical seed cleaner is very efficient and is used extensively by county agents.

Fertilizers.—The natural fertility of the soil and its previous treatment must be taken into consideration in determining the kind and amount of fertilizer to use. Probably no crop grown in the Southern states is so sensitive to the stimulus of fertilizer as is the tobacco crop. In the bright tobacco section there is no factor

VARIETIES ADAPTED TO THE SEVERAL STATES

South Carolina
- Virginia Bright Leaf
- Jamaica
- Gold Dollar
- White Stem Orinoco
- Hester

North Carolina
- Virginia Bright Leaf
- Cash
- Jamaica
- White Stem Orinoco (light soils)
- Gold Dollar
- Gooch

Florida
- Big Cuba (cigar type)
- Sumatra
- Flue-cured (same as Georgia)

Georgia
- Virginia Bright Leaf
- Jamaica
- Gold Dollar
- Bonanza
- Yellow Mammoth
- Yellow Pryor

Virginia
- Lizzard Tail Orinoco
- Kentucky Pryor
- Narrow Leaf Orinoco
- Warne

Kentucky
- Burley (Stand-up)
- Green River (Stemming District)
- Kentucky Pryor

that has more influence on the quantity and quality of the crop produced than does the commercial plant food. The soils in this section as a class are rather infertile, but because of their light friable nature they respond readily to fertilizers. This condition of soil is not true of the Burley area. In this area, as a rule, the soil is well supplied with phosphorus and potash, nitrogen being the only element of plant food in which there is a deficiency. But even here, except in the bluegrass region of central Kentucky, a light application of phosphorus is advisable.

Fertilizers for Bright Flue-Cured Tobacco.—Numerous tests have been carried on in all states where tobacco is grown to determine the best fertilizer formula to use and the most economical rate of application. For

A Fertilizer Test

The source of plant food is very important in the preparation of fertilizers for tobacco.

the heavy, or more productive, soils in the flue-cured areas the best rate of application seems to be from 800 to 1000 pounds per acre. This fertilizer should contain about three per cent nitrogen, ten per cent phosphoric acid, and six per cent potash.

For the lighter soils the rate of application should be increased from 100 to 200 pounds above the amount that would be applied to the more productive soils. The formula should be the same as for the heavier soils with the possible exception that the per cent of phosphorus may be slightly reduced.

Recent experiments indicate that it is profitable to side dress with from 120 to 240 pounds of muriate of potash within a week or two after transplanting.

With respect to placement, two methods of application are recommended. One method consists in applying all the fertilizer in the row and thoroughly mixing with the soil prior to transplanting; the other consists in applying the fertilizer in bands. In the latter method, the fertilizer is placed three to four inches to the sides of the plant and about one inch below the crown of the plant. This method, the second, is gaining in popularity. Care must be used that the fertilizer does not come in direct contact with the plants.

Sources of Plant Food.—The sources of the plant food for tobacco are important. One-third of the nitrogen, it would seem from experimental data, should be derived from high-grade organic materials, such as fish meal, or cottonseed meal, or animal tankage. The other two-thirds should come from inorganic materials such as nitrate of soda, or urea.

Too much phosphoric acid in tobacco fertilizer causes premature ripening or firing of the lower leaves. A 16 per cent superphosphate seems to be a satisfactory source of phosphorus.

The sources of potash are important. The lower grades of potash salts contain chlorine in too large quantities. Materials such as muriate of potash and sulphate of potash are among the best sources. Tobacco trash should not be used as this may contain disease organisms.

Tobacco fertilizer should contain about 2 per cent magnesia, one-half of which should be water soluble. Sulphate of potash magnesia and dolomite limestone are good sources of this material.

While too much chlorine is objectionable, the best tobacco fertilizer must contain a little of this element. This is usually present in some of the sources of plant food used in the complete fertilizer.

It is desirable for tobacco fertilizer to carry about 6 per cent calcium oxide.

Fertilizers for Dark Tobacco.—Generally the fertilization of dark tobacco is little different from the flue-cured type, but manure is used to a great extent as a source of plant food. This is usually supplemented with a 600 pound application of a fertilizer containing 3 per cent nitrogen, 10 per cent phosphoric acid, and 4 per cent potash. What has been given concerning the sources of plant food for bright tobacco applies also to dark tobacco.

Tobacco Rotations.—Rotations are important in relation to the quality of tobacco produced. While it is impossible to give suggestions that will meet the conditions and requirements of all farms, the following rotations are given as among those that are quite generally approved:

FOR BRIGHT LEAF

1

1st year—tobacco
2nd year—grass mixture
3rd year—grass mixture

2

1st year—tobacco
2nd year—cotton
3rd year—corn with peas
4th year—oats

3

1st year—tobacco
2nd year—oats (followed with peas or soy beans)
3rd year—rye

4

1st year—tobacco (followed by vetch or clover)
2nd year—corn
3rd year—wheat or oats
4th year—grass mixture

FOR DARK LEAF

1

1st year—tobacco
2nd year—wheat
3rd year—clover
4th year—clover

2

1st year—tobacco
2nd year—wheat
3rd year—grass
4th year—grass

The proper rotation of crops on tobacco land is the key-note to growing a quality crop. The continuous cropping of land to tobacco is a mistake and the crops that are selected for inclusion in the rotation are important. Nematode, which causes root-knot, is present in most of the light sandy soils of the Southern States. It is practically impossible to kill out this organism. The rotation of crops constitutes the only effective control measure. Unfortunately, a large percentage of the crops grown in the tobacco areas are susceptible to this pest. By using crops that are immune, this pest may be held in check. Corn, wheat, rye, oats, sorghum, most grasses, velvet beans, Brabham and Iron peas, and peanuts are immune, or nearly so, and may be used in a rotation with tobacco.

It is advisable not to use legumes and other soil improvement crops in tobacco rotations too often as this will tend to enrich the soil to the point where the tobacco will be coarse and of poor quality. Some organic matter is needed, but it should be thoroughly rotted before the plants are transplanted.

Another troublesome factor on some farms is the small area suited to tobacco. On such farms a short rotation, say a two-year rotation, should be practiced. However, longer rotations are more effective in controlling disease and are otherwise advisable.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What varieties of tobacco are grown in your community?
2. What are the important points to consider in selecting a variety?
3. What is the real problem in fertilizing tobacco?
4. Why is the source of plant food important? Give an example.

5. What are the recommended sources of nitrogen?
6. What is meant by organic nitrogen? Give example. What is meant by inorganic nitrogen? Give examples.
7. What sources of potash are recommended? Why?
8. Discuss chlorine, magnesia, and calcium in connection with tobacco growing.
9. Tell how to apply fertilizer for tobacco.
10. What fertilizer formula would you recommend for your farm? How much should be applied per acre?
11. Why are rotations important in tobacco production?
12. What are some of the things to take into consideration in planning rotations for tobacco-growing farms?

Selected References

State Publications

Georgia—Bulletin 359—*Bright Tobacco Culture in Georgia.*
Annual Report (1935-36) Ga. Coastal Plain Exp. Sta., Tifton, Georgia.

Florida—*Tobacco Culture in Florida*

North Carolina—Bul. 212—*Factors Affecting the Quality of Flue-Cured Tobacco*
The Culture of Flue-Cured Tobacco, Dept. of Ag., Raleigh, N. C.

South Carolina—Bul. 118—*Growing Good Tobacco*

Tennessee—Bul. 116—*Burley Tobacco Culture*

Suggested Activities

1. Bring samples of tobacco seed to class and carry out the instructions given for separating the good seed from the poor.
2. Make out a fertilizer formula for growing tobacco in your community, determining the sources and the amount of each element that should be included in each ton.
3. Work out a practical rotation for growing tobacco on your own farm, taking into consideration all the factors involved.
4. Make a study of the varieties of tobacco grown in your community to determine the characteristics of each.

Chapter 25

GROWING TOBACCO PLANTS

GEO. ROBERTS

GETTING an even and early stand in the field is an important factor in tobacco production. This makes the selection and preparation of the plant-bed an important responsibility of the tobacco grower.

Locating the Bed.—A south or east exposure is the most desirable site for the bed, as this will insure earlier plants. The particular site chosen should be loamy and mellow, naturally moist, but having good drainage and free from standing water at all times. A location near a stream of water is desirable for a tobacco bed. Such a location is naturally moist, and in times of drought the bed may be more easily watered. Freshly cleared land makes the most ideal bed because there is plenty of humus in such land. Plants grow off better on new ground.

The spot chosen should be as free from weeds and grass as possible. This may be insured by burning; the burning will also destroy fungus diseases and insects. Before the bed is burned, all leaves, grass, and litter should be raked off as they hold moisture and will prevent the heat from penetrating the soil to a sufficient depth.

Burning the Bed.—To insure thorough burning, long poles or skids should be laid along the ground at intervals of about four feet. Across the ends of these poles, on the upper side of the bed, brush and wood should be piled about four feet wide and three feet high. The wood and brush should be fired at several places and allowed to burn down. After it has burned down, the embers should be pulled down to the adjacent strips four or five feet from the fire. The fires should then be renewed by piling on more wood or brush sufficient to burn for about one half hour, or until the soil seems well heated and dried out to a depth of three inches. This process is repeated until the whole bed is gone over.

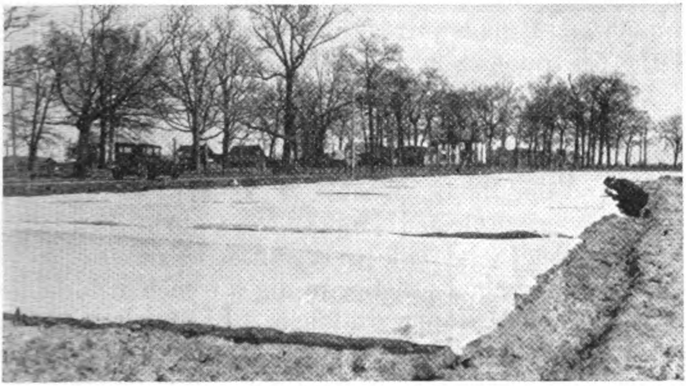
The scarcity of wood may make the burning of plant-beds impractical. On farms where wood is scarce, it is a good practice to select a site in the woods well covered with leaves. By raking off all leaves and trash, one obtains a fairly clean bed. Sedge fields prove satisfactory when a liberal amount of fertilizer and manure are used to give the plants a good start. If manure is used, it should be hog manure or well-rotted compost, as all other farm manure may contain weed and grass seeds, which are very objectionable.

Whether the burned or unburned site is selected, careful preparation of the plant-bed is necessary to insure germination.

Preparing the Bed.—The best method of preparing the bed is to double-break the soil with a single shovel plow and then go over the bed several times with a drag harrow. If the bed has been burned, the embers should be raked off before the ground is broken. After breaking and harrowing as suggested, very little hand work will be required to obtain a fine surface tilth.

The beds should be prepared early; in the latter part of February in most of the bright tobacco sections, and during February and March in the dark tobacco areas. In the southern part of the tobacco belt, earlier planting of the seed-beds is necessary.

Fertilizing.—The bed should be fertilized liberally by raking in some good fertilizer, such as a 4-8-3 or its equivalent with about one or two pounds per square yard. Soon after the seeds germinate, a top dressing of



TOBACCO PLANT BEDS

nitrate of soda, at the rate of 5 pounds per 100 square yards, will start the plants growing vigorously. Care must be used in applying the nitrate of soda or the young plants will be burned. The bed should be watered well immediately after being top dressed. Nitrate of soda should be applied only when the plants are dry. Some growers prefer to put the nitrate of soda on in solution. This is done by dissolving 5 pounds in 50 gallons of water and sprinkling the bed. After this has been done, the bed should be watered to prevent burning.

Seed Required.—One tablespoonful of seed will plant a bed 100 square yards in size, and will produce from ten to fifteen thousand plants.

Method of Sowing Seed.—For sowing, the seed should be mixed with dry fertilizer or wood ashes at the rate of one tablespoonful of seed to one peck of the sowing mixture. The bed should be gone over several times to insure even distribution. After sowing, the land should be firmed.

After Seeding.—For convenience, the bed should be narrow in proportion to length. Rarely, if ever, should the bed be over fifteen feet in width. To secure the number of plants required, one should add to the length of the bed rather than to the width.

After the bed is seeded, it should be enclosed by placing poles or boards around it and covered with cheesecloth. By covering the bed in this way, warmth is retained and the plants will appear earlier; they will also be somewhat protected from insects. The bed must also be protected from winds, insects, and excessive water. It is a good practice to dig a trench around the bed to provide proper drainage. Livestock must be fenced away from the bed.

Preventing Diseases.—Many diseases which damage tobacco in the field have their origin in the plant-bed. These diseases must be controlled. There is nothing more essential in tobacco production than starting with healthy plants.

Among the diseases which must be considered are the damping-off or bed-rot diseases, mosaic, wildfire, blackfire or angular leaf-spot, and frogeye.

The principles of control for all these diseases are essentially similar, since the organisms which cause them must either be destroyed or the chance of their introduction into the seed beds be eliminated. Experience has shown that if the plants are free from disease at the time of setting in the field, the crop will not become seriously damaged. If, however, the young plants are affected at the time of setting, only a most favorable season will prevent serious injury.

The measures following on page 320 are essential to the production of disease-free plants:

—*Courtesy Ga. Coastal Plain Exp. Station*

Blue Mold

Unsprayed check bed. Blue mold killed 84 per cent of plants. Only 1.7 acres set from 100 square yards.

Sprayed bed on same farm as above. Not one plant killed by blue mold, and an average of 7.3 acres set from each 100 square yards.

Producing Disease-Free Plants

(1) If possible, locate the seed-bed on new ground, or away from land on which tobacco was grown the previous year.

(2) Use seed from plants known to be disease-free. If one is not certain that they are disease-free, the seed should be treated. Either formaldehyde or bichloride of mercury may be used. The seed may be placed in a cloth bag for treatment; the solution may be put in a fruit jar. If formaldehyde is used, one tablespoonful is used with a pint of water; if bichloride of mercury, or corrosive sublimate, as it is commonly called, is selected, it should be used one part to 1,000 parts of water. The seed should be soaked for ten minutes in the disinfecting solution. Then they should be washed thoroughly in several changes of water and immediately and thoroughly dried. In order to avoid injury to germination, *the seed must not be treated more than ten minutes.*

(3) Use new bed-covers. If old ones are used, they must be boiled for at least ten minutes.

(4) Use planks or poles that have never been used on tobacco beds before.

(5) Trash from tobacco barns and stripping sheds should not be used as fertilizer on plant beds.

(6) Persons caring for the plants should not go near diseased beds.

(7) Do not seed too thickly. Water the bed well occasionally, but not too often.

(8) Inspect the bed at intervals for diseased plants. If any are found, they should be removed and the area soaked with formaldehyde—one part to 25 parts of water.

Diseases, including those of the plant-bed, will be considered in Chapter 27.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Why does the plant-bed occupy such an important place in the production of a good crop of tobacco?
2. What is the best location for the plant-bed? Why?
3. Why should the bed be burned?
4. How should the bed be burned?
5. Why is it advisable not to use a bed more than once?
6. Under what conditions may beds be used more than once?
7. How much and what kind of fertilizer should be used on the beds?
8. What may be said about using manure on plant-beds?
9. How is the soil of the bed prepared?
10. At what time and in what manner should nitrate of soda be used?
11. How many seeds are required for each 100 square yards?
12. What size plant-bed is required to plant five acres?
13. How should the seed be sown? How should they be covered?
14. What should be done immediately after seeding the bed?
15. What are the advantages of covering the bed?
16. Where do most of the diseases of tobacco originate? What are they?
17. How are the seed treated for disease?
18. Why should new seed-bed covers be used each year?
19. How should tobacco beds be watered?
20. What should be done in the event that diseased plants are found in the bed?

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Farmers' Bulletins
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1629—*Steam Sterilization of Soil for Tobacco*
State Publications
Georgia—Bulletin 359—*Bright Tobacco Culture in Georgia*
Kentucky—Ext. Circular 77—*Management of Tobacco Plant Beds*

North Carolina—Ext. Folder 8—*Tobacco Plant Beds*
South Carolina—Bulletin 118—*Growing Good Tobacco*

Suggested Activities

1. Visit a farm near the school and select a site for a tobacco plant-bed. Write a report on why the particular site was selected.
2. Mix seed to be sown with a suitable sowing material. Use the preparation in sowing a bed.
3. If possible, bring seed to school to be treated as recommended in the text.
4. Prepare a bed for seeding near the school. Plant one part of the bed with treated seed, and the other with untreated seed. Note the difference, if any. Care for the bed as directed and make notes on the observations.

Chapter 26

TOBACCO
TRANSPLANTING AND CULTIVATING

E. L. BOTELER

A WELL prepared seed-bed is necessary in order to give the plants a quick start after setting. Like the preparation of soil for the planting of any other crop, this preparation requires thorough breaking and harrowing until the soil becomes fine. Different types of soils vary as to the kind of plows and harrows best suited to insure thorough preparation. The heavy soils should be harrowed with a disk after plowing, while on the lighter and very sandy soils a drag or smoothing harrow will be satisfactory.

Fall plowing on clean land should not be practiced where there is a great loss by leaching. It is an advantage, however, to break heavy soil in the fall in order to allow freezing, thus making it loose and more friable in the spring.

If land is broken in the early spring, it should be harrowed after rains to keep it from crusting. Land sown in rye and other crops should be broken early. Weeds should not be allowed to grow after the land is first broken.

Preparing the Rows.—The rows should be run off a few days before time to set the plants. A good method for small fields is to lay off with a bull-tongue single shovel plow.

Unless placed in bands, the fertilizer applied in the row should be incorporated with the soil. This may be done by going along the row with a double or single shovel plow or other suitable implement, and then bedding the rows by turning two furrows together. The four-furrow bed is used in some sections on the theory that the wide bed holds the moisture more efficiently.

Light soils should be put in final shape for planting by dragging down and slightly packing the ridge. It is a popular practice to drag off the beds with an acme or light spike-tooth harrow. This knocks down the bed, and at the same time pulverizes the top soil, and helps kill grass and weed seeds that may have started to germinate.

SETTING THE TOBACCO PLANTS

Transplanting.—Every possible effort should be made to get the crop transplanted early. Early planting permits the crop to mature before the late summer rains which may start a second growth in late tobacco. It also insures ample rain for growth in the early summer and reduces the possible damage from insects.

Before pulling the plants, the bed should be watered thoroughly. This makes it easier to remove the plants and reduces the damage that otherwise might result from root injury. Plants of uniform size should be used. The roots should be mulched, as otherwise they would be damaged from the sun and wind.

In the flue-cured region the greater portion of the crop is transplanted by hand. A peg is used for making the poles and pressing the soil back into contact with the roots of the young plants. When the application of water is necessary or advisable, a hand planter may be used that gives excellent results. The two-horse machine setter is used to a limited extent and it is quite satisfactory. The cost of hand and machine setting is about the same; the advantage of machine-setting is that the transplanting may be done when the plants are ready, rather than having to wait for a satisfactory season. This, of course, saves time.

In three to five days after the field is set, it should be gone over again to replant where necessary to secure a perfect stand.

Cultivating.—In order to encourage a quick start in growing, a good cultivation and hand hoeing should be given the newly set tobacco as soon as it becomes established. A little fresh earth should be drawn about each plant, but care should be taken not to loosen the newly established roots.

In cultivating tobacco it is necessary at all times to provide drainage. Work the soil to the plants at every cultivation and keep a good deep furrow open in the middle of the row in order that the air may circulate through the soil and provide the necessary food for the plants' growth. Tobacco roots cannot live without air, and when the soil is saturated with water for even a day or two, the air is cut off from the roots and they die. New roots must then develop before the plant can mature, and it is then that a second growth begins. If this should occur after the tobacco is topped, a dark colored diseased leaf is very likely to be the result.

Late cultivation is objectionable. Tobacco should be "laid by" at least a week before it is topped. The last cultivation should be given with a view of giving the plants ample drainage to take care of any rains that might come.

Poor cultivation or improper cultivation that will cause the plant to continue its growth too long, or cause second growth after the bottom leaves have been taken off, is probably responsible for more dark tobacco in the Eastern Tobacco Belt than any other one thing.

TOBACCO MAY BE THE SOUTH'S MOST TEMPERMENTAL CROP, BUT CONTOUR CULTIVATION ON THIS FIELD IS HELPING TO CHECK SOIL EROSION AND AT THE SAME TIME PROVIDING ADEQUATE DRAINAGE FOR THE TOBACCO PLANTS

Topping and Suckering.—If tobacco is fertilized properly and cultivated in the right manner, it should be topped so that the top leaves will develop to nearly the size of the middle leaves. It is safer to top too high rather than too low. When the tobacco is grown in dry weather or moderately good seasons, it is always advisable to top higher than when it has grown well under favorable weather conditions.

The Oxford Tobacco Station of North Carolina has found that too much nitrogen either from too rich a soil or from fertilizer tends to darken the color of tobacco. Topping low, throwing too much growth into a given number of leaves, causes the leaves to thicken, and thereby causes a darker color in the cured leaf.

Soon after the plants are topped, suckers will begin to grow from the axils of the leaves. The first suckers will appear at the top of the plant, and appear lower as the upper ones are broken off. Two full sets of suckers will usually grow on a plant; it will be necessary to go over the field five or six times at intervals of about one week in order to get them all. The whole object of topping will be defeated if these suckers are allowed to grow; generally they should not be permitted to get more than four inches long before they are removed. Sometimes, however, when a period of wet weather comes just as the tobacco should be getting ripe, it may be an advantage to let the suckers remain temporarily, as their growth will tend to prevent the leaves from taking on a second growth, which would make them coarse and dark.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Is there any difference in the method of preparing a heavy and a light soil? If so, what?
2. What advantage is claimed for the wide bed over the narrow bed?
3. Why should the beds be dragged down before transplanting?
4. What is the advantage of machine-setting over hand-setting?
5. Why set plants of uniform size?
6. How soon after being set should tobacco be cultivated?
7. Why should one leave a furrow between the rows?
8. What is the effect of second growth on tobacco?
9. How may cultivation cause a second growth in tobacco?
10. What effect will poor drainage have on the quality of tobacco?

11. Would you cultivate tobacco up until the time for harvesting?
12. What effect will low topping have upon the quality of the leaf?
13. What is the object sought in topping tobacco?
14. Is it ever advisable to allow suckers to grow? Explain.

Selected References

Virginia—Bulletin 197—*Growing and Curing Sun-Cured Tobacco.*

Suggested Activities

1. Make a field trip to study methods of preparing the field for planting. Record the information obtained under the headings: (1) Implements used, (2) Distance of rows apart, (3) Methods of ridging and dragging down. On the blank outline leave space for recording at the proper time—Method of setting, method of watering, treatment of plants before setting, and other data of importance.
2. If possible, arrange for a school test plat on which data may be secured as to proper spacing and the best practices with respect to topping and suckering.

Chapter 27

TOBACCO
CONTROLLING INSECTS AND DISEASES

JOE M. CHAMBLEE

INSECTS and diseases of tobacco cost the growers millions of dollars annually. Seasonal conditions from year to year have a great influence on the extent of the damage. Various preventative and sanitary measures are helpful in reducing these losses and, for the most part, these measures are practical and inexpensive when the value of the crop is considered.

The insects which do the most damage to the tobacco crop include: tobacco flea-beetles, budworms, cutworms, hornworms, grasshoppers, and male crickets.

Tobacco Flea Beetles.—Tobacco flea-beetles are the worst enemies of tobacco in the early spring. They live over the winter under leaves and trash, in the woods, along ditch banks, or around old tobacco fields. As soon as the days warm up in the spring, they crawl out from under the leaves and go to the tobacco beds. Here they do a great amount of damage by eating the buds of the young plants, or by eating holes in the leaves. Tobacco growers are familiar with the damage but they often blame it on the small "manure-flies" which breed in the decaying manure of the beds. An examination of the mouth of the fly will show, however, that it cannot damage the tobacco plants.

The damage done by flea-beetles to young plants in the bed may be reduced by the use of tight-fitting, fine mesh cheesecloth covers. This, however, when used alone will not prevent damage. A dusting material highly recommended is cube or derris dust with one per cent of rotenone. This mixture is dusted on the bed with a hand duster at the rate of one-half pound per 100 square yards of bed. The application should be repeated every four or five days until control is obtained. It is not essential that the plant-bed cover be removed when the application is made.

Hornworms.—Hornworms are a very familiar object to tobacco growers, and, in general, their life histories are well known. Most tobacco growers recognize the large, strong-flying, narrow-winged "candle-flies" as the insect which lays the small, light green, spherical eggs on the underside of the leaves, and as a rule, they know that these eggs hatch into hornworms, which change to brown "pitchers" and issue later as "candle-flies."

Growers know, too, about the damage the insect does in eating the leaves, first on the under side and then in view from the top.

Hornworms are subject to attack by various enemies. Chief among these is a bacterial disease which causes the worm to turn black and die. Another is the small, four-winged parasitic fly, which lays its eggs upon the hornworm. The larvae of the parasite live in the hornworm until full grown. They then emerge and spin white oval cocoons. Hornworms covered with these cocoons are frequently seen in the tobacco fields. Such hornworms should not be destroyed, as their days for doing damage are practically over, and the parasites issuing from them would mean the destruction of an increasing number of hornworms in the next generation.

Many growers rely largely upon turkeys and guineas to reduce the crop of hornworms.

Hand picking or worming is still the favorite method in most sections for destroying these worms. When very numerous, a mixture of Paris green and lime—1 part to 6 by weight—may be applied with a rotary duster at the rate of five to seven pounds per acre, depending upon the size of the plants.

PREPARING THE TOBACCO FOR MARKET

Fall plowing will reduce the number of these pests that live over the winter.

Budworms.—Two distinctly different insects are confused under the name budworm—the cotton bollworm or false budworm of tobacco, and the true tobacco budworm. The former is a common pest of corn, cotton, and tomatoes, and the latter, while not generally so common, is by far the more destructive to tobacco.

Both injure tobacco by working in the bud.

The worms may be picked off, or a pinch of poison may be placed in each bud once each week. The poison is made by mixing, in the dry state, one pound of lead arsenate with seventy-five pounds of corn meal.

Cutworms.—No form of insect injury is more familiar to growers of tobacco plants than that caused by cutworms. Damage from this insect may occur in the plant-bed or in the field. In many instances cutworms make it difficult to get a good stand, especially where vegetative matter has been turned under. The chief method of control is the application of Paris green mixed with fifty pounds of wheat bran. Enough water is added to moisten the mixture.

When applied to the bed, the mixture is broadcast at the rate of four pounds (dry weight) per 100 square yards of the bed. The cover must be removed.

When applied in the field, the mixture is more effective if only twenty-five pounds of wheat bran are used with one pound of Paris green. Also, sirup should be used in mixing. This mixture is scattered over the field, or spread along the rows a day or two before the plants are set. Livestock and poultry must be kept away from such fields because this mixture is very poisonous.

Grasshoppers.—Grasshoppers sometimes appear on the young tender plants soon after they are set in the field. They seldom do great damage. A poison bait composed of wheat bran—50 pounds, Paris green—2½ pounds, cheap sirup—3 quarts, and water—6 gallons, is recommended. This should be applied between the rows at the rate of about 20 pounds per acre.

Mole-Crickets.—This insect sometimes causes losses on plants in beds. A poisoned bait made of cottonseed meal—5 pounds, rice flour—5 pounds, calcium arsenate—½ pound, and molasses—2 quarts may be applied, within 48 hours after mixing, at the rate of three to four pounds per 100 square yards. Care should be exercised not to allow the bait to hit the young plants.

It should be scattered around the edges of the bed, and where the stand is sparse or missing. Two or more applications may be required.

DISEASES

The most important diseases of tobacco are: blue-mold, root-knot, mosaic, tobacco-wilt, and angular leaf-spot.

Blue-mold.—This is a new disease compared with the others listed. It is confined to the plant bed and may cause the complete loss of all plants. It is caused by a fungous organism that produces many spores; consequently, it spreads very rapidly. Sanitary measures are of extreme importance in combatting this disease. The following list of measures are advocated by the Tobacco Research Committee:

SUGGESTIONS FOR THE CONTROL OF BLUE-MOLD

(1) Locate beds on new sites and some distance from old beds. If necessary to use an old bed, it should be thoroughly burned or steamed. Select a warm sunny place for the bed, where it will not be shaded during any part of the day.

(2) Destroy any hold-over plants before seedlings appear in the new bed. Also prevent growth of volunteer seedlings in the old beds.

(3) Sow more bed space than is needed for the crop. Two or three beds are better than one large one.

(4) Sow beds early, but in Georgia not before the middle of December.

(5) A moderate stand is better than a thick stand.

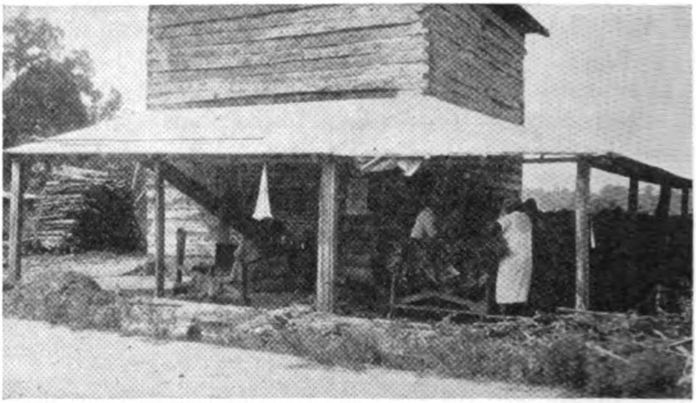
(6) Remove covers during the day as soon as the weather will permit, to admit sunlight and air.

(7) If necessary to increase rate of growth of plants, water and add nitrate of soda as recommended by your experiment station.

(8) If possible transplant ahead of disease attack. Do not set diseased plants until they have recovered.

(9) If necessary, use the chemical methods of control or prevention outlined below.

A spray has been developed which is effective in controlling blue-mold, if properly applied. It is made of ½ pound of red copper oxide, 1 quart of lethane spreader, ½ gallon of cottonseed oil, and 50 gallons of water. A good sprayer is essential in applying this mixture.



A SCENE DURING TOBACCO HARVESTING TIME

A barrel sprayer is preferred. The material should be applied in a fine mist. For each application use 2½ to 3 gallons of mixture per 100 square yards of plant bed. The first application should be made before the mold appears, and be continued with two applications per week until the plants are set in the field. The cost of spraying 100 square yards of bed during a normal season is between three and four dollars. It should be understood that this is a preventative measure and not a control of the disease.

Root-knot.—Root-knot is perhaps the most widespread plant disease in the Southern States. It causes greater damage to the tobacco crop than is generally realized. It is caused by nematode, a small eelworm barely visible to the naked eye. The damage to the crops is brought about through interference with the normal root functions.

The control of this disease consists in the rotation of crops. Only crops that are immune should be included in tobacco rotations.

Mosaic.—This disease is known to the growers of tobacco by many names including: French, Walloon, calico, and top burning. It is caused by a virus which remains active in cured tobacco and is carried over winter in the roots of tobacco plants which remain alive.

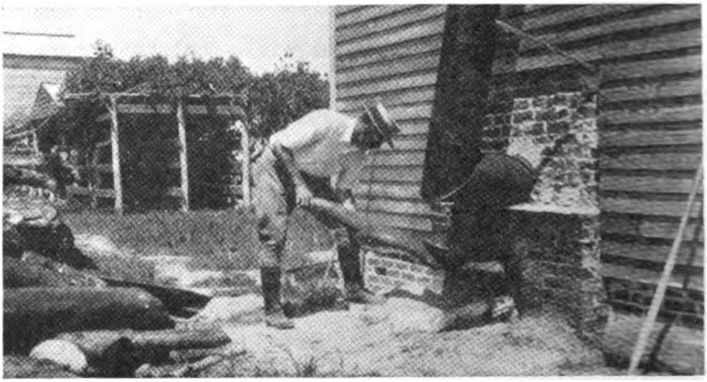
The chief source of tobacco mosaic infection is from the hands of the laborers which have become contaminated by handling cured tobacco commonly used for chewing or smoking purposes. If the virus is on the hands it may be transmitted to an occasional plant while weeding a bed, or it may be transmitted to plants while pulling or setting. The disease spreads rapidly in the field.

The disease is easily prevented if those working with the plants and in the field will be sure to rid themselves of all sources of infection. This precaution consists of washing the hands, wearing freshly-laundered clothes, and refraining from the use of tobacco while at work.

Where fields are heavily infested with mosaic, they should be disced and seeded to a winter cover crop. Infested plants should be removed from the field.

Tobacco-wilt.—This disease was first found in Granville County, North Carolina. It is commonly called Granville-wilt. Where prevalent, it is one of the most serious tobacco diseases. It is caused by a soil-inhabitating organism.

Plants are first infected through the roots from infested soil. The wilting of plants, two to three weeks after transplanting, is evidence of the disease. To determine whether the trouble is due to wilt, cut one of the stalks from a wilted plant; if the trouble is tobacco-wilt the woody portion of the stem will be discolored and



FIRING THE TOBACCO BARN

dark. The disease kills the plant by stopping the water-carrying tissue, thus starving the plant to death.

After wilt is once found, crops that are affected by the organism should not be grown on the land. Four or five years may be required to free the land from the organism. Among the plants affected by the wilt germ are tomatoes, peppers, eggplants, velvet beans, garden beans, and peanuts, as well as ragweed and jimson weed. Crop rotations, using immune crops, present the only method of combatting the tobacco wilt.

Angular Leaf-spot.—Angular leaf-spot and wildfire are controlled through the application of the sanitary measures recommended for the treatment of seed and the growing of plants. These measures are also important in the control of other minor diseases and in the production of quality tobacco.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Where do tobacco flea-beetles live during the winter?
2. At what time of year can one best control this insect? Why is it so important to protect the young plants against this pest?
3. What methods should one use to control the hornworm?
4. Describe the injury done plants by this pest.
5. How is the budworm controlled? What are the two kinds of budworm? What other crops do they damage?
6. What is the most effective control for cutworms? Do they damage crops other than tobacco?
7. How are grasshoppers controlled? What care should be exercised?
8. Where do mole-crickets do damage? How are they controlled?
9. What are the most important tobacco diseases? How many can you identify?
10. What is the most serious plant-bed disease? What measures should be used as preventatives? What is the control?
11. Give an effective control for root-knot.
12. What disease is spread by handling tobacco? How is it controlled?
13. Where was tobacco-wilt first found? Is this disease serious?
14. How is wilt controlled? What other crops does the wilt organism attack?
15. Where do most tobacco diseases originate?

Selected References

U. S. Department of Agriculture, Washington, D. C.
Farmers' Bulletins
867—*Horn Worms*
1352—*Flea Beetle*
1494—*Tobacco Cutworms and Their Control*
1489—*The Green June Beetle in Tobacco Plant Beds*
1531—*The Tobacco Budworm and Its Control*
Circulars
263—*Downy Mildew of Tobacco*

Department Bulletins
562—*The Control of Tobacco Wilt in the Flue-Cured Districts*
1256—*Tobacco Diseases and Their Control*
1410—*The Brown Root Rot of Tobacco and Other Plants*

Suggested Activities

1. Make a field trip to study tobacco insect pests. Collect specimens for the laboratory. Prepare a table for your notebook in which will be recorded: (1) The insects attacking tobacco, (2) the nature of the injury done, and (3) the methods of control.
2. If it is possible to have a plant-bed for the use of the school, carry out all the sanitary control measures and also the spray for blue-mold. If possible, have a check-bed on which these measures are not carried out. Arrange a check on your blue-mold control plan.

Chapter 28

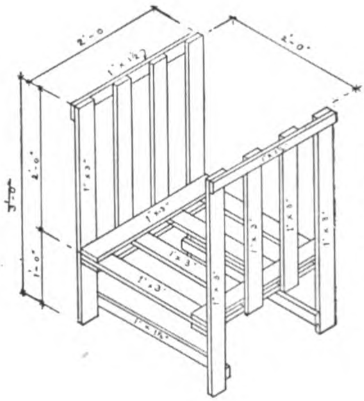
TOBACCO
HARVESTING, CURING, AND MARKETING

P. M. MUNGLE

THE two methods of harvesting are (1) cutting the entire plant, and (2) priming.

When the tobacco is to be harvested by cutting the entire plant, the general condition of the whole plant must be considered. The top leaves should be allowed to get as ripe as possible without much loss at the bottom of the plant. As a general rule, a plant will ripen in from 90 to 100 days after transplanting and from 35 or 40 days after topping. The time, however, is subject to great variation, depending upon seasonal variations and the character of the leaf desired. A heavy, thick leaf, as is desired for open fire-cured tobacco and cigar fillers, should not be harvested before thoroughly ripe. Tobacco for wrappers and binders should be harvested a little green, since a smooth leaf with much elasticity is desired for these purposes. Harvesting while green tends to give a leaf these qualities. The white Burley should also be harvested early in order to produce a lighter color and smoother leaf. Cutting while green tends to reduce the yield, but the loss in weight is more than made up in the higher price paid for the finer product.

A ripe tobacco leaf will break when folded between the fingers. Color is another indication of the degree of ripeness. The cigar tobaccos and dark varieties grown in central Virginia and Kentucky show a slight

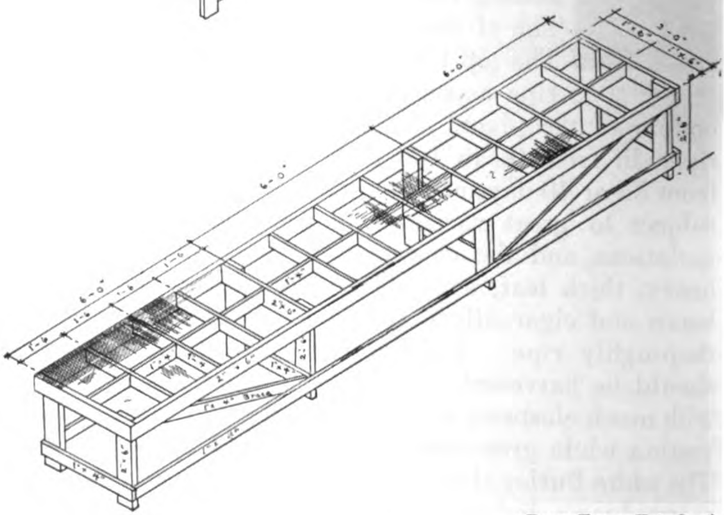


Tobacco Rack

(Scale 1 in. equals 1 ft.)

Several racks of this size will make the handling of tobacco easy. It requires only one man to handle and also provides system in grading. The lumber used should be dressed or sized. This prevents tearing or damage to the tobacco.

—From Tenn. Ext. Service



—From Tenn. Ext. Service

Tobacco Sorting Table

This table may be built in any length desired by building the required number of six-foot sections. The table is covered with wire mesh. The advantage of this material is that all trash or dirt can drop through, keeping the table top and tobacco clean.

yellowing of the leaves in spots when they are ripe, giving them a mottled appearance. Tobacco grown in the flue-cured districts changes to a golden yellow when ripe, while the white Burley changes to a lighter green and later to a pale yellow or cream.

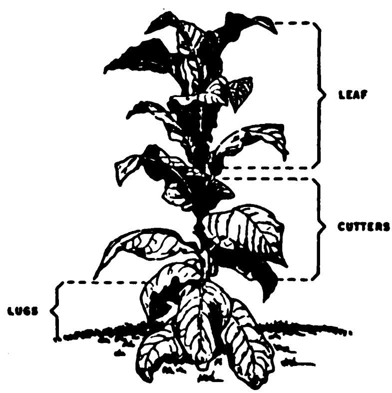
Scene in an Auction Tobacco Selling Warehouse

Priming is a method of harvesting by picking the leaves off the plant, beginning at the bottom as they ripen. It usually takes five or six pickings to complete the harvest. Harvesting by priming results in greater profits per acre, according to experiments conducted by the Tobacco Experiment Station Test Farm, Oxford, North Carolina.

The additional cost of picking, stringing, and hanging the leaves in the barn is offset by the saving in fuel in curing and in the space required in the barn and in the pack-house. It is estimated that one barn 18 by 18 feet will take care of five acres of tobacco when primed, but only three or four acres when cut.

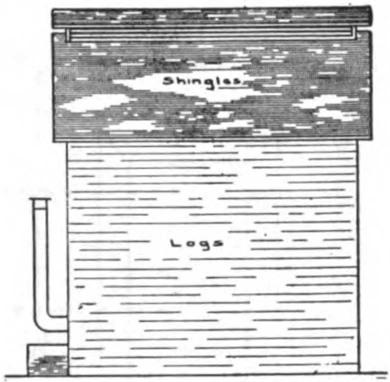
Most flue-cured tobacco is harvested by priming.

Curing.—The object in curing tobacco is to produce given textures and colors in the leaf by removing moisture from the leaf and stem. The particular method of accomplishing this object will depend upon the use to be made of the tobacco when cured. For instance, some cigar markets demand a tobacco of a certain color, texture, and aroma that is best developed by the open fire method of curing. Some manufacturers of chewing tobacco demand a tobacco of heavy texture and dark color that is best developed by the sun cure method. The cigarette trade wants a tobacco of light texture and yellow color which is best developed by the flue-cure method. Thus, the curing problem resolves itself into three methods, namely: flue-curing, sun or air curing, and fire curing. The two principal factors in each of these methods are temperature and humidity, and these three methods of curing are only three different ways to control these factors in such a manner as to produce the different grades.



Flue-Curing.—Barns especially adapted to flue-curing may be seen in all parts of the Tobacco Belt where this method is used. The plans for these barns, together with a bill of material may be secured from your experiment station or from the state extension service.

The procedure to be followed in curing tobacco in this way naturally depends upon a number of factors, the most important of which are: (1) the ripeness of the tobacco, (2) seasonable conditions under which the crop was grown, (3) atmospheric conditions within and without the curing barn, (4) variety of tobacco, and (5) the part of the plant from which the leaves were pulled. With so many factors involved, it will be seen that no fixed set of rules can be given which will apply to all conditions.

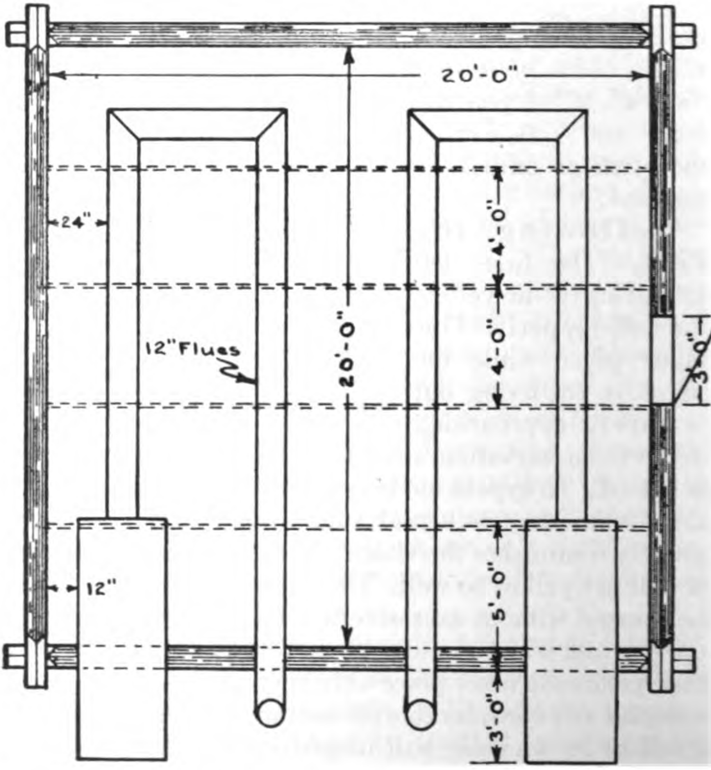


TOBACCO BARN · SIDE ELEVATION
SCALE ¼" EQUALS 1'·0"

The flue-curing process is divided into three stages, (1) yellowing the leaf, (2) drying the leaf, and (3) drying the stem or midrib of the leaf.

Yellowing the Leaf.—The first step in curing is to yellow the leaf properly. This takes place while the plant is yet living but is slowly approaching death from starvation, since the food and moisture supply is cut off. To expose too long to the sun and air after cutting, even though actual sunburning does not result, greatly diminishes the vitality of the leaf and as a result it will not yellow so well. The tobacco should, therefore, be housed without excessive wilting or long exposure to the sun and wind. As soon as the leaf is dead or dry, further yellowing takes place only very slowly, and, if there remains any considerable amount of moisture in the leaf, a red or brown color will immediately begin to develop.

In curing, one should keep well in mind the principle that it is necessary to preserve the life (cell activity) and at least some of the moisture while the leaf is yellowing, and so manage as to have the moisture exhausted by the time it is completely yellow, or rather a little before it is fully yellow as the most satisfactory cures and the clearest colors generally follow when the leaf is dried out with some green remaining in it. Tobacco yellows best, especially in the first stages, when the temperature of the barn ranges from about 80 to 100 degrees, but it

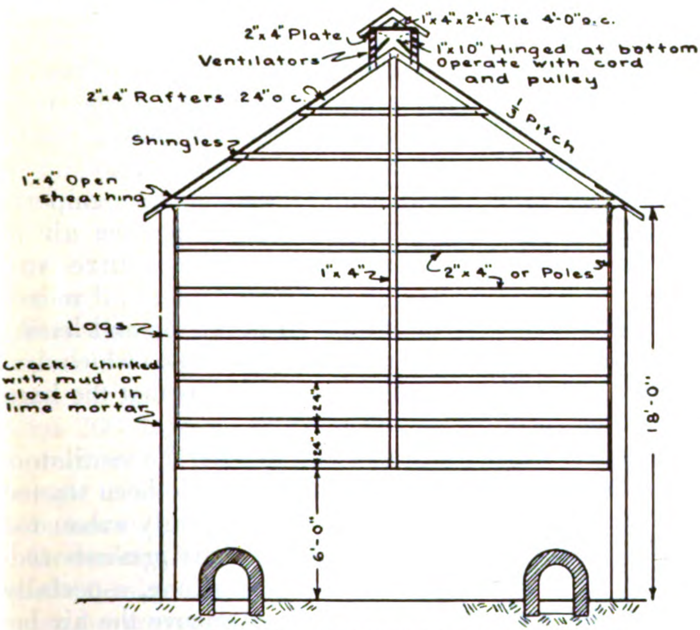


TOBACCO BARN · FLOOR PLAN

SCALE 1/4" EQUALS 1'-0"

will continue to yellow in the later stages up to 115 or or 120 degrees.

As the yellowing proceeds, it is well, toward the later stages, to increase the heat slowly toward these higher temperatures and to begin to dry a little, on the yellowest leaves, by admitting a little extra ventilation.

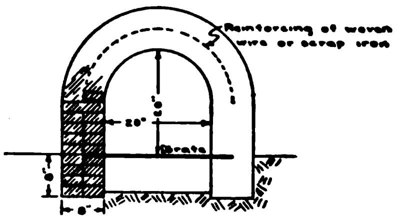


TOBACCO BARN • SECTION

SCALE 1/4" EQUALS 1'-0"

In order to obtain the best results in yellowing under the varied conditions, it is best to have the barn very tight, so that in the earlier stages the desired temperatures may be obtained without exhausting the moisture too rapidly. As the process advances, it is necessary that the moisture be removed gradually at first and more rapidly later. To accomplish this, it is highly desirable that the barn be so arranged as to be fully and freshly ventilated. This will make it possible to remove steadily the warm, moisture-laden air as it becomes saturated.

Drying the Leaf.—In drying out an ordinary barn holding 500 sticks of cut tobacco, about 4,000 pounds of moisture (water) must be removed. The movement of the air through ventilation is the only means of getting rid of this moisture.



TOBACCO BARN·FURNACE
SCALE ¼" EQUALS 1'0"

Raising the temperature permits the air to absorb moisture and creates a draft, if means are afforded for letting out the air at the top and letting it in at the bottom. This is the principle upon which drying proceeds; it is to achieve these results that the barn is constructed.

Generally it will be found best to open the ventilators and raise the heat soon after the fires have been started in order that the moisture may be sufficiently exhausted by the time the tobacco is yellow. This prevents reddening. The draft should not be too strong, especially at first, but it should be sufficient to remove the air before, or at least by the time, it becomes saturated.

In light-bodied tobacco, as grown on the lighter soil types, the yellowing process will take about 36 to 48 hours. If the tobacco is very heavy and dark it may be necessary to consume three or four days in the yellowing process.

When the yellowing of the leaf is completed, during the latter stages of which the temperature has been maintained at from 110 to 120 degrees, move up the temperature quite rapidly, say at the rate of two and one-half degrees per hour, to 130 or 135 degrees. Hold the heat at this point until the leaf itself is entirely dry, or at least until those leaves on the bottom poles are entirely dry. Higher temperatures are not safe before the leaf is dry as they will result in a blackish discoloration known as scalding.

Drying the Midrib.—When the leaf is dry throughout the barn, the ventilators may be partially or wholly closed to save fuel, and the heat gradually moved up at the rate of about five degrees per hour to about 175 degrees for the light bright types. The heat is maintained at this point until all the stems and midribs are completely killed and dried out. The cure is finished before handing it in the barn or shed.

Scorching.—Tobacco will tend to redden at a temperature of 180 degrees or above. In the filler districts, the stems and stalks are commonly killed out at about 200 degrees, or even, during the last few hours, as much as 225 degrees. These higher temperatures are thought to sweeten the leaf, and a reddish, rich-looking face, known as *scorching*, is imparted.

Ordering After Curing.—Except in cool, very dry weather, tobacco will generally come into order so that it can be removed from the curing barn on the second morning after the cure is finished. All the doors and ventilators should be opened at night to let the moist air in. The web of the leaf will generally become fairly soft the first night. The next day the barn should be closed if the weather is dry in order to hold the moisture. At night the barn should again be opened. On the second day the tobacco may be removed and bulked or rehung in the storage or packing house.

Fire Curing.—This method of curing is confined to those sections that grow export types. The barns are large; in fact, it is possible to drive a loaded wagon through the barn under the tier poles. After being filled, the ventilators are left open for several days, after which fires are started on the floor. Temperatures of about 90 degrees are maintained until the yellowing process is finished and then they are raised to about 130 or 140 and held there until the tobacco is thoroughly dried out. This may require four or five days from the time the fires are started.

Air Curing.—Barns for air curing should be provided with ventilating doors along the sides and ends, and also in the roof. In addition to the barn, it is advisable to have a large open curing shed attached to the south side with openings from the shed into the barn. It is a good practice to scaffold the tobacco in the open air for a few days. After the stalks have been killed and the curing well started, it should then be hung in the shed until the cure is complete, after which it should be carried into the barn and hung until it is ready to strip.

Marketing the Crop.—In preparing tobacco for market, the following steps are necessary and important: (1) Ordering and grading, (2) tying into hands, (3) hanging hands on sticks, (4) conditioning for market, and (5) packing for delivery to market.

Ordering and Grading.—After tobacco has been cured and just prior to grading, it should be brought to a soft pliable condition by hanging it in an open shed during a warm moist day or by hanging in a damp cellar or steam room. It should be graded leaf by leaf, according to quality, color, and other factors.

Tying Into Hands.—After the tobacco has been graded, or assorted into lots, it should be tied into hands of from five to thirty leaves. The hands are tied with a leaf, which is folded for this purpose by turning both edges backward and inward. The leaf thus folded is given a couple of turns tightly around and partially or completely covering the butts of the leaves forming the hand or bundle, beginning with the tip of the leaf. The butt end of the tie is tucked through the hand between the leaves so as to wedge and hold the tie-leaf in place.

Hanging Hands.—When tied, the hands or bundles should be hung on laths or sticks to facilitate handling.

Conditioning for Market.—Several days before it is carried to market, the tobacco should be brought into order by tying and bulking down with butt ends out in the pack room.

Packing for Delivery.—When ready to deliver to the market, the tobacco should be taken from the sticks and bulked down with the butt ends out on the wagon or truck. It should be covered to prevent drying.

Time to Market.—If sold on the auction market, a congested market should be avoided if possible. If sold through a cooperative association, no thought need be given this matter.

Flue-cured tobacco is sold by the auction system. Warehouses are operated in all production centers. When tobacco is put on the warehouse floor for sale it is removed from the sticks and placed on baskets according to grade and color. It is weighed and tagged and placed on the floor for sale. When the sale starts, the buyers follow the auctioneer and bid on such lots as interest them. The highest bidder buys the lot. The warehouse charges the amount of the sale to the buyer and issues a bill and check to the grower.

Government Grading.—Government inspection of tobacco according to grades began in 1929. Government graders are located in certain markets and grade

CLASSIFICATION OF TOBACCO, TYPES 11, 12, 13, 14

- **Class 1 Flue-Cured**
  - **Types**
    - 11 (a) Old Belt N.C. and Va.
    - 11 (b) Middle Belt N.C. and Va.
    - 12 New Belt. N.C.
    - 13 S.C. and Southeastern N.C.
    - 14 Ga. and Fla.
  - **Groups**
    - **Wrappers (A-Group)**
      - Qualities: 1-Choice; 2-Fine; 3-Good
      - Colors: L-Lemon; F-Orange; R-Red or Mahogany
      - Special Factors: T-Short Wrappers (3rd Quality); U-Unsound; W-Doubtful Keeping Order
    - **Leaf (B-Group)**
      - Qualities: 1-Choice; 2-Fine; 3-Good; 4-Fair; 5-Low; 6-Common
      - Colors: L-Lemon; O-Orange; R-Red or Mahogany; D-Dark Red or Walnut; G-Green
      - Special Factors: K-Variegated; M-Mixed; T-Tips; V-Greenish Tinged; U-Unsound; W-Doubtful Keeping Order
      - Sub-Group (H-Smoking Leaf)
        - Qualities: 1-Choice; 2-Fine; 3-Good; 4-Fair; 5-Low; 6-Common
        - Colors: F-Orange; R-Red or Mahogany
    - **Cutters (C-Group)**
      - Qualities: 1-Choice; 2-Fine; 3-Good; 4-Fair; 5-Low
      - Colors: L-Lemon; F-Orange
      - Special Factors: K-Variegated; M-Mixed; V-Greenish Tinged; U-Unsound; W-Doubtful Keeping Order
    - **Lugs (X-Group)**
      - Qualities: 1-Choice; 2-Fine; 3-Good; 4-Fair; 5-Low
      - Colors: L-Lemon; F-Orange; R-Red or Mahogany; G-Green
      - Special Factors: K-Variegated; M-Mixed; V-Greenish Tinged; U-Unsound; W-Doubtful Keeping Order
      - Sub-Group (P-Priming Lugs)
        - Qualities: 1-Choice; 2-Fine; 3-Good; 4-Fair; 5-Low
        - Colors: L-Lemon; F-Orange; G-Green
    - Nondescript
    - Scrap

U. S. Department of Agriculture — *Bureau of Agricultural Economics* all the tobacco sold. The service is free to the grower and warehouseman under the authority of the Tobacco Inspection Act. The object of this service is to enable the grower to know the value of the product that he has produced in terms of current market prices.

All tobacco is usually thought of in terms of leaf. However, where tobacco is grown under different climatic and soil conditions, and where different methods of harvesting and curing are practiced, it takes on somewhat different characteristics. This makes it necessary to divide tobacco of like character into *classes.*

The various classes of tobacco are further divided into *types.* A type is a division of a class. Flue-cured tobacco is divided into the following types:

U. S. Type 11—Produced principally in the Piedmont Sections of Virginia and North Carolina.

U. S. Type 12—Produced principally in the Coastal Section of North Carolina.

U. S. Type 13—Produced principally in the Tidewater and Coastal Sections of South Carolina and in the southeastern counties of North Carolina.

U. S. Type 14—Produced principally in the southern section of Georgia, and extending into Florida and Alabama.

The next division breaks down a type into what is known as a group. The groups of tobacco are closely associated with the position in which the leaves grow on the plant (See illustration). The Federal system of classification by types is given in the chart appearing on page 350. It will be noted that there are four principal groups. Each group is represented by a letter symbol. The various groups are then divided into quality and color descriptions. This system enables the grader to describe a pile of tobacco in few words.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What are the two ways in which tobacco may be harvested? Which is the more desirable, in your opinion? Explain each.
2. What is the object sought in curing tobacco? What are the ways in which this may be done?
3. Why is one method not satisfactory for all tobacco?
4. What are the steps in curing bright tobacco?
5. What is meant by yellowing? How is it accomplished?
6. Tell how a tobacco barn is constructed and operated in the flue-cured region. In the fire-cured section.
7. What does it mean to bring tobacco to *order?*
8. What are the jobs in preparing tobacco for market?
9. Describe the method of tying.
10. How is tobacco sold?
11. What services does the warehouseman render the grower?
12. Outline briefly the structure of the Federal Grading System.
13. What is the difference between lugs and leaf tobacco?
14. What is meant by *type?* Which type do you grow?
15. What kinds of tobacco bring the highest prices on your market?

Selected References

U. S. Department of Agriculture, Washington, D. C.
Farmers' Bulletin 523—*Tobacco Curing*
Circular 249—*American Tobacco Types, Uses, and Markets*
Bureau of Agricultural Economics Publications—*Classification of Leaf Tobacco Covering Classes, Types, and Grades,* and *Rules and Regulations under the Tobacco Inspection Act*

Suggested Activities

1. Make a farm study in your community to determine the practices in harvesting, curing, and marketing tobacco. Prepare an outline for recording the data obtained by the class.
2. If possible, secure a record of the temperatures during a complete curing period. If this is not possible, then get the temperatures at such times as may be possible. Plot a curve

showing the results, giving the time and the temperature for each hour and day.

3. Make a study of the classes, types, and grades of tobacco in the classroom. If possible, visit a market when there is a Federal Grader present and ask for an explanation of the grades given.

Chapter 29

PEANUT PRODUCTION

ELGIE HAYES

THE peanut did not become of commercial importance as a farm crop in this country until after 1870, though it was introduced into the United States during the early days of colonization. As a money crop, peanuts are important in at least eight Southern States. There has been a total increase in production in the United States from about one-half billion pounds to almost a billion and a half pounds recently. The yield per acre for the average peanut is about 700 pounds, while the yield per acre for the large type peanuts grown in Virginia and North Carolina is about 1000 pounds.

Peanut production in the United States is divided into two major areas: the region of Virginia and North Carolina and the region of southeastern Georgia and southeastern Alabama. Peanuts are grown to a limited extent throughout the Southern States in addition to the two main areas mentioned.

The Virginia-Carolina region peanuts are grown largely for roasting and those of Georgia-Alabama are grown mainly for oil, peanut butter and stock feed.

Peanuts are used to a large extent for human food and as feed for livestock, including such things as cooking and salad oil, oleomargarine, peanut butter, and oil cake.

Only a small part of the peanut crop of the world is produced in America. There is a great amount of international trade in peanuts and peanut oil.

PEANUT PRODUCTION

Acreage in United States and Average Yield Per Acre
(A ten-year period)

Years	*United States*	*Average Yield, Pounds per Acre*		
		Virginia-North Carolina Region	*Georgia-Alabama Region*	*Texas*
1927	1,142,000	882	703	600
1928	1,211,000	989	550	650
1929	1,325,000	1025	600	420
1930	1,133,000	810	625	415
1931	1,419,000	1115	630	530
1932	1,607,000	1045	496	550
1933	1,361,000	950	578	620
Average	1,314,000	974	597	541

Selecting the Land.—The most satisfactory soils for peanuts are of a light, sandy type and well drained. Black soils are not recommended and deep sands, silts, and clays are not well-suited for this crop.

Growing Season.—Peanuts require a growing season of from 100 to 140 days with plenty of sunshine and a comparatively high temperature.

Rotations.—In order that the soil may be in good condition and that production may be economical, a rotation should be followed. Peanuts should not be grown on the same land more often than once in three years. In the rotation, a cover crop, preferably a legume, should be turned under in plenty of time to allow partial decomposition before planting the peanuts. A good rotation recommended by the Virginia Experiment Station is:

ROTATION NO. I

1st year—Peanuts.
2nd year—Cotton with crimson clover at the last cultivation.

3rd year—Corn with crimson clover at the last cultivation.
4th year—Soybeans with rye or crimson clover as a winter cover crop.

This rotation may be modified by planting soybeans with the corn crop. The winter cover crops may be turned under for green manure or may be grazed with hogs or cattle during the winter and early spring and the crop residue turned under.

Rotation No. II

1st year—Early potatoes, followed by cotton planted between crimson clover seeded at last cultivation.
2nd year—Corn and soybeans with crimson clover seeded at last cultivation.
3rd year—Peanuts.

Planting Seed.—Seed may either be saved or bought from some reliable grower. Seed for planting are shelled, except for the Spanish peanut which is planted in the hull.

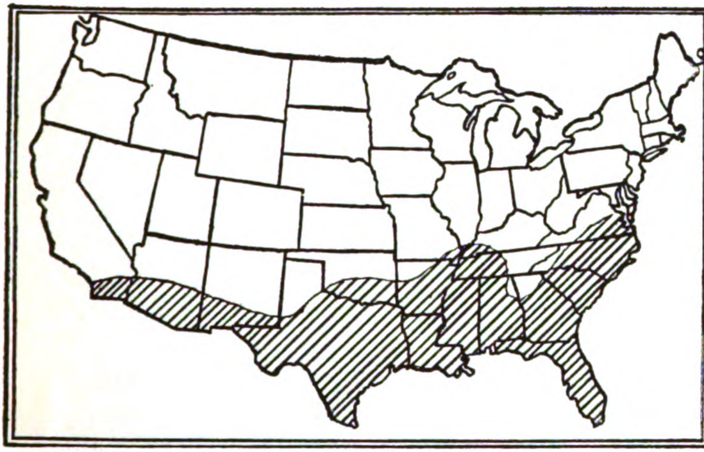
Varieties.—The varieties of peanuts may be divided into the runner and the bunch varieties or the large-podded and the small-podded groups. According to Bulletin 503 of the Texas Station some of the main varieties of these groups are:

Small-podded Varieties

"The Spanish variety is the most commonly grown variety in this country for the manufacture of oil and peanut butter. The stems have an upright growth and are somewhat coarse. The pods are small, containing as a rule two kernels, and form a dense cluster at the base of the plant. The covering of the kernels is of a light-brown color and the nuts fit tightly in the pod.

"The Macspan variety is a selection from the Spanish variety made by G. T. McNess of the Texas Agricultural

Experiment Station. It is similar in type and growth habit to the Spanish variety but is more erect in growth.



WHERE PEANUTS ARE GROWN

"The Virginia Bunch variety, also called Virginia Jumbo, is the main variety grown for commercial roasting. The nuts are large and usually contain two kernels to the pod. The vines are erect in growth and the pods are bunched around the base of the plant. The envelope covering the kernel is of a light-brown color and the nuts, as a rule, do not fit tightly in the pod. This variety does not have as good a flavor as the other varieties.

"The Valencia variety has an erect vine growth. The pods are not bunched around the base of the plant as closely as is the case with the Spanish variety, but are not so scattered as in the runner types. The envelope covering the kernel is deep red in color, which is considered objectionable for milling purposes. The pods contain, as a rule, two kernels but three are not uncommon. The kernels fit tightly in the shell and the flavor is excellent.

"The Tennessee Red variety is very similar to the Valencia variety with the exception that the pods contain two to five kernels. It also has a red envelope covering the seed and has an upright growth, but it is not

—*Courtesy Bureau of Plant Industry*

VIRGINIA BUNCH PEANUTS

This variety has an upright or bunch habit of growth and the pods are formed in a cluster around the base of the plant.

a vigorous grower at the station. The kernels fit tightly in the shell and the flavor is excellent.

"The Virginia Runner variety has pods similar to those of the Virginia Bunch variety, but are somewhat smaller in size. The pods usually contain two kernels, which do not fit tightly in the pod. The kernels are covered with a light-brown envelope. The flavor is poor.

This variety has a vigorous prostrate type of growth and the nuts are scattered along the vines.

—*Courtesy Bureau of Plant Industry*

SPANISH PEANUTS
Grown exclusively in the Gulf Coast Region.

"The Carolina Runner variety produces a nut that is similar in type and envelope color to that of the Spanish variety, but slightly larger. The vines have a prostrate type of growth and the nuts are scattered along the vines. This variety makes a very vigorous growth and produces high yields of both nuts and vines."

Fertilizer.—For peanuts grown on naturally fertile soils or when they follow crops that have been fertilized heavily, the amount of fertilizer need not be large. Also, the nitrogen may be left out. From 200 to 400 pounds per acre of fertilizer recommended for cotton usually gives satisfactory results with peanuts, if commercial fertilizer is required.

Lime.—Soils that have never been limed should have an application of 400 pounds of ground limestone or its equivalent per acre. When lime has not been applied to the soil, an application of 200 to 400 pounds of gypsum or landplaster on the foliage at blooming time, will im-

CULTIVATING PEANUTS

prove large-type peanuts. It is usually not profitable to use gypsum on Spanish peanuts.

Planting and Cultivating.—By planting on a ridge, better stands may be secured, the seed are less likely to rot, and the plants are cultivated more easily. On dry soil, and for late planting, the planting may be made on the level, with 36 inch rows. The hills should be twelve inches apart with two seed to the hill for runner varieties. For bunch varieties, 30 to 36 inch rows with hills eight inches apart are desirable.

From April 15 to the middle of July are the planting dates. About ninety days are required for the Spanish varieties to mature, while the large type varieties require about 120 days. Peanuts should not be planted until the weather is warm.

For the first cultivation, a weeder or light harrow should be used. Frequent cultivations should be given thereafter.

Harvesting.—Problems incident to harvesting peanuts involve: when to harvest, how to harvest, digging, curing, picking and cleaning, grading, and storing and caring for the hay.

Peanuts may be harvested by digging or by letting hogs run on the field. The value of peanut hay for feeding compares favorably with other leguminous hays.

North Carolina Extension Bulletin No. 281 suggests the following in regard to harvesting and picking:

(a) Dig when peanuts are well matured, but do not delay digging until they begin to shed badly.

(b) The ground should be fairly dry so that the soil may be easily shaken off. Loose soil in the stack may cause damage to the pods and nuts.

(c) Stack so that the nuts are not exposed to the weather and finish the stack in such a way that water will not run down the center of the stack. Two cross arms should be nailed on the pole 12 inches from the ground to keep the vines off the ground.

(d) Canvas hay caps are recommended, especially for protecting seed for planting the next year's crop.

(e) Pick as soon as thoroughly cured, removing as far as possible all dirt, sticks and pods.

Peanuts should be harvested when the number of pods is greatest. Approaching maturity is indicated by the shedding of leaves. Peanuts may be dug by "plowing out" or by using a peanut digger. The peanuts should be allowed to dry after digging by spreading so the sun will shine on them. In from two to four hours and while in a wilted state, the peanuts should be stacked. Stacking is done by placing the dug peanuts around poles with cross pieces on the pole a few inches from the ground to prevent molding.

Farmers' Bulletin Number 1127 gives the following suggestions about growing and harvesting peanuts:

1. Plant peanuts in rotation with corn, cotton, cowpeas and other farm crops.
2. Be sure your land is adapted to growing peanuts. Do not plant sour or poorly drained land to peanuts.
3. Prepare your peanut land as though you were going to use it for a garden; then give it an extra fitting for good measure.
4. Good seed is essential to a full stand and a profitable crop. What has been done with corn by way of seed improvement can also be done with peanuts. Have a seed patch and grow seed from high-yielding peanuts.
5. Shell seed by hand, or in the case of Spanish peanuts, soak the pods over night and plant whole. If troubled by moles or salamanders, treat the seed with a little pine tar.
6. Cultivate early and often. Keep the grass and weeds from getting a firm hold.
7. Have stacking poles at hand before the crop is ready to harvest.
8. Harvest during good weather before the vines are frosted. Cure in small stacks around poles, two cross-pieces nailed to them 8 to 12 inches above the ground. There is only one right way.
9. Allow peanuts to cure thoroughly in stacks; then pick them from vines with machine that will not break the pods.
10. Grade according to standard grades, pack in clean bags, and store in a dry well-ventilated storage room or building until marketed.

Grading.—The Southern Peanut Crushers' Association gives the following grade of peanuts:

Section 1—There shall be four general classes known as "White Spanish," "Bunch," "Runners" and "Mixed." There shall be three grades of each class, known as No. 1, No. 2, and No. 3.

Section 2—These grades shall be based upon the percentage of total sound and matured kernels as follows:

1. Not less than 70 per cent sound and mature kernels and not more than 3 per cent damaged.
2. Between 65 and 70 per cent total sound and mature kernels and not more than 3 per cent damaged.
3. Between 60 and 65 per cent total sound and mature kernels and not more than 3 per cent damaged.

Section 3—Off grades, showing any of the following, to be sold according to sample:

a. Moisture present in excess of 7 per cent.
b. Hulls black or moldy in excess of 5 per cent.
c. Less than 60 per cent sound kernels and over 3 per cent damaged.
d. Any mixture of red peanuts.
e. Mixture of other varieties in excess of 2 per cent.
f. Shelled nuts in excess of 2 per cent.

Section 4—Mixed peanuts shall include:

a. Any mixture of other varieties.
b. Any varieties containing more than 2 per cent of shelled nuts.

Section 5—"Sound kernels" shall mean those that are bright, mature, and marketable.

"Damaged kernels" shall mean those that are not prime in flavor, or show mold sourness, rancidity, or are wholly or partly decomposed.

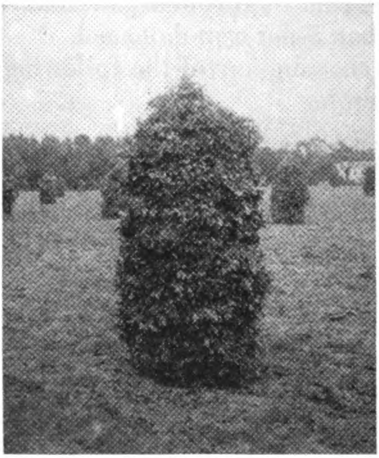
"Shelled nuts" shall mean all those that are shelled, including whole and broken kernels.

Section 6—Percentages by weight shall be based on the samples of farmers' stock, hand shelled.

Section 7—Deduction at the rate of delivered price shall be made for all foreign matter in excess of 1 per cent and for moisture in excess of 7 per cent.

Section 8—Six samples of 5 pounds each shall constitute a fair sample to be taken from various parts of each car and two samples of 2 pounds each from a wagonload. These samples shall be thoroughly mixed, then quartered, and 100 grams shelled by hand as a basis for determining grade.

Marketing.—The question of marketing is a problem that the farmer has to consider. He may sell direct to the buyer or broker or to a co-operative association. A large portion of the Georgia-Alabama crop is marketed through hogs.



A STACK OF PEANUTS

Diseases.—North Carolina Extension Bulletin No. 281 gives the following pointers about peanut diseases and insects:

Seed should be taken only from clean, bright, undiseased pods harvested preferably from disease-free or nearly disease-free fields.

Peanut leaf-spot frequently causes this serious premature shedding of leaves. Since the fungus which causes this disease lives through the winter on dead leaves and stems left in the field at harvest time, the land should be planted to some other crop for one or two years before peanuts are again grown on it.

Serious losses in the peanut crop are caused by diseases whose natural dwelling place is the soil. Some of these, as for example, bacterial (Granville)-wilt (Bacterium solanacearum), black root-rot (Tielaviopsis basicola), white stem-rot (Sclerotium rolfsii), and brown stem-rot (Rhozoctonia solani), which also cause large losses in tobacco, and other crops. If these diseases have recently appeared in previous crops, grow corn and small grains in the peanut rotation rather than tobacco, Irish potatoes, tomatoes, soybeans or cowpeas.

Sorghum and Spanish Peanuts
Peanuts constitute the most important feed crop for hogs in a portion of the South.

Destruction of all weeds by clean cultivation is especially desirable since many of the common weeds also perpetuate peanut diseases.

Insects.—Peanut plants may be injured by thrips and the potato leaf-hoppers. Field borders should be kept as clean as possible in order to destroy winter hibernating quarters for insects. It is best not to plant peanuts near an early crop of Irish potatoes. No direct economical control measures can be given for these insects.

SUGGESTIONS FOR STUDY

Questions and Problems

1. When did peanuts become an important crop? How does this date compare with the important development of other cash crops?

2. How many acres are now devoted to peanut production? What is the trend in acreage?
3. In how many states are peanuts an important crop? What are these states? How do they rank in peanut acreage? How do they rank in production?
4. What are the two great peanut-producing regions? What type of peanuts are grown in each?
5. How may the varieties of peanuts be classified? What are the important varieties in each group?
6. For what purposes are the various types of peanuts used?
7. What types of soil are best adapted to peanut production?
8. Do peanuts do best on an acid or alkaline soil?
9. What part does lime play in peanut production?
10. What are the fertilizer requirements of peanuts?
11. Tell how peanuts are planted. Are they shelled for planting?
12. When are peanuts planted? How long a time is required for the crop to mature? How can one tell when the crop is mature?
13. Are peanut members of the legume family? How can you tell?
14. What rotations are recommended for farms growing peanuts?
15. What often causes poor stands in peanut production?
16. What are some of the ways in which peanuts may be harvested?
17. What does it mean to say that peanuts produce soft pork? What per cent of the peanut crop in your section is hogged down?
18. How are peanuts graded? Discuss each grade.
19. What are some of the common diseases of peanuts? How are they controlled? Are there important insect pests?
20. Discuss the use, value, and method of handling peanut hay.

Selected References

U. S. Department of Agriculture, Washington, D. C.
Farmers' Bulletins
1656—*Peanut Growing*
Department Bulletins
1401—*Marketing Peanuts*

State Publications
Florida—Bulletin 12—*Peanuts for Oil Production*
North Carolina—Bulletin 281—*Approved Practices for Peanut Growers*
Texas—Bulletin 503—*Peanut Growing in the Gulf Coast Prairie of Texas*

SUGGESTED ACTIVITIES

1. Make a statistical study of peanut production, using the figures given in the Yearbooks of the U. S. Department of Agriculture. Be able to answer the following questions and record the data in a notebook: In what countries are peanuts grown? What is the rank of each of these countries? What per cent of the peanuts of the world are produced in the United States? How do the states rank? What is the trend in peanut production in this country? in your state? What is the average acre yield in your state? in the nation? What is the average price of peanuts?
2. What is the average cost of growing peanuts? Make a table to show the distribution of these costs, including all the items involved. At the average price and acre yield, what are the possibilities of making a profit from the growing of peanuts?
3. Make a survey of peanut growing in your community. What are the questions that you will seek to answer? Make a list of them before attempting to secure the information. Be sure to include the ways in which the crop is utilized and sold.
4. Make a list of the jobs that are involved in the growing and marketing of peanuts. Make a table showing the distribution of the jobs and the hours of labor required in each month. Under each of the jobs make a list of the decisions that are involved.
5. Make a study of the value of peanuts as a crop to feed to hogs. From the results of experiment station data, and the yields of the several crops, determine what is the most profitable crop to be grown for pork production. How do peanuts compare with corn in value as a feed for hogs? (Note: Valuable information can be secured from *Feeds and Feeding* by Morrison.)

Chapter 30

RICE—GROWING AND HARVESTING

B. M. HAGER

RICE is the principal grain of the Orient. It is the most important food crop of the world in that millions of persons depend upon it for existence. Rice is the basis of the daily diet in Japan, China, parts of India, and of other countries of the world. In the United States, our annual per capita consumption is only about five pounds. Most of the rice used in this country is consumed in the Southern States. In the Hawaiian Islands the per capita consumption reaches the almost unbelievable sum of 220 pounds per year. In Puerto Rico the average adult eats 125 pounds each year.

Rice is used for feed for livestock, also. In the milling process, some of the most nutritious parts of the grain are removed. These by-products are what is used for feeding livestock. The superiority of these rice feeds has been demonstrated by the livestock producers of Texas and other parts of the country where they have been fed.

India is the leading country of the world in the production of commercial rice, producing about 40 per cent of the world's supply. China ranks second, and Japan third in rice production. All the other nations of the world together produce less than 20 per cent of the total crop.

Only four states in our country produce rice in commercial quantities. These, in the order of rank, are:

Louisiana, Arkansas, Texas, and California. In the early history of the United States, rice was the principal source of income for the planters of South Carolina and Georgia. Today, however, these states grow very little

Rice Field Covered with Water

rice. As a nation, we both import and export rice. For the most part, our exports exceed our imports.

Rice is one of the grains included in the great family of the grasses. In general structure, rice is very much like the oat plant. The root system is shallow and fibrous.

Soil and Water Requirements.—Rice differs from other grains in that it requires wet conditions for growth. It was formerly grown in the lowlands near the Atlantic coast. It is now produced adjacent to the Gulf and near the banks of rivers. The development of the new rice-growing regions has been due chiefly to the abundance of irrigation water and to the presence of extensive areas of level, stiff, nearly impervious soils which will retain irrigation water. It is apparent that the land on which rice may be grown successfully is limited by the water requirements of the crop.

Varieties of Rice.—There are thousands of varieties

—*Courtesy USDA, F. B. 1092*

IRRIGATION WATER COVERING THE LAND
The land is continuously submerged until the crop is mature.

of rice grown in the Orient; there are but a few varieties in the United States. All varieties may be classified under the heads: (1) the long grain, (2) the medium grain, and (3) short grain.

The principal long-grain rice of the United States is the Honduras variety. It is grown in all the rice regions of the nation except California. It is an early-maturing variety which requires about 120 days for growth. A new variety of this type, Fortuna, is increasing in popularity.

The Blue Rose, a medium-grain rice is grown on a large acreage in Louisiana, Arkansas, and Texas. The varieties Acadia and Colusa are well adapted to prairie conditions. They are hardy and produce large yields, and belong to the short-grain group. They are the varieties grown in California. These varieties do not break in milling and are therefore a favorite with millers. The American public, however, prefers to buy the long-grain varieties.

Fertilizing Rice.—Rice has one peculiarity with respect to plant food. It can use nitrogen in the form of ammonia. This has made it rather difficult to determine the best manner of fertilizing the crop. It has been found through experimental work that the best yields are obtained when rice is grown in a rotation including soy beans which are turned under. The fertilizers used commonly contain ten to twelve per cent of phosphoric acid and four to six per cent of potash. They are applied at the time of seeding, varying from 150 to 200 pounds of acid phosphate and 40 or more pounds of muriate or sulphate of potash, to the acre.

Preparing the Seed-bed.—Plowing is the first field operation in the preparation of the seed-bed for rice. This is usually done in the fall. The final preparation of the seed-bed consists of discing in the spring. This is all the preparation that is required if the land has been well-drained. The surface soil should be well pulverized to a depth of two inches. This will aid in germination by retaining the moisture in the soil.

Seeding.—The disc drill is used in sowing rice. The quantity of seed used varies from 65 or 100 pounds in the prairie lands to 150 pounds in California. Sowing, over the greater part of the area, is done in May. The seed is covered with about two inches of soil.

Cultivation.—The important factor in rice culture is irrigation. This requires a water supply and level land. Flooding is usually started 15 days after the seeds have germinated. It may be delayed for 30 days on land where a crop of soy beans has been turned under. The land is covered with water to a depth of about four to six inches. The crop grows to maturity while the land is covered with water. The water is then drained off and the land allowed to become firm for harvesting.

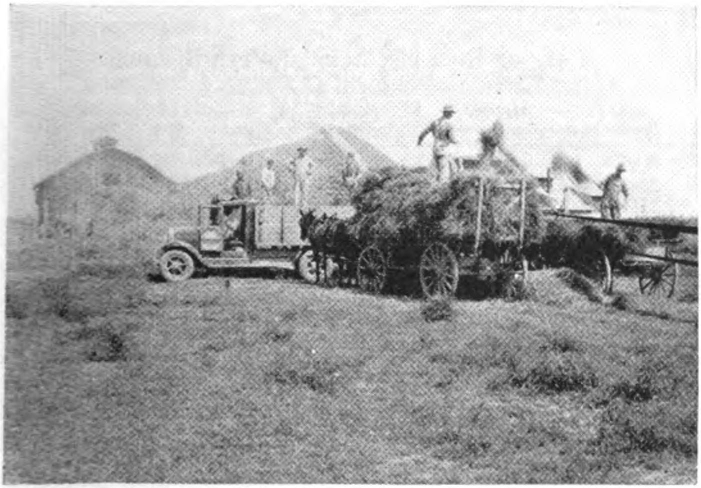
HARVESTING RICE

Insects and Diseases.—The most destructive insect attacking rice is the water-weevil. In the worm stage, it is known as the root-rot maggot. The most important practical method of controlling this pest is to drain the water off the field in early stages of growth. If the field is kept dry for two weeks the maggots are killed in large numbers.

Fortunately, only a few plant diseases affect the rice crop in this country. The most important is known as the *straighthead.* This may be controlled by allowing the field to dry after it has been covered with water for about six weeks. This seems to permit the plants to overcome the disease in most cases. After the roots have become well established, then the field is again covered with water.

There are some other enemies of the rice plant, but for most part alternate flooding and draining seems to be the most effective way to control them.

Rice is attacked by smut. This may be prevented by



THRESHING RICE

the hot-water treatment or the formaldehyde treatment just as with other small grains.

Yields and Cost of Production.—Studies dealing with the cost of production have been made by the Rice Experiment Station of Arkansas which show that the cost of production in that state varies from forty cents to about $1.50 per bushel. As is the case with all other crops, the lowest costs per bushel are obtained by those who secure the largest acre-yields. This is a very important factor to take into consideration in the production of any crop. Every producer must strive to reduce costs if he wishes to have a profitable business. Students of agriculture should analyze every job very carefully in an effort to discover new ways to reduce production costs.

The figures relative to yields and costs of production are taken from Arkansas Bulletin No. 266 entitled, *The Cost of Producing Rice in Arkansas:*

COST OF RICE PER ACRE AND PER BUSHEL

Yield Groups	*Mid Point of Group*	*Farms in Group*	*Average Cost per Rice Acre*	*Average Cost per Bushel*
Bushels	*Bushels*	*Number*	*Dollars*	*Dollars*
25-34	30	6	40.01	1.32
35-44	40	11	38.10	.94
45-54	50	19	44.98	.92
55-64	60	22	41.27	.70
65-74	70	11	51.74	.76
75-84	80	5	42.01	.54
Average	53	74	42.49	.80

This table means that the farmer who produced from 25 to 34 bushels of rice per acre did so at a cost of $1.32 cents per bushel, which was more than the selling price; while the efficient producers who secured a yield in excess of 75 bushels per acre made their crop at a cost of fifty-four cents per bushel and consequently had a nice profit.

Harvesting.—Most rice grown in the United States is harvested with a self-binder. Harvesting should begin as soon as the heads are well-filled and begin to turn down. A binder will cut from four to ten acres a day, depending upon the condition of the land and the crop. The bundles are placed in shocks as soon as cut. The grain is threshed about two weeks after shocking. In other words, the crop is handled much as the other small grains. In shocking, care must be taken to protect the heads from the sun, otherwise the grain will dry too quickly and will, as a result, crack badly in milling.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Why is it said that rice is the most important food crop in the world? In what countries do we find the greatest consumption? What is our per capita consumption in the United States? What, do you suppose, is the per capita consumption in your family?
2. Where is rice grown in the United States? What are the limiting factors in production?
3. Would it be possible to increase the production of rice in the United States? Would it be practical? Give reasons for your answers? Why did Georgia and South Carolina give up rice growing? Could it be resumed?
4. How does the rice plant differ from others that you have studied? What do these differences mean in practical production problems?
5. Where does the water come from that is used in producing rice? How is it controlled?
6. How are the varieties of rice classified?
7. How does the cost of growing rice compare with the cost of growing cotton? with oats?
8. What are the enemies of rice?
9. How does the fertilizing of rice differ from that of other crops?
10. What is the average production of rice per acre? How does that compare with other small grains? How does the value per acre compare with other small grains?

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1543—*Insects Injurious to the Rice Crop*
Department Bulletins
1127—*Some New Varieties of Rice*
Miscellaneous Publications
132—*Rice and Its By-Products for Feeding Livestock*
State Publications
Arkansas—266, *Cost of Producing Rice in Arkansas*
291, *Study of Rice Fertilization*
299, *The Rice Water Weevil*

Louisiana—105, *Diseases Affecting Rice*
172, *Rice Investigations*
216, *Rice Farm Irrigation Systems in Louisiana*
Texas—398, *Fertilizers for Rice in Texas*
485, *Varieties of Rice for Texas*

Suggested Activities

1. From the statistics given on rice in the Yearbooks of the U. S. Department of Agriculture, make a study of rice production from the most recent data and determine: (1) the leading states in production in the order of rank, (2) the leading state in the production per acre, (3) the leading countries of the world in rice production, (4) the consumption of the various countries of the world, and (5) the export and import business of the United States in rice.
2. On an outline map of the United States, shade the areas where rice may be grown successfully.
3. Make a graph showing the price of rice over a period of years. The data may be obtained from the Yearbooks of the U. S. Department of Agriculture. Compare with some other crop grown in your section. How do they compare? What is the explanation?
4. Would the rice growers of the United States be benefited if a tariff were placed on rice so that none could be brought into this country in competition with our own growers? Prepare a paper in which this subject is discussed. This subject might well serve as the topic for a debate.
5. Make an investigation of the possibilities of growing *upland rice,* which requires no flooding, as a source of home supply. Secure seed and plant an experimental field either at home or on a plat belonging to or selected by the school. Determine how much rice is used in your home each year, and how much this rice costs, or is worth, at current prices.

Chapter 31

GROWING SUGARCANE

J. B. SHACKELFORD

SUGARCANE is distinctly a tropical plant. It is grown commercially only in the extreme southern portion of the United States. For the making of sugar, it is grown only in Louisiana and Florida, but for the making of sirup it is grown in eight of the Southern States. In 1936, the cane sugar made from our Southern crop brought the producers an income of 17 million dollars. Ten million dollars was realized, in the same year, from the sale of cane sirup.

The United States produces, on the continent, only a small portion of the sugar consumed. Some sugar is produced from beets grown in the Western States, but not so much as is made from sugarcane. Cuba, British India, and Java produce approximately 60 per cent of the sugarcane grown in the world. Hawaii, Puerto Rico, and the Philippine Islands, each produce about 5 per cent of the world's supply. Our own production can be materially increased. In recent years quite a remarkable expansion has taken place in the lower part of Florida.

Sugarcane requires a long growing season. In Cuba, and other countries below the frost line, yields of fifty tons of cane to the acre are not uncommon. In the United States, with a shorter growing season, the average production has been much less. It is interesting to note, however, in this connection that in 1936 the yield per acre in Florida was 35.3 tons per acre, or almost exactly twice the acre-yield made in Louisiana. The longer growing season of the tropics makes cane growing more

Young Sugarcane in Louisiana

profitable there because of the greater accumulation of sugar in the stalks in addition to the greater yield. The amount of sugar is important because the growers are ordinarily paid on the basis of the "sugar turnout" at the mill.

Soil Requirements.—Sugarcane, for its best growth and development, requires a soil that retains moisture.

In the lowlands, where much of the commercial sugarcane is grown, the necessary drainage is provided by the use of ditches constructed at proper intervals through the field. A clay-loam or silt-loam soil, rich in humus is ideal. Cane grown on a sandy-loam seems to make a better sirup than that grown on other types of soil.

Varieties.—Cane has all the characteristics of the grass family. It often attains a height of 12 or 16 feet. It suckers freely, growing in stools. Ten or fifteen stalks to the stool are not uncommon for the larger varieties, with as many as 40 or 50 for the smaller ones.

The roots grow out from the basal part of the stem. They are largely confined to the surface layers of the soil. With cane planted in six-foot rows the roots readily fill all the middles.

The stems are solid and made up of joints, or internodes. Growth is terminal and new joints are constantly being added at the top. Each internode contains a bud or "eye," at the lower end. The buds alternate from one side to the other. Around the node, or joint, there are spots that look like dots. These dots are the root buds. If the stalk is used for seed, a root will grow from each bud. In the United States, cane seldom produces seed.

The varieties of cane first grown extensively in this country became so susceptible to disease that they have been discarded. Had new, disease-resistant varieties not been found, farmers could not have continued to grow cane. Experiment stations at the colleges of agriculture and large sugar companies are constantly searching for new and better varieties. Most of these varieties are brought into the country from Java and other distant lands. The new varieties are usually named with a letter and a number. The letter is usually the initial of the station at which the variety was produced.

Of the new varieties, P. O. J. 234 became widely known because of early maturity and high sugar content. This variety came from Java (Proet Station Oest-Java).

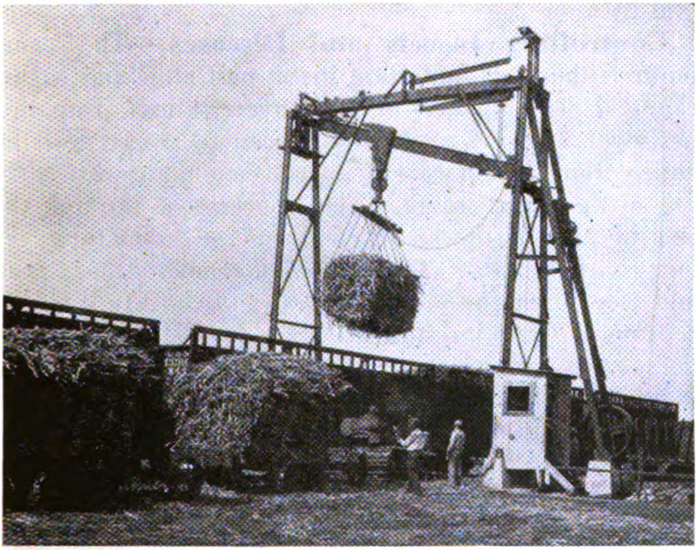
Some of the popular varieties in Louisiana are Co. 281, Co. 290, and C. P. 807. Growers, who are in doubt about the best variety for a given locality, should write to their state experiment station and ask for a report of recent experimental tests.

Plant Food Requirements.—Sugarcane requires an abundant supply of plant food, as anyone will realize who stops to think of the tonnage produced per acre. The controlling factor in production is usually nitrogen. This may be supplied in the form of commercial fertilizer, but even when this is used the best results are obtained when the soil contains a large quantity of humus. Humus is supplied by turning under a crop of legumes grown in the rotation. The usual rotation is cane for two years followed by corn with some legume. The legumes used by sugar planters include cowpeas, soybeans, velvet beans, and (melilotus) yellow sweet clover. Under ordinary conditions 200 to 250 pounds of nitrate of soda and 250 pounds of acid phosphate, or the equivalent, per acre will supply the nitrogen and phosphoric acid required. Commercial fertilizer should be applied in the spring about the time the cane is well established. It is usually applied as a side dressing.

Planting.—Seed selection pays. In the case of sugarcane, this means selecting those stools that show freedom from mosaic disease and little damage from the cane-borer. The cane saved for seed is ordinarily planted shortly after selection. The entire stalk is usually planted. When planting is done in the spring, the cane must be bedded to protect it from freezing during the winter months.

The time of planting varies from October to February.

That planted prior to the first of the year is known as *fall plant*, and that after as *spring plant*. Sugarcane is usually grown on ridges. The middles between the ridges provide drainage. The ridges may be formed in



—*Courtesy U. S. Sugar Cor.*

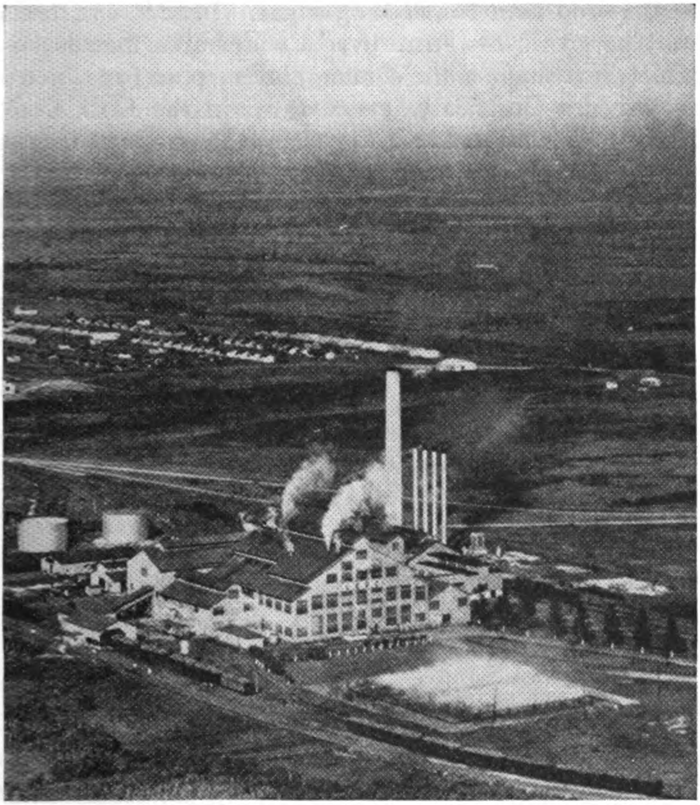
A SUGARCANE HOIST IN OPERATION

the first operation, or the land broken flat and the ridges thrown up later. In the Sugar Belt cane is planted in rows six feet apart. Immediately preceding the planting, the rows or ridges are opened five to six inches deep. The seed cane is distributed in the furrows, usually two running stalks are planted. This is a large quantity, by weight. Often an excess of three tons is planted per acre. This is a larger amount than required in the tropics, where sections of stalks with two or three nodes, rather than the entire stalk, is the seed unit.

Cultivation begins early in the spring, by removing soil from the top of the row so that the earth near the young plants will warm up quickly. As the plants grow, soil is thrown toward the row. The cane is cultivated until large enough to shade the middles and is then laid by.

Controlling Insects and Diseases.—The cane-borer is the most important insect pest attacking sugar-cane. It is estimated that the average loss from this pest over a period of years has been 20 per cent of the entire crop. The borers attack the cane plant while they are in the larvae stage. The insects bore through the central part of the stalks, and emerge at maturity as buff-colored moths. The moths lay eggs on canes, corn, and rice plants or other grasses, and the life cycle is repeated. Cane infested with borers produces very little sugar. It is also rendered unfit for planting. The following control measures are recommended: (1) all vegetable matter containing borers, such as old corn-stalks, should be plowed under; (2) young cane stalks containing borers should be cut out well below the ground; (3) infested crops should be fed to livestock and the uneaten portions destroyed; (4) the wasp *Trichogramma minutum*, which lays its eggs in the eggs of the borer, should be introduced into the badly infested field; and (5) dusting should be done, using 12 to 15 pounds per acre, with high-grade light sodium plyosilicate.

The mosaic disease is the most serious of several diseases which include *red-rot* and *root-rot*. Mosaic produces a mottling or striping of the leaves. It reduces the production per acre through retarding growth. The best control measure is the selection of resistant varieties and disease-free stalks for planting. The control of insect pests reduces the loss from diseases. Improving the drainage and physical condition of the soil is also important. Anything which aids in the growth of the plants is in a measure effective.



RAW SUGAR-HOUSE, CLEWISTON, FLORIDA

Harvesting and Selling.—Harvesting begins about the middle of October in the Sugar Belt. The cutting is done by hand. Sugar mills take the crop at a contract price, or at the prevailing market price. Each grower is paid on the basis of the sugar content of his cane as determined by laboratory test.

Sugarcane for Sirup.—As many acres are devoted to sugarcane used for sirup as are devoted to the portion of the crop used for making sugar. In fact, sugarcane may be grown for sirup over a wider area than is possible when sugar is the commercial purpose for which it is grown. Practically every farm in the Gulf Coast region has a patch of cane used for the making of sirup to meet home requirements.

Cane sirup is a commercial product of importance in Georgia, Louisiana, Mississippi, Alabama, Texas, and Florida. The crop has a commercial value of 10 or more million dollars a year, and yet only a portion of the sirup made finds its way to the market, as cane sirup is one of the home supply products where it can be produced.

The relative commercial importance of cane sirup is shown in the following table, the figures for which are supplied by the Bureau of Agricultural Economics:

SIRUP CONSUMPTION IN THE UNITED STATES

Kinds of Sirup	*Gallons Consumed*
Cane Sirup	14,359,000
Sorgo Sirup	17,818,000
Corn Sirup	81,686,000
Maple Sirup	2,186,000
Cane Molasses	5,168,000

In the above table the cane molasses listed is only that portion used for human food, and does not contain the quantities used in the preparation of livestock feeds. The consumption figures for corn sirup include all mixtures containing any corn sirup.

Quantities of cane sirup are packed in cans and bottles and sold to local dealers. The major portion of the production is packed in barrels and sold to dealers, jobbers, and others engaged in the sirup-packing business. The price varies with the world production of sugar. The price of sirup in barrels at Cairo, Georgia, which is a large producing center, ranged from 60 to 90 cents a gallon in 1925, from 40 to 60 cents three years later, and was as low as 20 cents a gallon in 1931-1932. The average price over a period of years for all producing states has been about 40 cents. This does not provide a very large return for the growers at this price which means that high yields per acre must be made if the crop returns a satisfactory profit.

SUGGESTIONS FOR STUDY

Questions and Problems

1. For what purposes is sugarcane grown? What is the relative importance of these uses?
2. Where is sugarcane grown in the United States?
3. What part of the sugar consumed in this country is produced in the United States?
4. What are the principal sugarcane-producing countries of the world?
5. How do yields in the United States compare with yields in other sugarcane-producing countries of the world?
6. In what part of the country are sugar beets grown? How does the quantity of sugar made from beets compare with the quantity made from cane?
7. What states produce cane for making sirup? How does the sirup made from cane compare with that made from sorghum?
8. What are the soil requirements of sugarcane? How is it fertilized?
9. How does the tonnage of sugarcane compare per acre with other crops? with corn? sorghum? hay crops?
10. How is sugarcane planted? How much is required to plant an acre?
11. When is cane planted? How is the land prepared for planting? What is spring-plant cane?

12. What rotations are practiced in cane growing sections? Why is rotation important?
13. What is the most serious disease of sugarcane? How is it controlled?
14. What are some of the more important varieties of sugarcane? Where do our varieties come from? How are they named?
15. What are the most serious pests of sugarcane? How are these insects controlled?
16. How is sugarcane harvested? How is it sold?
17. How is "seed" cane handled?
18. How does the growing of cane for sirup differ from the growing of cane for sugar? Why can cane for sirup be grown over a much greater area than cane for sugar?

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Sugarcane for Sirup Production, Circular 284
State Publications
Louisiana—Bulletin 263, *Studies on Sugarcane Mosaic*
Bulletin 267, *General Summary of Sugarcane Experiments*
Bulletin 274, *Sugarcane Variety Test Fields*
Florida—Bulletin 278, *Effect of Freezing on Sugarcane in Florida*

Suggested Activities

1. From the most recent Yearbook of the U. S. Department of Agriculture, make a study of the sugarcane situation determining: (1) the total consumption of sugar in the United States; (2) the part produced in this country; (3) the division, in our production, between cane sugar and beet sugar; (4) the countries from which sugar is imported, together with the amount from each; (5) the trend in sugar production in this country; and (6) the relative production of the several states in the country.
2. From a list of the jobs involved in growing sugar cane (see appendix) and data secured from local growers, determine the hours of labor required to produce an acre of sugarcane together with the total cost. Distribute the labor and costs by calendar months.

Chapter 32

OATS—GROWING AND HARVESTING

G. H. COLLINGS

OATS rank third among the cereal crops of America. The normal number of acres planted to corn approximates 100,000,000, to wheat 50,000,000, to oats about 40,000,000. The acreage devoted to oats increased consistently from 1866 to 1932. Oats constitutes a feed crop of major importance, being surpassed in economic importance only by corn.

Oats are grown to some extent in every state in the nation. The average acre-yield for the United States is about 30 bushels. The average yield for the Southern States is consistently above 20 bushels, which is a much better comparative yield than is secured in growing corn.

The price of oats is usually higher in the South than in other parts of the country. Over a five-year period, when the price of oats was 23 cents in the Middlewest, they sold for 51 cents in the South.

The acreage planted to oats in the Southern States, together with average production, for a five-year period is shown in the table on page 388.

Feeding Value.—Oats make the best feed for horses and mules that can be obtained; in fact, they may be fed to all classes of stock. They are highly prized as a feed for young stock. The high ash content of the crop makes it an ideal feed for developing bone; the relatively large amount of protein makes oats a splendid muscle-building feed. When the price is not too high, it is a valuable grain for feeding dairy cows, sheep, and poultry. Oats make excellent hay. And when the grain is threshed the straw serves as a satisfactory roughage for wintering stock.

OATS—ACREAGE AND PRODUCTION

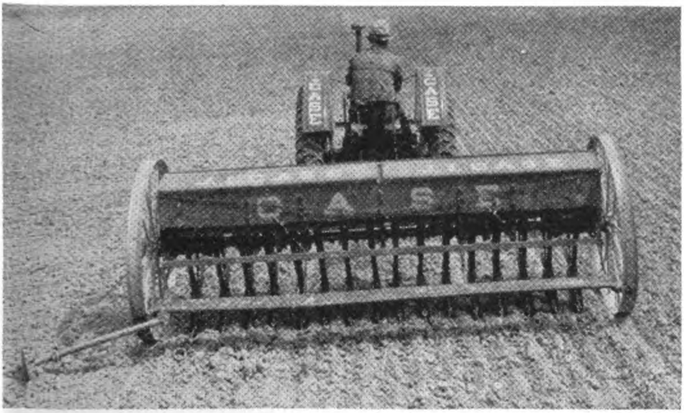
State	*Acreage*	*Production* (Bushels)
Maryland	56,000	1,560,000
Virginia	141,000	2,837,000
West Virginia	139,000	2,883,000
North Carolina	185,000	3,572,000
South Carolina	365,000	8,076,000
Georgia	300,000	5,741,000
Florida	8,000	116,000
Kentucky	179,000	2,992,000
Tennessee	112,000	1,871,000
Alabama	103,000	1,919,000
Mississippi	39,000	837,000
Arkansas	121,000	2,358,000
Louisiana	20,000	481,000
Oklahoma	1,157,000	25,434,000
Texas	1,485,000	39,032,000

Oats in the Farming System.—Oats fit into practically every rotation of crops recommended for the South. They are especially valuable in that part of the country where they may be sown in the fall. They constitute an intermediate crop that occupies the land only a part of the growing season. When seeded in the fall, they make an excellent cover crop which prevents soil erosion.

Oats grow best in cool weather, but they freeze more quickly than wheat. The best yields are made in the Northern States, although some of the highest yields recorded have recently been made with some of the improved varieties grown in the South.

The average yield per acre in Maryland, for a ten-year period has been 30 bushels, in Texas the yield has been 25 bushels, and in Florida only 14 bushels.

One of the best rotations which can be devised for the cotton-growing part of the country is: *First year*, cotton;



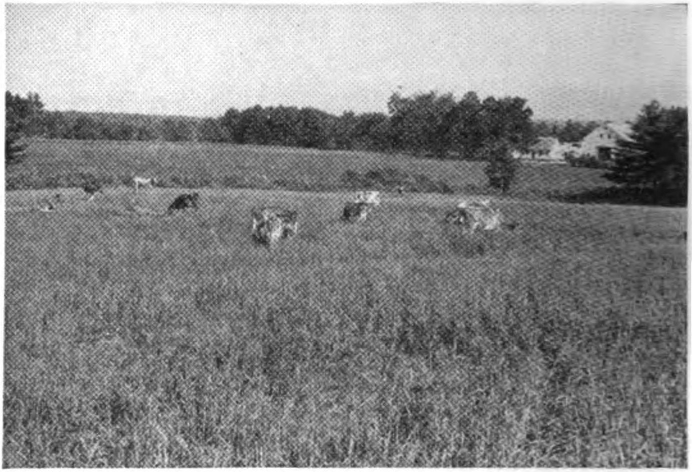
—*Courtesy J. I. Case*

DRILLING IS THE BEST METHOD OF SOWING SMALL GRAIN. DRILLS OF ANY DESIRED SIZE MAY BE PURCHASED

second year, corn; *third year*, fall sown oats followed by soybeans or cowpeas. If desired, crimson clover may be sown in the cotton the first year and plowed under in the spring before corn-planting time. Rye may be sown the third year after the beans or peas, thus providing a cover crop every winter.

A cover crop is of the utmost importance in the South. Much more plant food is removed by erosion than by crops. Erosion takes place most rapidly in the season of greatest rainfall, which occurs during the winter months. Again erosion occurs most rapidly on fallow land. This means that in the Piedmont section land should be protected during the winter. And again, plant food not used by plants leaches out of the feeding zone of plants.

Plant food, in the South, is constantly being converted to a soluble form. Chemical and bacterial action never stop in the South as in the North, where the land may be frozen, or "locked up," for five months in the year. For

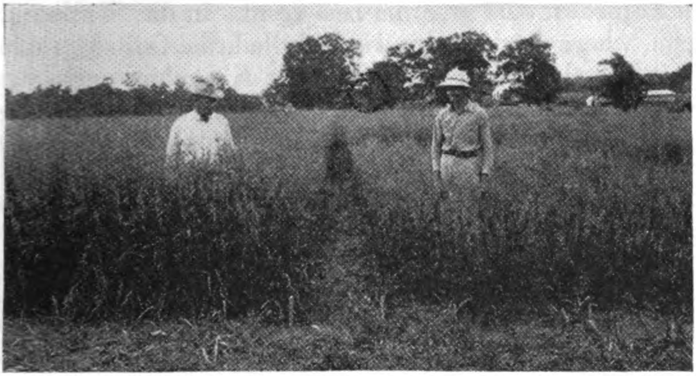


Oats Make One of the Best Grazing Crops

all of these reasons, and for the production of feed for livestock, we should grow crops in the winter in the Cotton Belt. Oats have as wide an adaptation as a winter crop as any that can be grown.

Economy of Labor.—Oats require fewer hours of labor than any other field crop grown in the South, with the possible exception of other small grains. There are, in reality, only two "operative" jobs connected with the growing of oats. These are (1) seeding and (2) harvesting. Together, these require about fifteen hours, or less, per acre as contrasted with 148 for cotton, 115 for sweet potatoes, 78 for peanuts, and 44 for corn.

Soil and Climate.—Oats are grown, to some extent, in every state in the nation. They have a wider distribution than any other crop grown, with the possible exception of corn. They do best, however, in a cool, moist climate. The largest yields are made along the



OATS
With (left) and without fertilizer. (Black Belt Station, Alabama.)

Canadian border. They make fair yields on all types of soil, but do best on well-drained, fertile land. Oats require a large quantity of water, and for this reason should be planted on soils that hold moisture well. The water-holding capacity of any soil can be increased by turning under vegetative matter. This is an important thing to remember in all farming operations. In periods of low rainfall, the best results are always secured on soils that have large quantities of humus. Humus is increased by turning under stubble, stalks, and cover crops. This is the principal reason why no crop residue should be burned.

Seeding.—Oats are seeded at the rate of two bushels per acre. In experiments in Tennessee, on very rich land, one bushel per acre gave results as good as those for any other rate. But, on the whole, safety warrants a higher rate of seeding.

Procuring seed involves the selection of a variety.

Varieties may be divided into two groups, those for fall sowing and those for spring sowing.

Fall-sown oats give the best results in the South. In fact, where they are not winter-killed, the fall sown oats yield, on the average, almost twice as much as oats sown in the spring. In the states in the far South, oats are planted in the fall; in the central portion they are

COMPARATIVE DATA FOR OATS

State	*Varieties*	*Rate of Seeding (pecks)*	*Time of Seeding*
Virginia	Winter Virginia Gray V. P. I. #1 Red Rustproof Spring Fulghum Swedish Select Burt	8 to 10	Winter Three weeks before first frost Spring As soon as land can be prepared.
Alabama	Red Rustproof Fulghum Appler	8 to 12	On or before October 15
Tennessee	Gray Turf Dwarf Culberson Fulghum	5 to 8	Spring—March 1 to 15 Winter—September 15 to October 1.
Texas	Texas Red Rustproof	8	Winter September 20 to October 10 Spring February or March.
Arkansas	Winter Lee Custis Culberson Spring Fulghum Burt Kherson Sixty-Day	Winter 7 to 9 Spring 10	Winter Late September to October 10 Spring Early planting important.

planted either in the fall and spring; in the North they may be planted only in the spring.

For the southern tier of states, the red rust proof, Fulghum, and Appler varieties are popular. Further north, these varieties are often winter killed when sown in the fall and are not grown so extensively as the winter turf and the Culberson. While the winter turf is the hardiest variety, it is rather late in maturity and is often injured by hot weather. It must be remembered that the oat is a cool weather crop.

Many local selections of oats have been made that are well adapted to the section where they were developed.

Seed oats should be selected from that grown in about the section where they are to be planted. Varieties of oats do not "run out" from being grown continuously in the South.

Preparing the Land.—The method of preparing the land depends upon the previous treatment, and on the character of the soil. In any case, a seed-bed with two or three inches of loose, mellow, surface soil and a firm sub-soil should be prepared, as the success of the crop depends, in a large measure, on the seed-bed and on the fall growth.

If oats follow a cultivated crop, it is unnecessary to plow the land. Under such circumstances discing is just as satisfactory and requires less labor. If it seems desirable to plow, the land should be turned five or six inches deep a month before the time of seeding, and a spike tooth, or a smoothing harrow, should immediately follow the plow.

Time of Sowing.—Time of seeding is important. Oats should be sown early—early in the fall, or early in the spring. If sown in the fall, they should be planted in September or before October 15; if in the spring as early as the weather will permit.

Treating for Smut.—Smut is the only serious enemy of oats, but yields are greatly reduced because of this seed-borne disease.

Smut may be controlled by treating the seed with a formaldehyde solution.

The grain to be planted should be placed on a canvas or on a tight floor and sprinkled with a solution of formaldehyde made by using one pint to forty gallons of water. The grain should be shoveled over while the solution is being applied, so that all of it will be thoroughly moistened. It should then be covered with a blanket or canvas and left for several hours, or over night, when it may be sown at once or spread out to dry. If preferred, the solution may be made in a barrel and the grain immersed in a loose open sack, and then spread out to dry.

This method will control the smut effectively. There are one or two objections to it, however. If the grain is planted before being dried thoroughly it does not flow evenly through the drill. If left to dry thoroughly, the seed may be injured and, as a result, the stand reduced.

A new method has recently been developed for the control of stinking-smut of wheat, loose-smut and covered-smut of oats, covered-smut and black loose-smut of barley, kernel-smut of grain sorghum and stripe of barley.

This is known as the ethyl mercury phosphate dust or improved *ceresan* method.

Only the ceresan made for seed treatment should be used. This, at the rate of one-half ounce ceresan per bushel of grain, should be thoroughly mixed in a revolving drum or barrel. The grain should be treated at least ten hours before planting. During this period it may be kept in sacks or small piles. It should not be covered, as in the formaldehyde method. The grain may be treated long in advance of planting, if desirable.

This method has the advantage of being a dry treatment. Grain treated in this way does not cake in the drill.

100 Bushels per Acre
The record of a North Georgia farmer.

Since yield per acre is such an important factor in success in farming and since losses from smut are so great, the control of this disease, and the effect of the control method on stand, are of vital importance. The results on these two factors of 24 methods of treatment, as determined at the Georgia Experiment Station (Circular 110) are shown in the table on page 396.

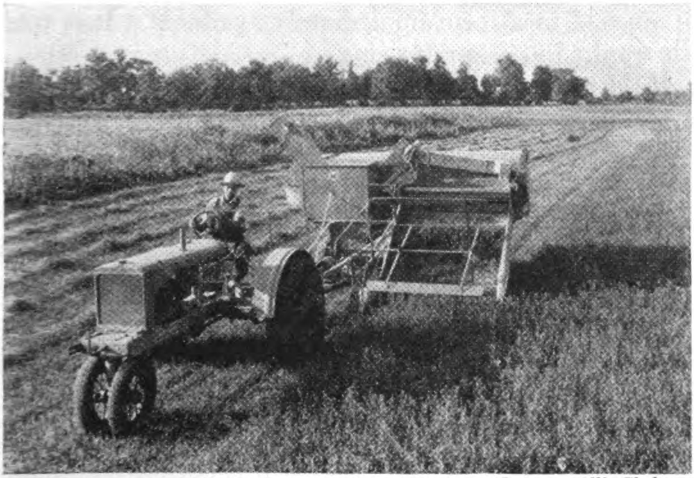
Rust is an enemy of small grain crops. It is controlled through the selection of rust-proof varieties such as Fulghum and red rust proof.

Method of Seeding.—Oats are sown broadcast or with a drill.

The Effect of Various Seed Treatments on the Stand and on Smut in Oats

No.	Treatment	Stand Increase or Reduction	Smutted Plants	Smutted Plants in Check
		per cent	per cent	per cent
1.	Formaldehyde 1 pt. to 40 gal., soak 30 min., covered 4 hrs., planted damp	1.7	0.0	22.1
2.	Formaldehyde 1 pt. to 40 gal., soak 30 min., not covered, planted damp	1.6	trace	22.1
3.	Formaldehyde 1 pt. to 40 gal., soak 5 min., covered 4 hrs., plant damp	5.4	trace	22.1
4.	Formaldehyde 1 pt. to 40 gal., sprinkled 1 gal. per bu. covered 4 hrs., plant damp	3.0	0.0	22.1
5.	Same as No. 1 but dried before planting	—10.7	0.0	14.3
6.	Same as No. 2 but dried before planting	— 3.5	0.0	22.1
7.	Same as No. 3 but dried before planting	— 5.7	0.0	14.3
8.	Same as No. 4 but dried before planting	— 3.8	trace	14.3
9.	Formaldehyde 1 pt. to 40 gal., soak 5 min. planted damp within 2 to 3 hrs	— 0.3	0.2	5.2
10.	Formaldehyde 1 pt. to 1 pt. sprayed 1 qt. solution to 40 bu., covered 4 hrs., aired	—10.8	0.2	11.8
11.	Water only, soak 30 min., covered 4 hrs., dried	— 4.0	10.6	11.8
12.	Paraformaldehyde-talc dust 6.9%, 2 oz. per bu., planted at once	0.7	17.0	22.1
13.	Paraformaldehyde-talc dust 6% 3 oz. per bu., covered 3½ mo.	—35.4	trace	24.9
14.	Paraformaldehyde-talc dust 6% 3 oz. per bu., covered 3 days	— 3.4	0.0	11.8
15.	Paraformaldehyde-talc dust 6%, 3 oz. per bu., covered 1 day	— 1.6	1.6	11.8
16.	Ansul formaldehyde dust 6%, 3 oz. per bu., covered 1 day	— 4.4	trace	5.2
17.	Ceresan 3 oz. per bu., covered 1 day	2.1	0.5	23.5
18.	Improved Ceresan ½ oz. per bu., covered 1 day	3.3	0.0	5.2
19.	DuBay 1100 WW dust, ½ oz. per bu., covered 2 days	— 4.4	0.0	24.9
20.	DuBay 1134 dust, 1 oz. per bu., covered 2 days	— 3.0	0.0	24.9
21.	DuBay 986 dust, 1 oz. per bu., covered 10 days	9.5	4.3	22.1
22.	DuBay 999 dust, 1 oz. per bu., covered 10 days	9.4	3.9	22.1
23.	Sanoseed dust, 3 oz. per bu., covered 14 days	8.8	10.7	22.1
24.	New Sanoseed dust, 3 oz. per bu., covered 14 days	6.5	9.3	22.1

Sowing with an ordinary grain drill is strongly recommended for the following reasons: (1) a more uniform distribution is obtained than when the seed is sown broadcast; and (2) the seed is placed in the ground deep



—*Courtesy Allis-Chalmers*

THE BABY COMBINE

Can be used for harvesting small grain and for threshing the seed of all crops. This, in the opinion of many agricultural engineers represents the most significant advance in farm equipment made since the invention of the reaper.

enough that the roots become well established, and thus are less likely to be winter killed.

Any size drill may be used from a one-horse implement such as can be run between rows of cotton, to a twelve-foot machine which requires from four to six horses.

Fertilizers.—Nitrogen seems to be the controlling factor in making a large crop of oats in the South.

At the Alabama Station, oats without fertilizer made 18.4 bushels per acre; with 100 pounds of nitrate of soda a yield of 38.4 bushels was made; when the nitrate of soda was increased to 468 pounds of nitrate, the yield per acre was 68.4 bushels.

Nitrogen may be supplied, at least in part, by turning under green manure crops. Commercial nitrogen must be applied in a form immediately available. It is usually applied as a top dressing.

If the crop preceding oats has been heavily fertilized, no commercial plant food need be added. Virginia, however, recommends 200 to 400 pounds of 4-12-4 at the time of seeding, in addition to top dressing.

For sections where commercial fertilizer is commonly used, Tennessee (Bulletin 136) makes the following recommendation:

1. For oats alone—150 pounds of acid phosphate to the acre, to be applied at seeding time; and 50 pounds or more of nitrate of soda, usually to be top-dressed in early March for fall-sown oats, but if the seeding was late and there is need of increasing the fall growth to enable the plants to go safely through the winter, the nitrate may well be applied in the fall soon after the plants come up. A spring application of nitrate may be of much value in overcoming injury from aphids, which are appreciably less destructive on nitrated than on unnitrated oats, unless the soil be rich, in which case nitrate is inadvisable. In the case of spring-sown oats the nitrate should be applied as a top-dressing as soon as the plants are up.

2. For oats with alfalfa or clover and grass—when either alfalfa or a mixture of clover and grass is to be sown with the oats, the amount of phosphate may well be increased to 300 pounds per acre, on account of its value to the hay crops which follow the oats. Also, if the soil belong to the poorer class, which is somewhat in need of potash, 50 pounds of muriate of potash, or its equivalent of other potash salt, is advised, to be mixed with the acid phosphate. The addition of the potash salt is not expected to increase the oat yield but to be of value to the clover and grass crops. No change is advised in the nitrate application, especially as a too heavy growth of oats is unfavorable to the clover and grass.

Harvesting.—The time of harvesting will depend upon the use to be made of the crop. If fed green, as a "soiling" crop, it may be cut from the time the head forms until it is almost ripe. Oats may not be used for a soiling crop as early as wheat or rye, but the quality of the feed is vastly superior to other small grains.

If the crop is to be fed to stock without threshing, it should be cut before the plant becomes too dry. When harvested for threshing, most of the grains should change color and be in the late dough stage or riper.

If the crop is to be used as hay, it may be cut with a mower and handled as other hay crops. If threshed, it may be cut with a binder and shocked for threshing at a later date, or may be harvested in one operation with a combine. If cut with a binder, oats may be fed from the sheaf. This makes a feed that will winter horses and mules in a satisfactory manner. If cut with a combine, the straw falls on the land and should be turned under.

There is no problem in marketing oats in the South. They are produced for feed. In fact, more than 60 per cent of the national oat crop is fed on the farms where it is grown. There is a cash market for oats in the South, however, and at the average price for a ten-year period, and at the average yield for the South during the same period of time, oats have been more profitable than corn.

SUGGESTIONS FOR STUDY

Questions and Problems

1. How does the acreage devoted to oats in the United States compare with that devoted to corn? How does the acreage compare with that of wheat?
2. If the average acre yield of oats is 30 bushels, what is the average total in bushels of the American crop?
3. Are there any states in which oats are not grown? Where do oats make the largest yields? Why?
4. What per cent of the oat crop is grown in the South?

5. Why is the price of oats higher in the South than in other parts of the country?
6. What are the leading states in the South in oat production?
7. How are oats used on the farm? Why are oats prized as live stock feed?
8. Why are oats a desirable crop? How do they compare with other crops in cost per acre? in labor per acre?
9. Why are the yields of oats in the South lower than in the Northern states?
10. Why do oats fit into most any rotation? Give an example.
11. What are some of the values of the oat crop, other than its feed value?
12. How is a cover crop related to the saving of plant food?
13. Give the soil and climatic adaptations of oats.
14. How can the water-holding qualities of the soil be increased?
15. Give the rate of seeding for oats recommended in your state. Discuss.
16. What are the most popular varieties of oats grown in your state?
17. Which do best in the South, fall sown or spring sown oats? Why?
18. Can oats be planted in the fall in the North? Why?
19. Which can better stand winter cold, wheat or oats?
20. When should oats be planted? In the fall? In the spring?
21. How should oats be planted? How should the ground be prepared? Why is seeding with a drill better than broadcast seeding?
22. What is the most serious enemy of oats? How is it controlled? Which method is best? Why?
23. If an oat crop is cut 20 per cent by smut, what is the loss per acre at the current prices and at the average yield for your state? How does this loss compare with the cost of production per acre?
24. What does it mean to say that seed *runs out?* Where should seed oats be secured with respect to locality?
25. What fertilizers are required for oats, generally? In your state?
26. Based upon the present price of nitrate of soda, what was the cost of the increased yields per acre in Alabama when 100 pounds of nitrate were applied? When the larger application was used? Which paid the largest net return?

27. How may oats be harvested? What machinery is required for each method? Which do you prefer? Why?
28. What is a combine? How much does one cost? Can an individual farmer afford to own one?
29. What is meant by the term *custom threshing?*
30. Discuss the marketing of oats.

Selected References

Farmers' Bulletins, U. S. Department of Agriculture

507—*The Smut of Oats.*

1640—*Fall Sown Oat Production.*

State Publications

Alabama—Circular 60—*Small Grain Crops in Alabama.*

Arkansas—Bulletin 301—*Oat Production and Variety Studies.*

Maryland—Bulletin 347—*Oat Variety Tests.*

Georgia Experiment Station—Circular 110—*Oat Smut Control.*

Tennessee—Bulletin 136—*The Oat Crop.*

Georgia Extension Service—Circular 272—*Treating Seed Grain.*

Georgia Coastal Plain Station—Bulletin 15—*Small Grain Production in the Coastal Plain.*

Suggested Activities

1. Make a summary of oat production in your community under the following heads: (1) varieties, (2) uses, (3) fertilizer requirements, (4) soil adaptation, (5) time of planting, (6) rate of planting, (7) method of planting, (8) harvesting for hay, (9) harvesting for grain, (10) machinery required, (11) hours of labor—power and man, (12) the rotation, (13) advantages and disadvantages of crop, and (14) trend in acreage, increasing or decreasing.
2. From the feeding practices on your farm or from the figures given in the chapter on *Living-at-Home,* calculate the number of bushels of oats, or the total production, that you can use and the acreage required for the supply needed.
3. Treat oats for smut according to the accepted method. This can best be done at the home of one of the members of the class.
4. In your shop, make a machine for the treating of small grain with ceresan.

5. At your local implement dealers, or at some other convenient place, make a study of drills and other machinery used in sowing and harvesting small grain. Record in your notebook the cost of this machinery.
6. Below you will find the analysis in percentages for oats, corn, corn stover, and oat straw:

Feed	*Total Dry Matter*	*Protein*	*Fat*	*Carbohydrates*
Corn	87.2	9.6	4.0	71.1
Oats	91.1	12.0	4.7	60.2
Corn Stover	90.6	5.9	1.6	46.5
Oat Straw	89.6	4.0	2.3	41.2

When the average yield of corn is ten bushels per acre and the yield of stover is 0.85 tons, how does it compare in total pounds of feed with a yield of 22 bushels of oats and 0.60 tons of straw? What would the yield of oats have to be per acre to make it a more valuable feed crop than corn at the average acre yield for your state? Compare the feeding value of oats and corn for all classes of livestock.

Chapter 33

WHEAT AND OTHER SMALL GRAINS

T. S. BUIE

WHEAT is one of America's basic cash crops. The average annual production has a value of more than half a billion dollars. Only two other crops, corn and cotton, exceed it in value.

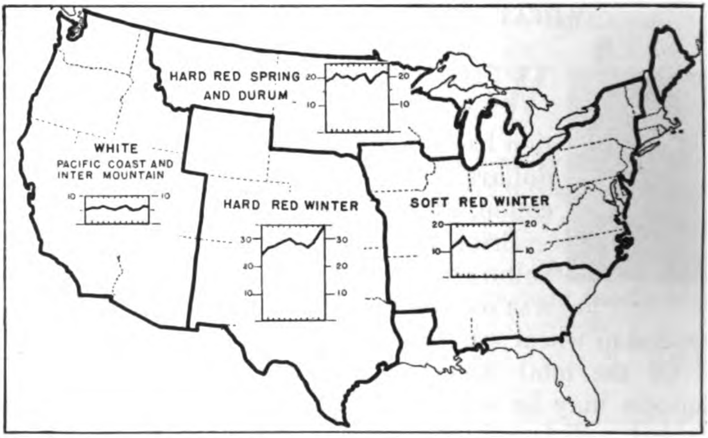
Prior to the inauguration of the Agricultural Adjustment Administration, there was only one year in twenty when the land seeded to wheat was less than 50 million acres.

Of the total American crop, perhaps 450 million bushels may be sold in one year for cash, 15 million bushels will be milled for use on the farms where it was produced, 85 million bushels may be fed to livestock, and at least 75 million bushels will be required for seed.

About 25 per cent of the wheat of the United States is produced in fifteen Southern States. But only in two states, Oklahoma and Texas, is it a commercial crop of importance. Oklahoma seeds about four and one-half million acres to the crop annually. Texas, which ranks third among the states in wheat production, devotes almost four million acres to the crop.

Kansas, which ranks first in wheat production, plants more land to the cereal than all fifteen Southern States, including Texas and Oklahoma. Thus it may be deduced that wheat in most Southern States is grown mainly as a home supply crop.

The average acre yield of wheat is lower in the United States than in any other major producing nation, but our production per worker is greater than that of any other nation. For one five-year period our national average was only 14 bushels per acre. During this same period, the average yield for the South Atlantic States was 8.6



THE WHEAT-GROWING REGIONS
Showing the increased acreage over a ten-year period.

bushels; that of the South Central States was 7.6 bushels. At the average price of wheat such a gross income per acre is not appealing.

Soil Requirements.—Some type of wheat is grown in every part of the United States, consequently one might naturally assume that the crop was adapted to a wide range of soil conditions.

Wheat does better on a clay or loam soil than on one that is sandy. The most suitable soil for the crop is a clay soil with a large lime content. Wheat does not thrive on acid soils. Often a large application of lime will make a sour soil suitable for wheat when otherwise the crop could not be grown on that land.

Wheat requires a rich soil. There are many soils in the South that, with the addition of vegetable matter, would produce wheat profitably. This holds true for other crops as well. The profits from any crop depend

TEST PLATS ON THE COKER SEED FARM

very largely upon the yield per acre, and probably there is no practice that would more rapidly increase yields than that of turning under legume crops such as vetch, clover, cowpeas, and soybeans. Some of the largest yields of wheat that have ever been recorded have been produced in the Piedmont section of the South on "heavy" lands on which cotton matured too slowly to be profitable in years of unusual boll weevil infestations. These yields were made on land that had been limed and which contained a large amount of humus resulting from the practice of turning under soil-improvement crops.

Varieties.—The Alabama Experiment Station has suggested the following essentials for a variety of wheat adapted to the Cotton Belt: (1) it must be of the type desired, that is, soft red; (2) it must be productive;

(3) it must be early as a means of reducing the possibility of injury from rust; (4) it must have plump grains, and a moderately heavy weight per bushel, preferably fifty-nine pounds or more. Furthermore, it is stated that acclimated varieties are desirable and that, other things being equal, a beardless variety is preferred.

All varieties of wheat may be divided into two groups —bearded and beardless. The beardless varieties are preferred by most growers, especially in the South because they are easier to harvest with the usual machinery and are better adapted to use as a hay crop.

Among the most popular varieties of wheat in the South we find the following: Fulcaster, Flutz, Stoner, Mediterranean, Purplestraw, and Currell's prolific. In the commercial wheat region of Oklahoma the Kanred, Turkey, and Malakof varieties are popular. Some of the highest yields ever recorded in the Southeast have been made with Coker's Redheart, which is early and smut resistant. Experiment stations in most of the Southern States conduct variety tests of wheat and will be glad to send the results of these tests to any persons interested.

Amount of Seed Required.—From four to six pecks of seed wheat will be required per acre. Since wheat tillers more on fertile soil, less seed need be sown on rich than on poorer soils.

Preparing the Land.—When wheat follows a cultivated crop that is removed sufficiently early, the soil can usually be prepared for seeding by the use of a disc and ordinary harrows. As soon as the previous crop is harvested, the land should be disced to prevent the growth of weeds and grass. A second discing, followed by harrowing, is given just before the seed is sown. If there are weeds on the land, it may be necessary to plow.

When wheat follows cotton the stalks should be plowed under as soon as the picking has been completed. Plowing should bury the stalks completely. The land should then be firmed with a roller and the wheat sown with a disc drill.

THE RESULTS OF PHOSPHATE AND LIME
The test plat on the left received a generous application of superphosphate and lime. That on the right was unfertilized. This demonstration was conducted in Tennessee.

When wheat follows any but a cultivated crop, the seed-bed should be prepared by plowing the land to a depth of six or seven inches several weeks before seeding. It should then be harrowed at once, and afterwards worked down with a disc, harrow, drag, or roller in such a manner as to kill all weeds, settle the subsoil, and keep the top well broken up. When it is necessary to plow just before seeding, as is often the case, the soil should be compacted by rolling and harrowing several times before seeding. In any event, when it is time to sow the grain a fine, mellow, seed-bed should be prepared by using the harrow or roller.

Time of Seeding.—Wheat, though much hardier than oats, should be sown early enough to allow the plants to get well started before winter. On the other hand, hot weather retards growth and gives an opportunity for injury from insects. A planting date has been determined for each state by the test work of the experiment station. It is advisable to secure this for any state or major subdivision. In general, it may be said that wheat is sown in October. In the northern portion of the United States, planting is earlier than October 15; in the southern portion, it is later.

Fertilizers for Wheat.—Wheat does not do well on a sour soil. While lime is not a plant food, in the usual sense of the term, it helps the production of wheat by overcoming an acid condition. On land that gives an acid reaction, it is advisable to apply two tons of ground limestone per acre every three or four years.

On soils of average fertility, it is usually recommended that an application of from 200 to 400 pounds of a complete fertilizer be applied at the time of seeding. This fertilizer should be something like a 4-12-4.

Wheat responds well to nitrogen. A top dressing in the spring is recommended on land where the straw is likely to be short. In the southern tier of states this application should be made about the first of March.

Controlling Smuts of Wheat.—Wheat is affected by two kinds of smut, loose-smut and stinking-smut. Loose-smut affects the entire head of the plant, forming a black mass. Stinking-smut affects only the kernels which, instead of developing naturally, become filled with a dark, smeary, dustlike mass, which has an objectionable odor. The following treatments are recommended for control:

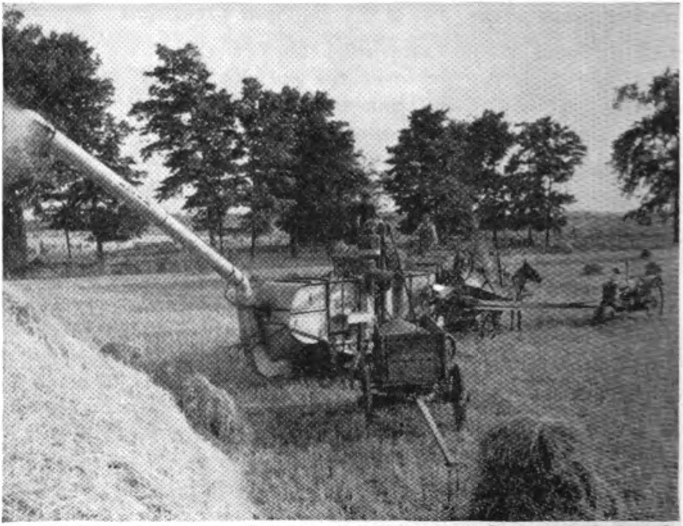
TREATMENT OF SMUTS IN WHEAT

Kind of Smut	*Seed Treatment*
Stinking-Smut	Powdered copper carbonate is dusted over the surface of the grain at the rate of two ounces per bushel. A barrel churn or similar receptacle may be used in the dusting operation. Grain may be sown immediately after treatment or stored indefinitely.
Loose-Smut	Soak grain in cold water for four hours, next temper in water held at 120 degrees for one minute, then treat in water held at 129 degrees for ten minutes. Spread grain on floor in thin layer to dry. If grain is not thoroughly dry at time of seeding, set drill to allow for swelling.

As can be fully appreciated, the hot-water treatment is one quite difficult to handle properly. Unless directions are followed carefully, the germination of the seed may be reduced. This is a great hazard and one cannot afford to take a chance in injuring the seed. As a safeguard it may be advisable to use the hot-water treatment only on a seed plat. This plat should be so located that the spores cannot be carried to it from infected fields. The spores are often carried a quarter of a mile.

In making the hot-water treatment only a small quantity of seed should be treated at one time so that the desired temperature may be reached quickly. For convenience, the seeds may be placed in sacks or baskets in lots of about one gallon.

Harvesting.—Wheat is generally harvested with a self-binder. It should be cut when the straw turns yellow, and the grains are soft enough to be indented by the finger nail, but too hard to be crushed between the thumb



—*Courtesy J. I. Case Co.*

THRESHING WHEAT

This illustrates the only method of harvesting grain prior to the use of the combine and is still employed extensively. It permits the saving of straw without additional labor.

and finger. The bundles should be shocked in the field, and carefully capped so that the rain cannot run down into the shock and injure the grain. After curing for a time, the grain is usually threshed by crews that move from farm to farm.

Of course, on farms where wheat is the major source of income, the harvesting will be done with the combine which performs all the operations at one time. This is a great saving in labor and has reduced the cost per bushel of growing wheat. Often one or more farmers in a community own a combine or separator and harvest wheat on a custom basis.

Barley

Barley.—Rarely more than 10 million acres are planted to barley in the United States. Here is an opportunity to compare the importance of the crop with wheat and oats. The usual yield per acre is from 17 to 25 bushels. The price per bushel within a period of ten years has varied from 22 to 80 cents.

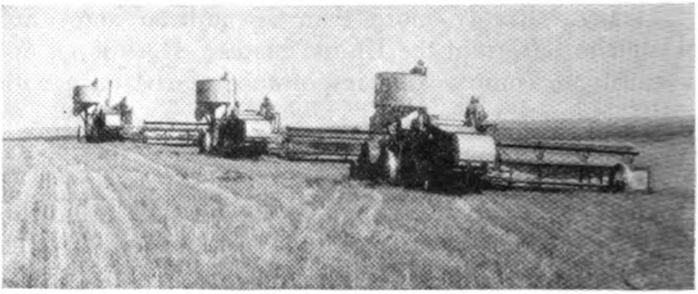
For the most part, barley is grown only in the Northern States. It is not generally recommended for the South. It requires a rich soil. Where it can be grown, it is an excellent feed crop which can be substituted for corn. The amount of barley feed that can be grown on good soils in the South compares most favorably with corn. It is a short-season crop with a relatively small labor requirement, as are all other small grains. Green barley ranks first among the small grains as a pasture crop.

In the Cotton Belt, barley may be sown between the first of September and the first of December. When sown broadcast for pasture, it is advisable to use two and one-half bushels of seed per acre. When drilled, less seed, from six to eight pecks, is needed.

Rye

Rye.—Rye, grown alone, is relatively unimportant from a national standpoint. The usual acreage for the United States rarely exceeds two million acres. It is a "poor land" crop and is used extensively to *bring back* eroded land that has been *lying out* until much of the topsoil has been removed. It is grown extensively, however, in winter hay crop mixtures in the South.

Rye is sown exactly in the same ways as other small grains. It may be sown over a wider period however than wheat, oats, or barley. It is the earliest of the small grains. On rich land, rye sown early in the fall may be



HARVESTING WHEAT

This scene in the great wheat-producing region of the West explains how one acre of wheat may be harvested with thirty minutes of man-labor. Prior to the use of the combine thousands of persons from all parts of the country found summer employment in the harvesting of the grain crop.

cut three or four times as a soiling crop, the first cutting being made in December or January. In order to obtain several cuttings, the plants must be cut just before the heads appear. Rye for pasturage must be kept rather closely grazed in the spring; some tall heads will appear which are not readily eaten by livestock.

SUGGESTIONS FOR STUDY

QUESTIONS AND PROBLEMS

1. Give the relative importance of the wheat crop in the United States. In the Southern states. In Kansas.
2. What are some of the factors to be taken into consideration by the Southern farmer in determining whether to grow wheat? What are the advantages, the disadvantages?
3. How much wheat is required to supply the needs of your farm? How much might be used?

4. How does wheat compare with oats as a Southern crop? Which is preferred? Why?
5. Give the soil requirements for wheat. For oats. Which has the wider adaptability?
6. What are the popular varieties of wheat in your community? In your state?
7. How much seed is required per acre? How does this compare with the other small grains? Why?
8. How is the land prepared for wheat? Why is a well packed seed-bed important? How is it secured?
9. What implements and machinery are required for growing wheat?
10. Give the fertilizer requirements for wheat in your locality.
11. How does the time for sowing wheat compare with the time for sowing oats? Why is there a difference? Which is more easily winter killed?
12. Discuss the smuts of wheat. How are they controlled?
13. Discuss the place of barley and rye in the farm program for your community.
14. What are the "jobs" in growing small grains? How do the hours of labor used in producing small grains compare with those for other crops? How does this affect cost of production?

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885—*Wheat Growing in the Southeastern States.*
1062—*Buckwheat.*
1305—*The Soft Red Winter Wheats.*
1429—*Emmer and Spelt.*
1464—*Barley: Culture, Uses, and Varieties.*
1544—*The Common Barberry and Black Stem Rust.*
1711—*Wheat Smuts and Their Control.*
Department Circulars, U. S. Department of Agriculture
378—Comparative *Hardiness of Winter Wheat Varieties.*
Miscellaneous Publications, U. S. Department of Agriculture
96—*Feeding Wheat to Livestock.*
Yearbook Separates, U. S. Department of Agriculture
846—*The Cost of a Bushel of Wheat.*

Suggested Activities

1. Make a study of the growing of all small grains in your community giving the results in a table in which you will show: (1) the acreage devoted to each, (2) whether the acreage is increasing of decreasing, (3) the varieties of each, (4) the date of seeding, (5) the rate of seeding, (6) the fertilizer applied, (7) the extent of disease injury, and (8) the method of harvesting.
2. At the home of one of the members of the class or in the school laboratory, treat wheat for loose-smut and stinking-smut. Plant a test plat to determine the extent of control and the effect upon germination of the treatment.
3. Bring samples in the sheaf of the wheats grown in the community to the laboratory and compare for color, size of grain, plumpness, and other characteristics of importance.

Chapter 34

SORGHUMS FOR GRAIN, HAY, AND SILAGE

W. E. WILLIAMS

THE sorghums merit a more important place in Southern agriculture than they now occupy in most sections. They may be used as grain, hay, and silage. Sweet sorghums are used for making sirup.

Sorghums are better adapted to the South as a whole than corn. Our corn yields in many states are too low to be profitable. This is due in the main to the unfavorable distribution of rainfall. In the Corn Belt it is said that the total corn yield can be forecast from the July rainfall. This means that there is a critical period in the life of the corn plant when it must have an ample supply of moisture. If this is not available, then the yield is cut materially. Often in the Southern summer there is a period of little rain which, unfortunately, may come when corn needs an abundance of water. As a result, in such years our yields are very low. On the other hand, sorghums have a popularity due mainly to their ability to resist drought.

It has been quite definitely proven that for most of the Southern States sorghum is superior to corn for silage.

There are four types of sorghum. These are: (1) grain sorghums; (2) sorgos, or sweet sorghums; (3) broomcorn; and (4) grass sorghums, such as sudan grass.

Sudan grass is a superior summer forage crop. It is used extensively as a pasture supplement and a hay crop. The popularity of Sudan grass is increasing as

Sorghums are for the most part natives of Africa, and most of the varieties now grown in United States originated on that continent.

It is estimated that in 1924 more than 5,000,000 acres of sorghum were grown for forage in the United States. Most of this acreage was located in the Southeastern States and in the southern half of the Great Plains.

The principal varieties of the sweet sorghums, considered from a forage standpoint, are the Black Amber, Orange, Sumac, Honey, Atlas, and Gooseneck. The grain sorghums most valuable for forage are Hegari and the Blackhull, Red, Pink, and Dwarf kafirs.

There is little difference in the yield of sorghum planted in rows 40 inches apart and that sown in close drills, but the cultivated rows are most dependable in seasons of low rainfall.

Sorghum which has matured, or at least headed, not only makes a better quality of fodder but is less dangerous to pasture.

Sorghum varieties hybridize freely, and lack of uniformity can be prevented only by constant attention to the purity of the seed used. Each farmer should select in the field the seed intended for his own plantings.

Sorghum is most useful as a hay crop in the Southern States because of its certainty of producing a crop and on account of the failure of ordinary hay crops, such as timothy and alfalfa, in that section.

Both the sweet sorghums and the grain sorghums are excellent silage crops. Stockmen in the Great Plains area can avoid the loss of thousands of cattle by feeding sorghum silage which has been stored at a small expense in pit silos.

The most serious disadvantage in the use of sorghums as a pasture or soiling crop is the danger of prussic-acid poisoning.

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more Southern farmers learn of its superior qualities.

Broomcorn is a specialized crop grown for its *brush.* It may be produced in any part of the United States. Unless grown on a community basis, few farmers would be interested in producing broomcorn.

Grain Sorghums.—Grain sorghums were introduced into this country from Asia and Africa. In the Far East they constitute a crop of major importance and are used for human food. In the United States grain sorghums are grown mainly in the Southwest. In Texas and Oklahoma they are used as a corn substitute to a great extent. The annual production is in excess of 100 million bushels.

The average yield of grain sorghums in this country is about 16 bushels per acre. Under favorable conditions in the Great Plains, yields of from 25 to 60 bushels per acre are not uncommon. The average price is slightly lower than that of corn.

For all kinds of stock, other than sheep and poultry, grain sorghums must be ground. They make an excellent feed for poultry and are included in most mixed feeds found on the market. The nutritive value of grain sorghums, as compared with corn, is shown in the following table:

GRAIN SORGHUM COMPARED WITH CORN

		Digestible Nutrients		
Feed	*Dry Matter*	*Crude Protein*	*Total Nutrients*	*Nutritive Ratio*
Feterita	90.9%	10.8%	80.2%	1: 7.4
Kafir	90.5	9.9	78.7	1: 7.9
Milo	90.7	8.1	80.6	1: 8.9
Dent corn	87.1	7.1	81.9	1:10.5

The popular varieties of grain sorghum, of which there are more than forty now grown in the United States, include: milo; feterita; durra; kafir; and hegari.

Sorghums mix badly. Hybrid seed is objectionable. Seed for planting should be pure, which means that it must be obtained in the beginning from a reliable source and keep pure by selection and by taking precautions against mixing, especially in threshing. A seed patch is recommended.

To prevent loss from smuts and seed rots, sorghum seed should be treated with ceresan in the same manner as recommended for small grain and cotton.

Sorghum is a warm-weather plant. It is usually planted in late May or early June, which makes the crop very desirable from the standpoint of fitting in with rotations that include winter cover crops.

The crop is ordinarily planted in rows 40 or 42 inches apart with the plants from 2 to 6 inches apart in the row. Planting is done with a lister or corn planter.

Sorghum does not germinate well; in many instances not more than 50 per cent will germinate. In the states where sorghum is grown extensively, it is the practice of the best farmers to test seed for germination. They either do this themselves, or send the seed to the state laboratory. About 3 pounds of good seed is required per acre, but because of the low germination often obtained, and because when the soil is too cold or the weather too damp many seeds rot before sprouting, usually 4 or 5 pounds of seed are planted per acre.

Grain sorghums are harvested by hand, by special machinery, or with combines. If harvested other than with a combine, the grain is threshed with a separator.

Important Steps in Growing Grain Sorghums. —E. A. Miller, Extension Agronomist for Texas, summarizes the important steps in growing grain sorghums as follows:

(1) Terrace the land if it is subject to washing, or in west Texas if there is any water run-off.

(2) In northwest Texas, prepare the land by deep listing or flat breaking in the spring. Preparing the land in the spring in that section will give as good yields as when listed or plowed early. In other sections, prepare the land similar to that of corn.

(3) It is suggested that the crop be fertilized in the sandy sections, except in west Texas, similarly to corn, by applying from 150 to 200 pounds, of a mixture having approximately a 1-3-1 ratio, such as 4-10-2 or 4-12-4. A side dressing of 100 pounds of a high grade nitrogen fertilizer may also be made.

(4) Plant only well bred pure line seed which was bred by the Agricultural Experiment Station or by breeders. At the Lubbock Experiment Station Dwarf yellow milo, Spur Feterita and Texas Blackhull Kafir, gave the highest yield and at the Beeville Station, Texas Blackhull Kafir and Hegari have been the best yielders.

(5) Do not plant grain sorghum seed too early. In northwest Texas, the best dates are from May 15th to June 15th. If planted earlier, the plants will head out during the dry summer period and will result in a low yield. Kafir may be planted somewhat earlier than the other grain sorghums. Hegari should never be planted until the ground has become thoroughly warmed up. At the Beeville Station, in south Texas, Kafir gave the best results when planted from March 10th to April 20th and Hegari when planted in May.

(6) The seed should always be treated if any kernel smut is present. Even if there is no smut, it usually pays to treat the seed on account of getting a better germination. Especially is this true of such sensitive seed as Hegari and Feterita, which do not germinate well unless moisture and soil temperature conditions are favorable.

(7) The treatment consists of placing the seed in a tight container such as a barrel, churn, or box, arranged so that it can be revolved on an axis, sprinkling two to three ounces of powdered copper carbonate on the seed and then revolving the container so that every seed receives a coating of the powder.

(8) Do not plant too thick. At the Lubbock Station, the best yield of Kafir has been obtained by spacing the plants from 3 to 6 inches apart, in 3 to 4 foot rows and for Milo Maize by spacing the plants from 24 to 36 inches apart. The difference in spacing is due to the ability of Milo to produce suckers, and thereby adapt itself to conditions of moisture.

Grain sorghums should be planted either in normal 3 to 4 foot rows or in paired rows, but not in 6 foot rows, since the wide rows give considerably smaller average yields.

(9) Do not cultivate deeper than 2 to 3 inches, after the first cultivation, because yields are often greatly reduced by cutting important feeder roots when cultivating too deeply. Experiments have proved that the main object of cultivation is to keep down weeds.

(10) If any off-type or hybrid stalks appear in the field, they should be pulled up to prevent any crossing with pollen from the hybrids.

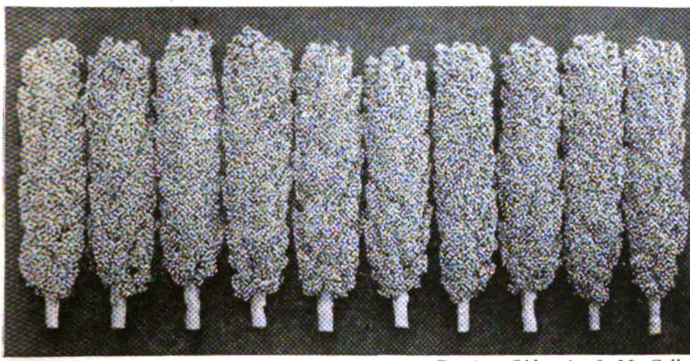
(11) If pure line pedigree seed has been planted, select a sufficient amount of seed from vigorous stalks, producing plump and well matured seed for planting the following season.

(12) Thresh the planting seed by hand on a washboard to prevent the seed from cracking, or with a handthresher, and store in a dry place away from rats. If necessary, fumigate with highlife in a tight bin for 24 hours at the rate of ½ lb. for every 100 cubic feet of space, and then thoroughly ventilate so as not to injure the germination. Keep fire away from highlife, as it is very inflammable.

(13) Harvest the crop as soon as it is ready, as otherwise it may be seriously damaged by being exposed to the weather and birds.

(14) The crop may be harvested for grain either by hand, or with a header attachment on a wagon, or with a combine. For forage, the bundles should be harvested with a row-binder. Milo Maize is harvested almost altogether for the grain only, on account of its dry stalk, whereas the other grain sorghums are harvested a great deal for forage as well as grain.

Stock Poisoning.—Sorghums may be pastured, but we are warned that (Farmers' Bulletin 1764) "*stock are sometimes killed by grazing on sorgo and grain sorghums, particularly on second growth plants.* Stunting may be caused by extreme drought, or other adverse conditions. At such time prussic acid, a deadly poison, sometimes accumulates in the plant tissue. When eaten by livestock in sufficient amounts, it causes poisoning, which is usually fatal. As the plants have this poisonous property only when under certain conditions, losses may be largely avoided by using care and not turning stock on wilted, stunted, or frosted sorghums. No losses have been reported from poisoning in feeding the grain, heads, silage, hay, or stover of the grain sorghums."



—*Courtesy Okla. A. & M. College*

PRIZE-WINNING BLACKHULL KAFIR

Sorgos (Sweet Sorghums).—The sweet sorghums, commonly called "cane," are grown over a much wider area than grain sorghums. There is almost no part of the South in which cane cannot be grown.

While it is true that the grain sorghums are used for silage to some extent, the sweet sorghums are superior for this purpose. They are superior as forage plants and are used extensively for hay and fodder.

The value of sweet sorghum, as compared with corn and grain sorghum, in feeding beef cattle is shown in the table on p. 423, which represents work done at the Kansas Experiment Station.

In the beef cattle test, in addition to the silage fed, each of the animals received about one pound of a pro-

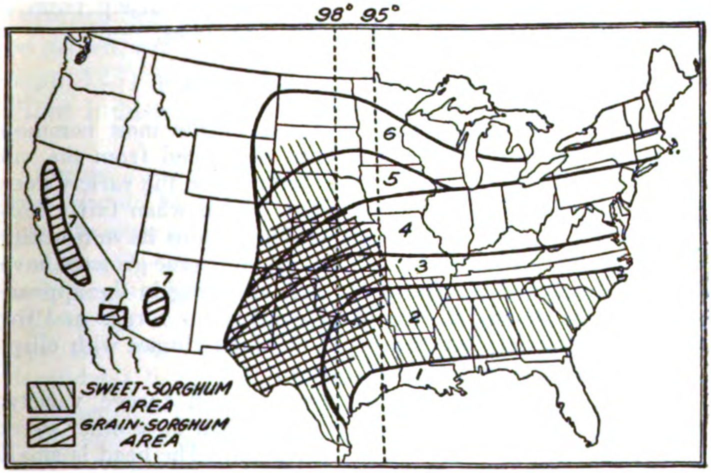
—*Courtesy Okla. A. & M. College*

Milo Stacked to Prevent Heating

SWEET SORGHUM SILAGE SUPERIOR FOR BEEF ANIMALS

Silage	*Yield Per Acre (tons)*	*Silage Fed Daily (pounds)*	*Gains from Silage Per Ton*	*Gains from Silage Per Acre*
Kafir	10.66	27.29	95.03	1013
Sweet Sorghum	16.93	27.55	81.28	1376
Corn	12.11	27.39	85.80	1039

tein supplement each day. Incidentally, it is of the most vital importance to realize that in sweet sorghum silage and cottonseed meal the South has two feeds of superior value which are peculiar to this part of the country, and



SORGHUM-GROWING REGIONS OF UNITED STATES

which make a balanced and desirable ration for feeding beef animals.

Sweet sorghums are even more valuable as silage for dairy animals. Tests made in Oklahoma show a milk production per acre twice as large as that for grain sorghums. They also report tests in which approximately 20 tons of silage were produced per acre.

Varieties.—The popular varieties of late sweet sorghums include honey and gooseneck; the medium maturing varieties include orange, sumac, and atlas.

Late Varieties

Honey. This is the most common late variety. It is used for syrup more than for fodder and silage since the yields of sweet, juicy stalks are very high. The heads of this variety are very open and spreading. The seed is nearly covered with reddish glumes which are usually retained on the threshed seed.

Gooseneck. This variety is even later than the honey. The gooseneck has brown seed and black glumes. The head is rather loose but not spreading, and tends to droop from a crook neck. It is one of the best syrup varieties.

Medium Maturing Varieties

Orange. The orange variety is one of the most common varieties. Several strains have been developed from the variety. As ordinarily found on the seed market, the variety does not develop a uniform type of plant. Even when fairly uniform seed is planted, the variety seldom retains its uniformity unless previous selections have been made. Some growers have selected heads and increased the seed, resulting in the appearance of pure strains of considerable value for forage and for syrup. The variety may have red or black glumes with elliptical seed of various shades of brown.

Sumac. Sumac is another very common forage variety. The plants are usually somewhat shorter than most other sweet sorghums, but the yields are usually good. The head is small and compact with small dark red, ovate seed. The variety is sometimes called "redtop" because of the appearance of the head.

There are two distinct strains of the sumac, a medium maturing strain, and an early one. The early one, known as early sumac, was developed by the Hays Branch Experiment Station, Hays, Kansas. It is of value where the seasons are too short for the regular sumac to mature. Some prefer it as a broadcast cane, believing it to be somewhat finer stemmed. The forage yields of the later maturing variety are nearly always the greater.

Various other selections have been made, but most of them are very similar to the common sumac.

Atlas. This variety was originally developed by I. N. Farr, of Stockton, Kansas, as a cross between sourless and blackhull kafir. It was later selected and improved by the Kansas Agricultural Experiment Station. The variety is medium in maturity, having white ovate seed and black glumes. It produces good yields and is superior to many varieties in its lodging resistance. The grain is very similar to kafir, allowing the variety to be used for both grain and forage.

Local Adaptation.—Local adaptation of the several parts of the nation for the growing of sorghums, and the varieties best suited to the purposes for which they may be grown, are given in the following outline (see map on page 423) prepared by agronomists in the Bureau of Plant Industry, U. S. Department of Agriculture:

Region 1.—For forage: Japanese sugar cane and Napier grass should be grown in preference to the sorghums, because they are more productive.

Region 2.—For forage: Sumac, Orange, Honey, and Gooseneck sorgos. For grain and forage: Corn and oats are preferable to the sorghums except in the section shown by crosshatching; there, Blackhull kafir and Dwarf hegari are more dependable than corn except on the river bottoms.

Region 3.—For forage: Sumac and Orange sorgos. For grain and forage: East of the 95th meridian, corn and the small grains; between the 95th and 98th meridians, Blackhull kafir; west of the 98th meridian, Dwarf kafir, Sunrise kafir, and Dwarf milo, with a small acreage of feterita as insurance against drought.

Region 4.—For forage: West of the 98th meridian, Early Sumac sorgo; east of the 98th meridian, Orange and Atlas sorgos. For grain and forage: East of the lined area, corn and the small grains; that portion of the lined area east of the 98th meridian, Blackhull and Pink kafirs on the uplands, corn on the river bottoms; west of the 98th meridian, Dwarf kafir, Pink kafir, Dwarf milo, and feterita.

Region 5.—For forage: Dakota Amber and Minnesota Amber sorgos. For grain and forage: In all except the lined portion, corn and the small grains; in the lined part, corn, feterita, Freed sorghum, White milo, and Dwarf milo.

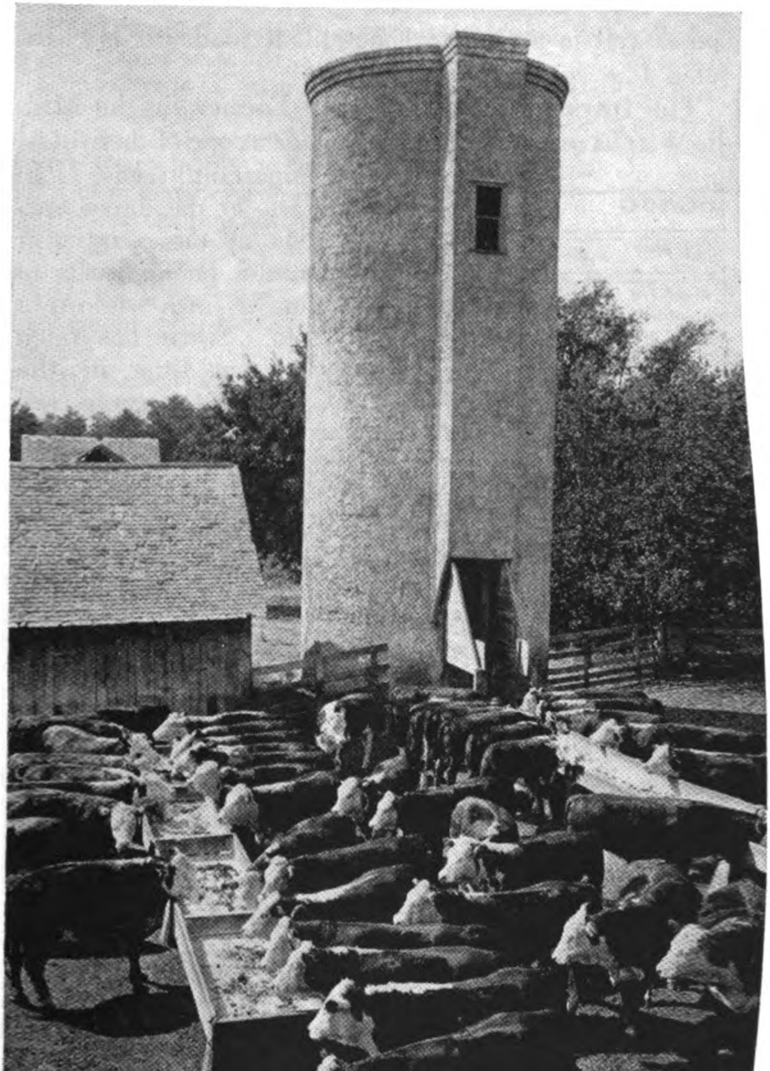
Region 6.—For forage: West of 98th meridian, Minnesota Amber and Dakota Amber sorgos. For grain and forage: Early varieties of corn and the small grains.

Region 7.—For forage: Honey, Gooseneck, and Sumac sorgos. For grain and forage: Dwarf milo and Dwarf hegari.

Sweet Sorghum for Silage.—Sweet sorghum may be used as a hay crop alone or with a legume, preferably peas. It is an excellent plant for this purpose and may be sown broadcast late in the season. Sorghum cane may be fed in the form of fodder, but it is as silage that it may be used more extensively and wisely. It will, as has been stated, make larger yields than corn.

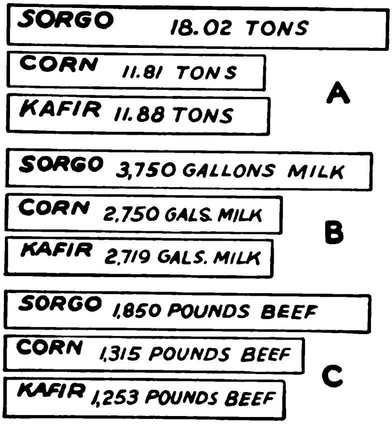
Until recent years sorghum was not valued highly as a silage crop. This was largely because farmers did not understand the necessity of allowing the crop to ripen before it was cut. Silage made from immature sorghum is sour and does not keep well. When sorghum is not cut until the seeds are hard, the silage has less acid than corn silage and keeps fully as well.

When planted for silage in *Region 2* the first half of May will prove to be a satisfactory date. The greatest tonnage will be secured when planted on good bottom land that has plenty of moisture. It will make excellent yields on uplands that contain a liberal supply of humus. Approximately one peck of seed per acre should be used; this is 12.5 pounds. This rate of seeding provides for three and one-half foot rows. Any of the varieties suggested in the regional chart will prove satisfactory for the section indicated but most states have a preference for one or two varieties. Barnyard manure is a desirable fertilizer for sorghum, but sorghum will re-



The Growing Livestock Industry of the South Makes More Silage an Essential spond well to any nitrogenous plant food. It is cultivated like corn.

The Importance of Silage.—Farmers in the Middle West have always regarded silage as one of their most important feeds. In fact, in the dairy section of the country it would be difficult to find a farm without a silo. Silage has been fed but little in the South, as compared with other sections of the country. But as the agricultural program is adjusted to a better balance, as we tend to live-at-home more than formerly, and as we bring more livestock into the farming operations of this section of the country, it will be necessary to produce and feed more silage in the South.



THE SUPERIORITY OF SWEET SORGHUM

This graph illustrates the superiority of sweet sorghums in three ways when compared with corn or grain sorghum. A.—tons produced per acre on rich land. B.—in gallons of milk produced when fed to dairy cattle. C.—in pounds of weight added when fed to beef cattle.

F. B. Morrison, the most eminent authority on livestock feeding in America, in the twentieth edition of his book, *Feeds and Feeding*, gives the following advantages of silage as a feed:

(1) The feeding of silage permits the keeping of more livestock on the same land than would otherwise be possible.

(2) Silage furnishes high-quality succulent feed for any season of the year.

(3) There is a smaller loss of nutrients when crops are fed as silage than when fed in any other form.

(4) Silage is all eaten without wasting any part of the plant.

(5) Silage may be made at any time, whereas crops cannot always be dried or cured at the time they are ready for harvest.

(6) Rains in the South often make it difficult to cure hay, but a crop may be ensiled in the rain if need be.

(7) The ensiling kills weed seeds.

(8) The product from a given area may be stored in less space in the form of silage.

(9) When ensiled the crop is removed from the land earlier than would otherwise be the case, so that another crop may be planted.

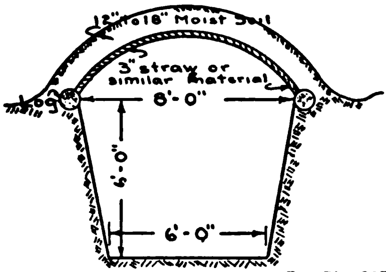
(10) Lessens the damage from the corn borer and other insects, and, in the South prevents the ravages of corn by weevils.

Next to pasture grasses, silage is perhaps the most important livestock feed that can be produced on the farm. Other than pasture, it is the cheapest feed. It has the same succulent properties as grass. It is palatable. Stock will eat more of it than of dry feeds and consequently will make greater gains in weight, or in the case of dairy cows will produce more milk.

While it is true that the South has had some difficulties in developing good pastures, the results in the growing of silage have been most gratifying. The yield of silage per acre on the better soils has compared favorably with the best production records made in any part of the country, provided that sorghum was selected as the crop from which to make the silage.

Farmers in the South have not fed silage to the extent that its value warrants. The reason for this is probably that the usual form of the upright silo was expensive and the cost of filling it was, in their opinion, excessive. These are valid points, but they need no longer stand in the way of a man who has the ambition and the desire to handle livestock more efficiently. The trench silo has been perfected and tested in the South.

The Trench Silo.—The trench silo, as the name suggests, is a trench scooped out of the ground. The silage is stored in this excavation. It has an advantage over any other kind of a silo in that the cost of construction is very low. Such a silo can be made by the labor on the farm. No special equipment, other than a slip scrape, is required. The cost of a trench silo having a capacity of 18 tons has been reported by Southern farmers to be as low as six dollars. Another advantage of the trench silo is that it costs less to fill than any other type. It is necessary to have an elevator or blower to put the silage in an upright silo. It may be poured into a trench silo.



—*Ga. Cir.* 247

THE TRENCH SILO
A cross section.

Location.—The trench silo should be located on a hillside, or at a place where drainage may be insured. A clay subsoil is almost essential, unless the walls are to be reinforced with planks or concrete, which adds materially to the cost. Naturally, the silo should be close to the barn, or the place where the silage is to be fed. But it is preferable to select a good location that will have perfect drainage, even if the silage must be hauled to the barn or feeding troughs placed near the silo.

Size of Silo.—Trench silos may be of any size. There are such silos now in use that will hold 500 tons of silage. These are probably too large; at any rate, they are larger than is required on the average farm. If such a large quantity of silage is needed, it will be preferable to construct two or more silos. The trench silo should not be too deep as unnecessary depth adds to the cost of digging, and the inconvenience of removing the silage. *Increased capacity is obtained by length.*

FILLING THE SILO

Before beginning the construction of a silo, it is essential to determine the size in order to be sure that the location is suitable. Two considerations will determine the size—the number of animals to be fed, and the length of the feeding period. Since silage should be regarded as a substitute for grass or grazing crops, and since it can be produced so abundantly, a generous allowance should be made.

As a guide, one cubic foot, or thirty pounds, may be estimated as the consumption per cow per day. The length of the feeding period when silage will be required as a substitute for grass may be from 125 to 150 days.

As an example, in using this basic information in determining the size or dimensions of the trench silo, we find in practice that enough silage for 10 cows for 75 days may be put in a silo 4 x 5 x 30 feet, that is, four feet wide at the bottom, five feet deep, and thirty feet long. To provide for a longer feeding period, the only dimension that need be changed is the length. If the feeding period were 150 days, the silo should then be made 4 x 5 x 60. Of course, the silo may be deeper than five feet and wider at the bottom than four feet. The following table will serve as a guide in determining the dimensions of the trench silo required:

TABLE OF SIZES FOR TRENCH SILOS

Based on 30 Pounds or One Cubic Foot Per Cow Per Day
(Length of Feeding Period Used 125 Days)

Number of Cows	*Width at Top*	*Width at Bottom*	*Depth*	*Length*	*Tons*
	Feet	*Feet*	*Feet*	*Feet*	
6	6	4	5	30	11
10	6	4	5	50	18
16	8	6	6	48	30
20	9	7	7	45	37
24	9	7	7	54	45
32	10	7	8	60	60
40	11	8	8	66	75
52	12	8	9	73	90

It will be observed that the silo is always wider at the top than at the bottom.

The top soil may be plowed and then removed with the scrape. This process may be continued until the desired capacity is obtained. The slope of the side walls must be sufficient to keep the soil from crumbling into the silo when empty. The walls should be smooth so that the silage will pack against them.

The silo should be protected from surface water by a ditch or terrace. A drainage ditch should be dug from the lowest point in the silo to the surface on the hillside. Tile or hollow pipe should be placed in the ditch to provide proper drainage. Both ends of this tile should be covered.

REMOVING SILAGE FROM THE TRENCH SILO

Filling the Silo.—The greatest expense involved in using the trench silo is in the machinery required for filling. Since a blower is not essential an ordinary feed cutter may be used.

The silage should be tramped down firmly in the silo to exclude the air. After the silo is completely filled and rounded up on the top, it should be covered with six inches of straw and thoroughly wet down. Then over the top of the pine straw or other covering, there should be placed a layer of soil to a depth of six inches.

In feeding, the silage should be taken from the front, from the top to the bottom. This will expose but little silage to the air. None will spoil if a foot or more is removed daily. The silage may be removed with a team and wagon. As the silage is used, the wagon can be

An Abundance of Feed
Sorghum planted during the late summer in North Georgia during a period of drought.

backed into the silo and loaded very conveniently. This brings out another reason for placing the silo on a hillside, for the horses can walk out of the silo onto more or less level ground.

SUGGESTIONS FOR STUDY

Questions and Problems

1. How are the sorghums classified?
2. Where are sorghums grown most extensively? Where are grain sorghums grown? Where are sweet sorghums grown?
3. What are the greatest advantages that the sorghums have over corn?
4. How do the yields of grain sorghum and corn compare?
5. How are grain sorghums grown? How are they fed?
6. How do the grain sorghums and the sweet sorghums compare as forage crops? How do they compare for silage?
7. Tell how, when, and why stock are sometimes poisoned from eating sorghums.
8. What are the advantages of feeding silage?
9. Why is silage a grass substitute?
10. Why have we not fed more silage in the South?
11. What is a trench silo? Do you have one in your community?
12. What are the advantages of the trench silo?
13. What determines the capacity of the silo required?
14. How much silage is fed per cow per day?
15. How many acres of cane would be required to produce the silage for ten cows for 125 days?
16. How is a trench silo constructed? What tools are required?
17. How is such a silo drained?
18. How is such a silo filled? How is the silage removed?
19. Why does silage and cottonseed meal make a good ration?
20. What are the sorghums best adapted to use on your farm? How do they compare with corn?

Selected References

Farmers' Bulletins, U. S. Department of Agriculture
578—*Making and Feeding Silage.*

724—*The Feeding of Grain Sorghums to Livestock.*
1126—*Sudan Grass.*
1158—*Growing and Utilizing Sorghums for Forage.*
1577—*Harvesting Grain Sorghums.*
1619—*Sorgo for Syrup Production.*
1631—*Broomcorn: Growing and Handling.*
1764—*Growing and Feeding Grain Sorghums.*

State Publications
Alabama—Circular 59—*The Trench Silo.*
Georgia—Circular 247—*The Trench Silo.*
Louisiana—Circular 148—*Trench Silos.*
Oklahoma—Circular 177—*Comparison of Cane and Kafir Silage for Milk Production.*
210—*Sorghum for Grain and Forage.*
215—*Broomcorn in Oklahoma.*
320—*Trench Silos and How to Make Them.*
South Carolina—Circular 121—*The Trench Silo.*
Texas—Bulletin 84—*Trench Silos.*
Leaflet 8—*Important Steps in Growing Grain Sorghums.*
Circular 47—*Scorecard for Grain Sorghums.*

Suggested Activities

1. Make a survey of your community to determine to what extent sorghums are grown, how they are used, what types and varieties are used, and the opinions of growers as to their value. If possible get opinions as to their value as compared with corn.
2. Determine the capacity of a silo required to provide feed for twenty head of cattle for the period when silage will be the best supplement for pasture in your community.
3. Make a farm survey of the practices in your community relative to the feeding of silage answering the following questions: (1) what per cent of the farms in your community, that have livestock, have a silo; (2) what type silos are used—how many of each type; (3) what is grown for silage; (4) what are the relative yields of corn and sorghum; (5) what is the opinion of the owners as to the desirability of trench silos; (6) what equipment is used in filling silos; (7) what is the cost of this equipment; (8) is any custom filling of silos done; (9) is any cooperative plan in effect; (10) what is your opinion of the efficiency of farming with and without a silo as based upon your own observations.

Chapter 35

PERMANENT PASTURES

F. E. GANDY

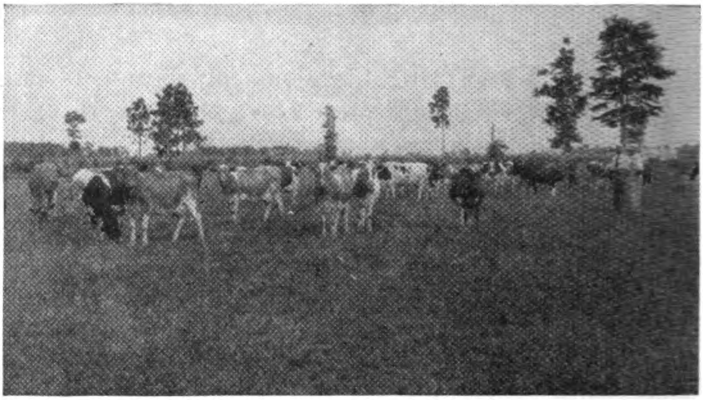
PASTURE development represents one of the greatest needs of Southern agriculture.

More than one-third of the farms of the South have no dairy cows. One-third have no hogs. One-sixth have no poultry. Very few have any beef cattle.

And yet we have only sixty per cent enough pasture to supply the needs of the livestock we are now attempting to maintain.

The great problem in farming today is to find satisfactory markets for the commodities that can be produced. The eternal question is: *What can we sell?* Each year the people of the South send millions upon millions of dollars out of the region to buy meat and other livestock products. These expenditures represent a home market which offers special advantages to local producers. Naturally, it may be assumed that as our foreign markets are lost we will turn more and more to the production of those things which our own people buy. Such an economic change means that we will become increasingly interested in livestock production.

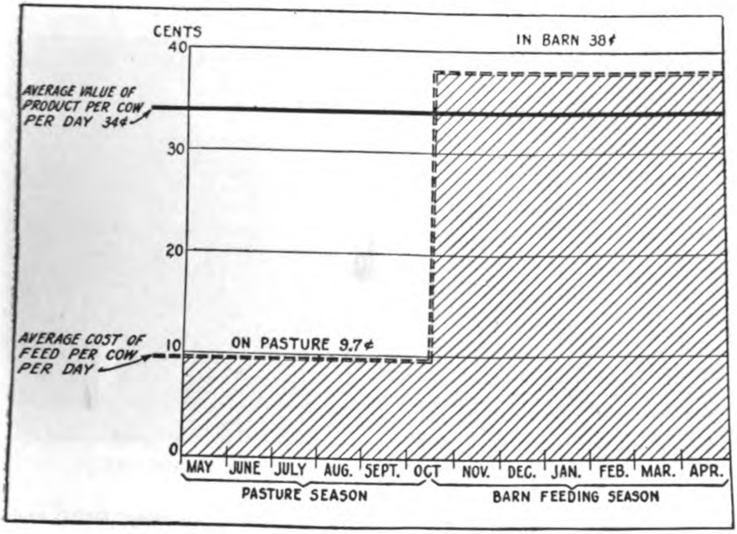
Livestock farming, however, offers more than a market for farm commodities. In connection with a program which calls for some stock on every farm, there are two other considerations which should be kept in mind. The *first* of these is that the members of the farm family require more meat, dairy products, and eggs in the diet than is now being supplied in many cases. The *second,* which is equally if not more important, is that there can be no permanently prosperous agriculture that does not include some livestock in the program.



"CONTENTED COWS"

It costs only one-fourth as much to pasture-feed as it does to stall-feed cattle.

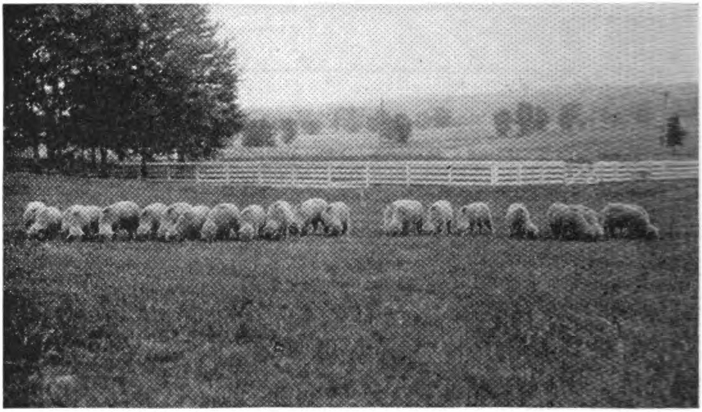
The reason for this fact is that rotations must be practiced on every farm to prevent erosion, maintain fertility, and control plant diseases. No farm can be permanently prosperous that does not provide for some plan for alternating crops. In any rotation, if it is effective, there must be some close-growing crops. Such crops can be used, in most instances, only in two ways —either they must be turned under as green manure crops; or they must be utilized as feed for livestock. Turning them under as green manure would meet the requirements that necessitate rotations, but farmers cannot afford to follow this plan exclusively. There must be some direct return made from most crops. For years, leaders in agricultural education have advocated turning under cover crops. Some such crops have been turned under. The acreage in cover crops is, perhaps, increasing as time goes on. But the sum total of such practices is negligible in comparison to the need. It



Pasture Feeding vs. Barn Feeding

A study of this chart will reveal that during the pasture season the feed cost amounted to less than one-third the value of the product while during the barn-feeding season it exceeded the value of the product.

always will be. Farmers in no part of the country can afford this method as the sole means of maintaining fertility, except in a few limited types of intensive farming such as vegetable growing or fruit culture. All *general farming* operators must realize some return from each acre during each cropping season to secure the greatest income. This means, in most cases, that the only available market for some of the crops which must be produced is through livestock. This is a lesson that the South must learn before the farm income of the section can be made comparable with that in other parts of the country. Furthermore, especially in the Piedmont region, there is much land that is too steep for cultivated crops. Such land must be kept in permanent pastures.



LAMBS ON GOOD PASTURE WITHOUT GRAIN

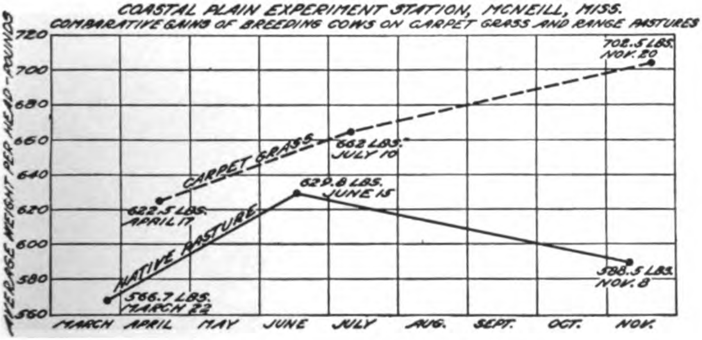
The situation may be summed up by saying that we need pasture and forage crops to maintain fertility and properly to utilize land, and that we must have livestock to provide a means of "processing" these crops so that they can be sold on the home market and utilized on the farm. Incidentally, pastures reduce the hours of labor, cut costs of operation, and constitute a crop harvested without expense.

Pastures as a means of income are not appreciated by many persons.

On one occasion a team of F. F. A. boys from a state in the "deep" South were enroute to a national livestock contest. They were driving through a beautiful part of the country in which cattle were seen grazing on every side. The farm homes were large and attractive.

"What do you think of this country?" asked the coach, who was helping prepare the boys for the national contest.

"It's beautiful," replied one of the boys, "but how do the people make a living."



NATIVE PASTURE IS NOT ENOUGH

A study of this chart will show that cattle on native grass gained in weight for about three months and after that lost weight. Native grasses must be supplemented by improved pastures.

The young man saw nothing but *grass*, a plant which for generations was considered objectionable on most Southern farms, especially those in the Southeast. He could not conceive of grass as a means of income worthy of consideration. A new viewpoint with respect to grass is being created; grass is essential in soil conservation.

Many interesting observations may be made with respect to livestock farming in the South and in the pasture situation.

In the initial stages of livestock farming in the South, many of the pioneers attempted to buy feed, including hay, from other sections of the country. Such purchases were made, of course, at retail prices. Needless to say, practically one hundred per cent of such farming efforts failed. Feed must be produced largely on the farm where it is fed. Often livestock make little, if any, direct profit. They merely furnish a market for feed that should be grown anyway. And they enable the grower to *sell* this feed and get the additional benefit

Rolling Land Should Be Planted to Pasture and Close-Growing Crops

that comes from the conservation of the soil through the prevention of erosion and the restoration of fertility in the form of manure.

If the South is to produce livestock, a constant struggle must be waged to keep down the cost of production per pound of beef or pork, or per gallon of milk. This is the major problem.

Few people appreciate the extent to which pastures lower the cost of production.

The value of pastures in livestock production is clearly shown in a statement made by the *Bureau of*

Plant Industry in which they state that over a period of years for a number of tests it has been determined that the cost of feeding a cow per day on pasture was nine cents, while the cost of feed per day for the same cattle when kept in the barn was thirty-eight cents. In other words, *during the pasture season the feed cost for these dairy cows amounted to less than one-third the value of the product, while during the barn feeding season it exceeded the value of the product.* Such a statement gives an appreciation of the value of pastures.

The following figures from a Mississippi experiment show how pastures reduce the cost of producing dairy products. Ninety cows, 80 of them in milk, were fed hay, silage, and grain one week. The next week they were turned on a 12-acre pasture which had not been grazed that spring. The hay was eliminated entirely and the silage ration reduced by half. Milk and butterfat production were increased and the net returns were increased by $50.25 for the herd, or $4.19 per acre. These results are given in the figures below:

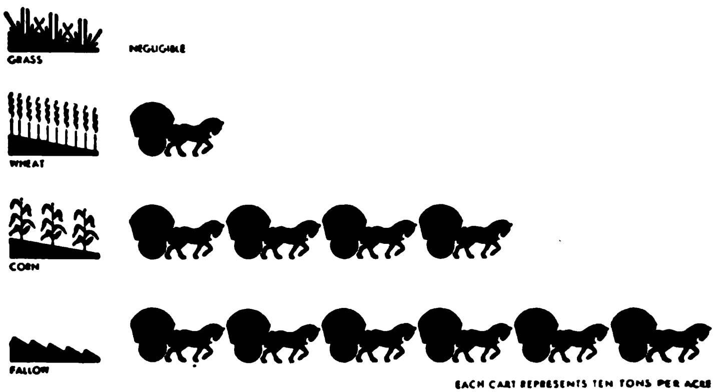
PASTURES INCREASE NET PROFITS FROM COWS

Feed Eaten	*Week without Pastures*		*Week with Pastures*	
	Amount	*Value*	*Amount*	*Value*
Hay	3,780	$15.12	——	——
Silage	25,200	37.80	12,600	$18.90
Grain	2,500	21.67	2,500	21.67
Total Cost of Feed		74.50		40.57
Milk Produced	8,007		9,748	
Butterfat	400	96.10	468	112.33
Value of fat over feed cost		$21.51		$71.76

The same relative values of pastures may be shown in the production of beef cattle, hogs, sheep, and even poultry.

Many people have little conception of what a good pasture is. It is not uncommon to pick up a newspaper and on the editorial page find a statement to the effect that the South has an advantage over any other part of

SOIL LOSSES THROUGH CULTIVATION



Note That There Is No Erosion on Land Where Grass Grows Abundantly

the country in the production of livestock for the reason that *we have such long grazing seasons.* The statement concerning the length of the grazing season is correct, but it is of no significance, if there is nothing to graze. It should be recognized by those who would succeed that the grasses with which we are most familiar in the United States grow best in cool weather, just as do the small grains. It is difficult to develop a good pasture in the South, but it is being done. Pasturage in the South constitutes one of the most important problems to which young men may give attention, if they wish to increase their own farm income or render a service to the society in which they live.

The value of any pasture is measured by its carrying *capacity.* This means the number of head of animals the pasture will feed and the length of time that it may be grazed.

LESPEDEZA RESPONDS TO LIME AND PHOSPHATE
The lespedeza held by the gentleman at the left received lime and superphosphate, that on the right was untreated.

In the final analysis *the value of any pasture is measured by the number of pounds of beef or pork, or the number of gallons of milk it will produce in a season.* This can be stated in terms of dollars per acre using the current prices for the products produced. In this way the net returns from pastures can be compared with other crops grown on the farm.

It is unfortunately true that some persons regard any land that is *turned out* as a pasture. Naturally, the returns from such lands are very small; consequently, the possibilities of improved pastures are not fully realized.

Native grasses alone are inadequate. They are short-lived, so far as carrying capacity is concerned. Such grasses are ready for grazing about the last of March. For two or perhaps three months they are excellent but soon after a period of such length, they begin to fail. Cattle kept on such pastures throughout the summer, over the same number of days that it takes to grow a cotton crop, may actually lose weight.

An experiment conducted in Mississippi showed that cattle put on range pasture in March gained in weight until about the middle of June. From this time on until November they lost weight. At the same time cattle put on an improved pasture of carpet grass in April gained steadily and consistently until the last week in November. *In this test the cattle on improved pasture gained four times as much as the cattle on the native range pasture.*

More attention should be given to pasture improvement. The native grasses must be supplemented, or replaced, with pasture mixtures adapted to the respective sections of the South.

Pasture Mixtures.—It has been definitely determined that mixtures of plants in permanent pastures give better results than only one kind of grass or leguminous plant. For this reason, every experiment station has recommended a pasture mixture adapted to the several sections or type-of-farming areas. Some such recommendations are given on pages 447 and 448.

Pasture Mixture Recommendations
(Rates Given on an Acre Basis)

Virginia

Strong Loams & Clay Soils

	lbs.
Kentucky bluegrass	10
Red top	3
Orchard grass	10
Alsike clover	3
Red clover	5

Light Loams or Sandy Soils

	lbs.
Tall oat grass	8
Orchard grass	10
Red top	3
Red clover	6
Lespedeza	12

Wet Bottom Lands

	lbs.
Red top	3
Meadow fescue	12
Alsike clover	5
Timothy	8

Poor Land & Gullied Hillsides

	lbs.
Sheep fescue	6
Red top	3
Orchard grass	10
Japan grass	10
Alsike	3
Bermuda grass	1 bu. Chopped roots

North Carolina

Coastal Plain

(a) Fertile black soils

	lbs.
Kentucky bluegrass	8
Red top	10
White clover	4
Lespedeza	12

Coastal Plain

(b) Fertile loamy soils

	lbs.
Carpet grass	10
Dallis grass	5
Kentucky bluegrass	5
Red top	5
White clover	3
Lespedeza	12

Coastal Plain

(c) Moist sandy soils

	lbs.
Carpet grass	10
Dallis grass	5
Lespedeza	15

Coastal Plain

(d) Well drained sandy soils

	lbs.
Dallis grass	5
Lespedeza	15
Bermuda grass (chopped roots)	

Piedmont

(a) Fertile, well drained soils

	lbs.
Kentucky bluegrass	4
Red top	5
Orchard grass	8
Tall oat grass	4
White clover	5
Dallis grass	4
Alsike clover	2
Lespedeza	8

Piedmont

(b) Fertile, moist soils

	lbs.
Kentucky bluegrass	4
Red top	5
Orchard grass	8
Dallis grass	4
Lespedeza	10
White clover	5

(c) Poor, dry soils

	lbs.
Dallis grass	5
Lespedeza	15
Bermuda (roots)	

(d) Lower Piedmont, moist soils

	lbs.
Carpet grass	8
Dallis grass	4
White clover	3
Lespedeza	15

Mountains

(a) Fertile, well drained soils

	lbs.
Kentucky bluegrass	5
Red top	5
Orchard grass	8
Timothy	5
White clover	2
Lespedeza	5
Tall oat grass	8
Alsike	2

Mountains

(b) moist, fertile soils

	lbs.
Kentucky bluegrass	5
Red top	6
Orchard grass	8
Timothy	2
White clover	3
Lespedeza	6

** Georgia*

Piedmont

	lbs.
Lespedeza	15
Dallis grass	6
Carpet grass	3
White clover	3

Coastal Plain

	lbs.
Lespedeza	12
Carpet grass	10
Dallis grass	8
White clover	5

* Other mixtures are recommended for restricted areas

Alabama

For General Use

	lbs.
Imported Dallis grass	10
Common lespedeza	10
Hop clover	1

Red Soils, North Alabama

	lbs.
Imported Dallis grass	10
Kentucky bluegrass	15
Orchard grass	10
White clover	3
Common lespedeza	10

Lime Soils, Black Belt

	lbs.
Imported Dallis grass	10
Black medic	10
White clover (bottom land)	3

Bottom Land, South Alabama

	lbs.
Imported Dallis grass	10
Carpet grass	5
Lespedeza (common)	10
Hop clover	1

Mississippi

Long Leaf Pine Region

	lbs.
Lespedeza	15
Carpet grass	10
White clover	3
Hop clover	2
Dallis grass	5

** Short Leaf Pine Region*

	lbs.
Lespedeza	15
White clover	3
Hop clover	3
Dallis grass	5

* A recommendation is given for the limestone soils which is like that for the short leaf pine region except that 5 pounds of black medic is added.

These recommendations cover a wide range in latitude and are representative of the mixtures used in all Southern States. Specific suggestions are available for each area within each state. These may be secured from

MOST SOUTHERN SOILS NEED LIME, ESPECIALLY FOR GROWING THE MORE POPULAR FORAGE CROPS

your experiment station. The recommendations do not properly emphasize Bermuda grass which is the basis of pastures in all parts of the South, especially the Piedmont region. Lespedeza, it may be noted, is common to all states. Plants which grow well in any locality may be added to the mixtures suggested.

Time of Seeding.—Grass seed, generally speaking, may be sown either in the fall or in the spring. Most recommendations call for early spring sowing. Dallis grass, carpet, and lespedeza are sown in the spring. To get the best results, seed should be sown evenly over the land. Grass seeders should be used. Half the seed should be sown in one direction and the remainder at right angles to the first sowing.

Fertilizers.—Dean H. P. Cooper of Clemson College included the following statement in a paper dealing with pasture development: "The need for a sound land use program and for more livestock in the South makes it very desirable that we produce more pastures and forage crops. Our long growing season and relatively heavy growing-season rainfall make it possible to produce excellent pasture crops in this section.

"Much of the land now used for pasture and hay crops is entirely too acid for the economical production of hay and pasture plants. *A large portion of our soils will require a basic treatment of one or two tons of limestone and an application of phosphorus equivalent to about 200 pounds of 18 per cent superphosphate annually before satisfactory returns can be expected.* Without these basic treatments, there is little chance of ever developing satisfactory pasture management programs in the Southeastern States."

The importance of this statement cannot be over emphasized. Lime must be added to most of our soils before profitable pastures or satisfactory yields of most legumes can be realized. In most of the Southern States an application of lime, regardless of what fertilizer materials were used, added to the production of grass. The only exception to this statement is found in portions of the Coastal Plain.

Pastures require fertilizer. In most cases the same formula and rate of application that is best for cotton should be applied to the pasture. Pastures should be fertilized annually.

For best results, it is necessary to apply fertilizer to pastures early in the spring. However, when only superphosphate and potash are required, it is the common practice to apply them in the fall. When a complete fertilizer, or only nitrogen is used, it should be applied in the spring, before March 1 in the Coastal Plain and before April 1 in the Piedmont.

As has been stated, the value of a pasture is determined by the gain in weight and the production of the animals which it is designed to feed. Many tests have demonstrated the value of fertilizers on pastures. The results of one such experiment as conducted by the Georgia Coastal Plain Experiment Station is shown in the following table:

COMPLETE FERTILIZERS INCREASE PROFITS

As Shown by the Gains of Steers on Lowland Pastures

(A five-year average)

	Average No. Steers Grazed	*Average Initial Weight*	*Average Final Weight*	*Average Gain per Steer*	*Average Gain Per Acre*
6 Acres Mixture * 600 lbs. 12-6-6 fertilizer **.......	6.65	470	719	249	290.4
6 Acres Mixture * 600 lbs. 12-6-0 fertilizer ** per acre.	6.60	454	680	226	261.8
6 Acres Mixture * 600 lbs. 0-6-0 fertilizer ** per acre	5.96	458	613	155	154.2
3½ Acres Mixture * 600 lbs. 0-0-6 fertilizer ** per acre.	3.6	448	603	155	156.9

* Pasture mixture consists of Carpet grass, Dallis grass, lespedeza and White Clover.
** Phosphoric acid, ammonia, and potash in the order named.

Pasture Management.—The following pasture management rules, if strictly carried out, will, according to E. D. Alexander, Extension Agronomist, State of Georgia, help in maintaining a desirable pasture:

"1. Keep drainage ditches open to enable excess water to pass off freely. The best pasture plants do not thrive well on poorly drained soil, and livestock are slow to enter boggy areas.

"2. Protect hill land from erosion. This may require terracing or contour ridging or furrowing.

"3. Graze heavy enough to keep weeds in check. Reasonably close grazing will keep the grass tender and palatable. Control grazing by use of small unit pastures is advisable.

"4. If bushes and weeds get beyond control of the livestock, clip them close with the mowing machine to prevent weed seed from maturing. Any undesirable perennials can be weakened or exterminated by close grazing or clipping.

"5. Indications are that yields from well sodded, high capacity pastures can be doubled in weight and tripled in protein content by liberal use of commercial fertilizers high in nitrogen. The cost per pound of this increased yield will be higher than the cost of the yield from unfertilized grass. Feed produced by fertilizing grass is some cheaper than bought feed of similar quality. Phosphate fertilizers stimulate the growth of legumes which in turn will aid the growth of grass. An application of 300 to 600 pounds of superphosphate, or its equivalent, over a three year period will be very beneficial. The fertilized grass is a better quality than the unfertilized and is preferred by grazing animals.

"6. Under favorable conditions carpet grass makes a very dense sod and tends to choke out the lespedeza. Little is known about the best way of getting lespedeza back in such pastures, but the best information at hand leads us to believe that plowing and partly destroying the carpet grass and reseeding lespedeza will be necessary. Where additional pasture is to be started, lespedeza could be seeded alone and the carpet grass allowed to come in naturally. An area adjoining the pasture sown to lespedeza and not grazed until the seed crop is mature will help get lespedeza back in the mixture. Lespedeza seed will be carried from these areas to the areas where it has been crowded out by the grasses. Without lespedeza carpet grass pastures give poor quality grazing.

"7. Bermuda and lespedeza sods, on all soils except those of very high fertility, are greatly benefited by having the sod broken at intervals of from three to six years. The soil should be rooted up with a scooter rather than turned. A subsoil plow works to good advantage in that it breaks the soil deep and leaves it smooth enough so weeds can be cut. The best time to do this is late winter or early spring after danger of freezing has passed. Turning the soil will bury the lespedeza seed so deep they will not be able to come up. If sufficient lespedeza is not present the pasture will be greatly benefited if 10 to 15 pounds per acre of lespedeza seed are broadcast on the loosened soil after it has been firmed down or harrowed. In south Georgia Bermuda sods will do better if turned often. Care needs to be taken not to leave the pasture in an extremely rough condition.

"8. While it is true that permanent pastures should be grazed close enough to keep objectionable growth down, they should not be grazed too close in dry seasons. It is well to have reserve grazing, such as lespedeza, cowpeas, kudzu and velvet beans to tide the animals over dry periods. These areas can be used for hay if not needed for grazing."

SUGGESTIONS FOR STUDY

Questions and Problems

1. Why are pastures essential?
2. From a farm management point of view, give five advantages of pastures.
3. Why do pastures decrease farm operation costs and lower labor requirements?
4. Why have we paid so little attention to pastures in the South?
5. Can we have good pastures? What are some of our advantages and disadvantages?
6. Why do pastures make the cheapest feed that can be produced for livestock? Why are they essential for dairy cows?
7. What is the relative cost of feeding cattle on pasture and in the barn?
8. What are some of the best pasture grasses in your locality? In your state?
9. Why are mixtures better than plants of one kind?
10. What mixture is recommended for your section?
11. When should grass seed be sown? How?
12. What fertilizers should be applied to pastures in your section? How? When?
13. Why is lime required as a basic treatment in pasture preparation?
14. Why should pastures be kept closely grazed?
15. How is the value of a pasture determined?
16. What pasture management practices should be followed?

Selected References

Farmers' Bulletins, U. S. Department of Agriculture
1125—*Forage for the Cotton Belt.*
1151—*Alsike clover.*
1724—*Farm practices with lespedeza.*
Miscellaneous Publications, U. S. Department of Agriculture
194—*A Pasture Handbook.*
200—*A Manual of the Grasses of the United States.*
A Range Plant Handbook (U. S. Forest Service)
A Digest of Pasture Research (A. J. Picters)
State Publications
Alabama—Leaflet 7—*Pastures for Alabama.*
Bulletin 243—*Permanent Pasture Studies on Upland Soils.*
Arkansas—Circular 334—*Permanent Pastures.*
Bulletin 307—*Permanent Pastures.*
Florida—Bulletin 289—*Pasture Value of Different Grasses Alone and in Mixture.*
Georgia—Bulletin 457—*Pastures for Georgia*
Circular 6—*Establishing Improved Pastures in the Coastal Plain of Georgia* (Tifton).
Kentucky—Circular 242—*Practices in Seeding Meadow and Pasture Crops.*
Louisiana—Circular 15—*Pasture Production and Management.*
Circular 156—*Louisiana Pastures.*
Maryland—Bulletin 373—*Permanent Pastures in Maryland.*
Mississippi—Circular 78—*Pasture Improvement.*
North Carolina—Circular 202—*Pastures in North Carolina.*
Growing Pastures in the South, a book by Joseph F. Combs, The University of North Carolina Press, Chapel Hill, N. C.
Texas—Bulletin 82—*Permanent Pastures for Texas Farms.*

Suggested Activities

1. If you do not have the specific recommendations for permanent pastures for your section as developed by your state, or branch experiment station, write for them. On the basis of these recommendations outline a complete plan for permanent pastures including: (1) plants to include, (2) proper mixture, (3) time of seeding, (4) method of seeding, (5) preparation of the land for seeding, and (6)

proper pasture management. Carry out the plan on your home farm, even if on a small scale.
2. Make a study of fencing for permanent pastures. Calculate the cost of fencing.
3. Make a list of all the plants recommended for permanent pastures in your state and write a description of each. Hold a contest in identifying seed and plants for those recommended for inclusion in your permanent pastures.
4. Make a farm study of permanent pastures in your locality by determining the (1) number of acres of permanent pastures in your school community, (2) the plant included, (3) the time of seeding, (4) the fertilizers applied, (5) the carrying capacity, and (6) the pasture management practices followed.
5. Make a study of liming soils in your locality by writing the answers to the following questions: Is lime needed on your soils? What kind of lime is to be applied? Rate and time of application should be observed? What is the source of supply? What is the cost? What is the value in terms of increased yields?
6. Calculate the value of the return from the complete fertilizer used at Tifton, Georgia, in the table given, at the current price, as contrasted with the application of potash. Contrast with the cost of phosphoric acid.
7. Calculate the value of pasture per acre on the basis of gains made on beef cattle in your community, or on the basis of milk production taking into consideration the reduction of other feeds made possible during the grazing season.

Chapter 36

TEMPORARY PASTURES

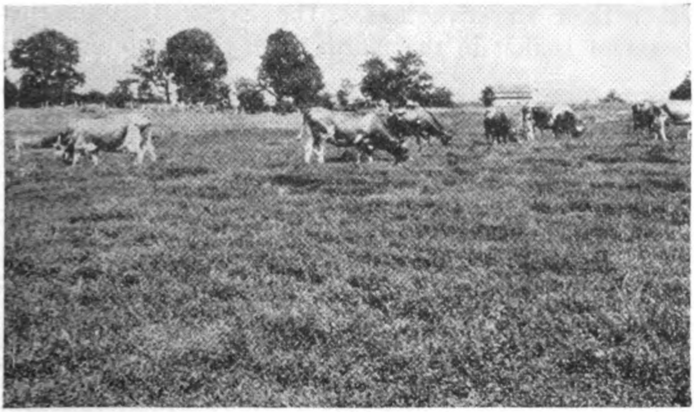
GEORGE W. NALL

EITHER to feed livestock economically, or to prevent the erosion of the soil, it is not enough merely to provide permanent pastures. In addition, temporary pastures and grazing crops must be supplied. In order that we may clearly distinguish between these two terms, the following definitions are given:

A permanent pasture is one located on land which is not to be cultivated and which is used for grazing livestock over an indefinite period. It is planted to perennial, biennial, or annual plants, or a combination of these plants.

A temporary, or supplemental, pasture is one located upon land that is ordinarily cultivated, and it is planted to quick-growing crops to be used for short periods of grazing. Such pastures are to be used summer or winter, spring or fall and are a part of the rotation system.

It is evident that a permanent pasture will not carry stock throughout the year. It is true also that on most Southern farms there should be more stock than the permanent pastures will carry throughout the season. Then too, there are periods of drought when the pastures are not as productive as usual. For these and other apparent reasons, it is necessary, in any cheap and economical feeding plan, to supplement the permanent pastures with other grazing crops. These crops are not so economical as first-class permanent pastures, because they must be seeded each year. But in most cases the increased production, as compared with the permanent pastures that have been developed, make such grazing



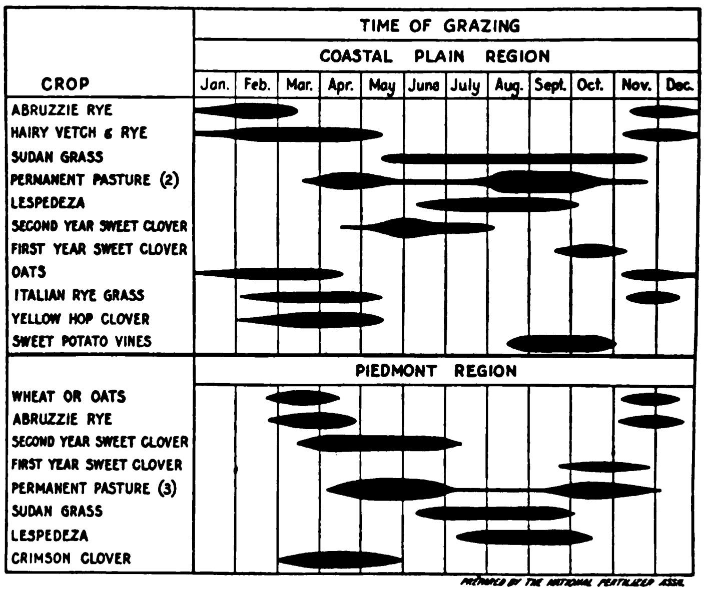
LESPEDEZA
Excellent for late-summer grazing.

crops the cheapest feed now produced on Southern farms.

Advantages of the South.—Temporary pastures are used to supplement grazing both in the early spring and in the fall and winter. The ideal toward which we should strive is an all-year-round grazing system. This ideal can be attained in the South to a greater extent than is possible in any other part of the nation.

The South is blessed with a mild, equitable climate. For the most part, this section of the country enjoys abundant rainfall rather well distributed throughout the year.

Unless we grow crops on all the land every month in the year we are not taking full advantage of this blessing from Mother Nature. *We should do more farming in the winter months.* We should follow the slogan of Tennessee, "A Growing Winter Crop on Every Acre." In fact, from a farm income point of view, if we do not grow winter crops the mild climate is a disadvantage, rather than an advantage. The explanation of this statement is that in the North during the winter when



Suggestions for a Year-Around Grazing Program

This chart was prepared by the National Fertilizer Association and is based upon data which was published in Miscellaneous Bulletin 194, *A Pasture Handbook*, by the U. S. Department of Agriculture. The black areas indicate when the respective crops may be grazed. It may be noted that there is no time in the year when grazing crops are not available in the Coastal Plain. In a part of the Piedmont Region of the South it is impossible to provide satisfactory grazing crops in January and February. During these two months, it is suggested that farmers plan to feed cottonseed meal and sweet sorghum silage, two home-grown feeds which make an excellent balanced ration.

the soil is frozen the plant food is *locked up.* It will stay where it is—in the feeding zone of the plants—until planting time in the spring. But in the South, where the soil never freezes, plant food is leaching out

Dairy Cattle on Sweet Clover

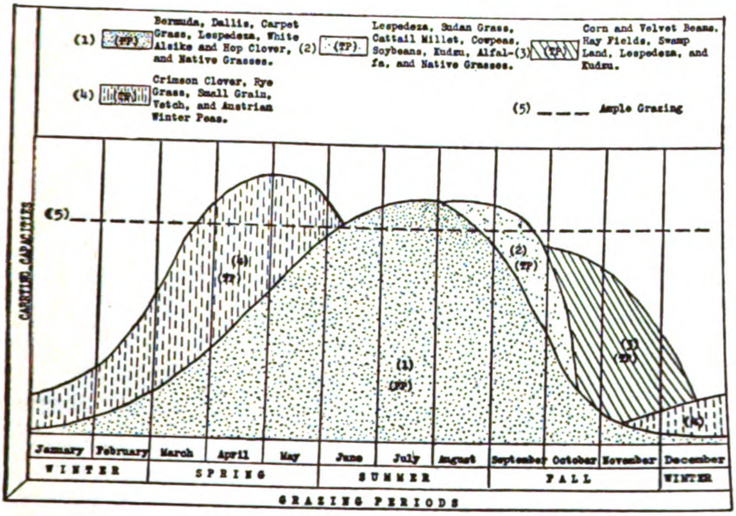
of the soil with every winter rain and the bacteria are constantly at work changing the plant food into a soluble form so that it is lost more easily. The only way to prevent this loss is to keep a crop growing on the land. The crop holds the plant food. If fed to livestock it is utilized and, to a great extent, held on the farm. If the crop is turned under, the plant food is held on the farm. But, if there is no crop growing on the land, the plant food leaches and washes away; so far as any particular farm is concerned the plant food is lost. The land becomes poorer and less productive; more plant food in the form of commercial fertilizer is required. To stop these losses and to take advantage of the mild, delightful climate which we so greatly enjoy, more crops should be grown in the fall and winter. But we should not forget either, the very hot months in the summer when growth, so far as most plants are concerned, is retarded. If these facts about soil and plant food are kept in mind, and temporary pasture provided, the livestock required to balance the Southern farm program can be fed most generously, and the acre-yields of all cash crops will be increased.

So far as winter cover crops are concerned, it is well to keep in mind that they have the following advantages:

1. They protect the land from washing and gullying.
2. They absorb soluble plant food and reduce leaching.
3. They make possible better use of the growing capacity of the late fall, winter and early spring temperature, rainfall, and accumulated plant food.
4. They build up the supply of organic matter which increases the fertility of the soil and, when turned under, they increase the soil's power of absorption and retention of water.
5. They aid in the substitution of winter grain for summer row crops.
6. They reduce the necessity of early spring preparation of the land at which time the rainfall is often so high that the spring planting preparations are delayed.
7. They provide late fall, winter, and very early spring pasture for light stock, colts, calves, brood sows and pigs, the ewe flock and lambs, and poultry.

We must learn to do more farming in the winter months, if we would take advantage of the opportunities which Nature has provided the South.

Cheaper Feeds for Livestock.—The question is often asked: Can the South produce livestock in competition with other sections of the country? The answer depends entirely upon the cost of producing pastures, hay, silage, and forage crops. At the present time our yields per acre, for all crops on which a comparison may be drawn, are lower than those in other parts of the country. This means, generally speaking, a higher unit cost of production. This cost may be reduced and the



—*Ga. Bulletin 457*

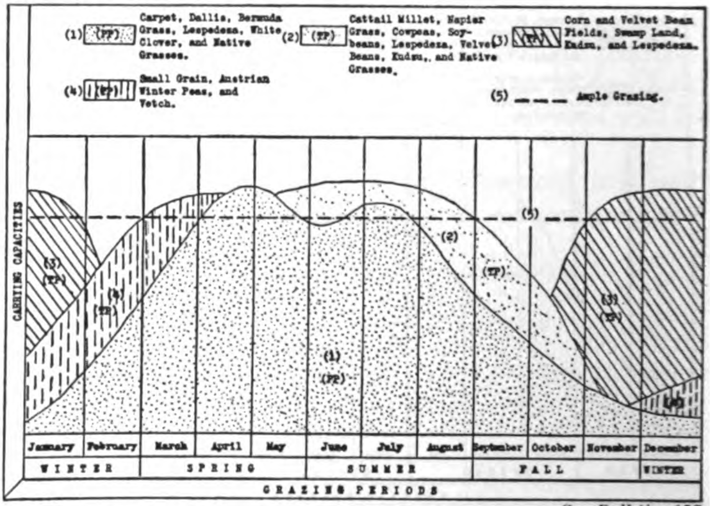
COMBINATION OF CROPS TO PROVIDE ALL-YEAR GRAZING

(*For North Georgia*)

The shaded areas indicate the kind and quantity of grazing crops which may be provided in North Georgia in an All-Year Pasture Program. Area 1 represents the grazing possibilities of a permanent pasture with Bermuda, Dallis, carpet grass, lespedeza, white, alsike, and hop clover, and native grasses. Area 2 a temporary pasture with lespedeza, Sudan grass, cattail millet, cowpeas, soybeans, kudzu, alfalfa, and native grasses. Area 3 temporary pasture with corn and velvet beans, hay fields, swamp land, lespedeza, and kudzu. Area 4 temporary pasture with crimson clover, rye grass, small grain, vetch, and Austrian winter peas.

amount of cheap feed supplemented through the production of supplementary grazing crops which may be utilized during the months when stock cannot be carried satisfactorily on permanent pastures. This requires for every section the development of a grazing program, or a succession of crops.

A Grazing Program.—The permanent pastures in the Piedmont region of the South, if properly developed,



—*Ga. Bulletin 457*

COMBINATION OF CROPS TO PROVIDE ALL-YEAR GRAZING

(For South Georgia)

The shaded areas indicate the kind and quantity of grazing crops which may be provided in South Georgia in an All-Year Grazing Program. Area 1 represents the grazing possibilities of a permanent pasture with carpet, Dallis, Bermuda grasses, lespedeza, white clover, and native grasses. Area 2 a temporary pasture with cattail millet, Napier grass, cowpeas, soybeans, lespedeza, velvet beans, kudzu, and native grasses. Area 3 a temporary pasture with corn and velvet beans, swamp land, kidzu, and lespedeza. Area 4 a temporary pasture with small grains, Austrian winter peas, and vetch.

may be expected to carry stock through the latter half of April, the month of May, and a part of June. Following this part of the spring and early summer, permanent pastures lose a part of their carrying capacity. Permanent pastures again are available for a part of

September, all of October, and a portion of November. For the other months of the year supplementary crops must be provided.

Sudan grass and lespedeza may be provided in most sections of the South for the summer period when pastures are limited.

In the early spring oats, rye, and some of the clovers may be utilized. Crimson clover is one of the best and most promising of all the legumes. Sweet clover is used successfully in some sections. In the late fall the small grains may be grazed again.

In the Coastal Plain section of the South permanent pastures are available for almost the same periods as in the Piedmont region. The Coastal Plain is more fortunate, however, in being able to supplement pastures for every month in the entire year, and in having a larger variety of plants from which to choose grazing crops.

Before permanent pastures are available for grazing in the late winter and very early spring, the Coastal Plain section may use as supplementary crops rye, hairy vetch and rye, oats, a few annual grasses, and hop clover. In the fall and early winter the grains, sweet potato vines, corn, peanuts, velvet beans, rye grass, and many other crops may be made available so that a year-round grazing plan may be put into practice without difficulty. This means, among other things, that cattle and hogs may be fed as economically as in any part of the United States.

A grazing plan should be developed for every farm, based upon the crops adapted to the section.

A Grazing Plan for Hogs.—Hogs constitute one of the major sources of income for the farmers in restricted sections of the Coastal Plain section of the South. This area should, and can, be extended. In this connection it is interesting to note that the people of the South are the largest consumers of pork in the nation. As yet, the South does not begin to produce the pork it consumes. For a time it was thought that hogs could be fattened only on corn. While it is true that corn fed hogs finish hard, which is an advantage, it is also true that hogs may be grown profitably when finished on peanuts, sweet potatoes, and other crops. The secret of producing hogs cheaply is to have an ample supply of feed which they can harvest themselves, and to give them plenty of grazing crops and clean fields so that parasite infestation may be kept to the minimum. At the present time most of the hogs produced in the South go to market within a period of four months. One of the problems, in addition to that of increasing the number of hogs, is to extend the period of time when they are ready for market. This can be done rather well by producing two litters per year and providing a year-round grazing system.

A year-round grazing system for hogs has been worked out and tested by the Georgia Coastal Plain Experiment Station, Tifton, Georgia. The system recommended, together with the results obtained for one year, is indicated in the table on page 465.

Supplementary Grazing Crops.—R. H. Lush, Louisiana State University, in a circular entitled *Pasture Production and Management*, lists the following supplementary grazing crops with his evaluation of each:

"Oats.—Rust resistant oats can be seeded early in September on well disced land and will provide splendid grazing, except in wet weather and the coldest winters. On upland a good hay crop, and most years a grain crop, can be produced if stock are removed by March 15. At Calhoun, five years' results of grazing vetch and different cereals indicate oats to be most valuable in milk production and returns per acre, followed

Year-round Grazing System for Hogs—Results of Tests 1935-36

Spring Litters

Mature Oats

April 23 to July 15

38 spring pigs on 5.4 acres, 84 days
Additional feed: corn 1.24 lbs., tankage .18 lb., daily per pig.
Gain per acre—304 lbs.
Daily gain per pig—.52 lb.

Otootan Soybeans (no beans set)—green grazing

July 16 to August 7

38 spring pigs on 2.2 acres—23 days
Additional feed: Corn .66 lb., tankage .05 lb., daily per pig
Gain per acre—253 lbs.
Daily gain per pig—.65 lb.

Grohoma Sorghum (mature) and Otootan Soybeans (no beans set)

August 8 to August 31

41 spring pigs on 3.4 acres, 24 days
Additional feed; tankage .08 lb., daily per pig
Gain per acre—176 lbs.
Daily gain per pig—.61 lb.

Grohoma Sorghum (mature) and Spanish peanuts (mature)

Sept. 1 to Sept. 24

41 pigs on 4.1 acres, 24 days
Additional feed: tankage .3 lbs., daily per pig
Gain per acre—323 lbs.
Daily gain per pig—1.35 lbs.

Corn (mature) and Hayseed Soybeans (mature)

Sept. 25 to Nov. 15

41 pigs on 8.3 acres, 52 days
Additional feed: tankage .27 lb., daily per pig
Gain per acre—367 lbs.
Daily gain per pig—1.63 lbs.

Dry Lot on Corn and Tankage

Nov. 16 to Dec. 10

30 pigs on corn and tankage
Feed fed: corn 7.7 lbs., tankage .36 lb., daily per pig
Daily gain per pig—2.07 lbs.

TOTAL:

11 Breeding gilts removed Nov. 15—Avg. live weight 186 lbs.
16 Pigs sold Nov. 9— " " " 245 lbs.
14 Pigs sold Dec. 10— " " " 250 lbs.

Total grazing acres per pig—.57 acre
Total additional feed per pig—corn 220 lbs., tankage 37.8 lbs.
Total gain per pig—200 lbs.

YEAR-ROUND GRAZING SYSTEM FOR HOGS—RESULTS OF TESTS 1935-36

Fall Litters

	Corn and Runner Peanuts
Oct. 22 to Jan. 10	44 pigs on 7.9 acres, 81 days Additional feed: tankage .2 lb., daily per pig Gain per acre—408 lbs. Daily gain per pig
	Runner Peanuts
Jan. 11 to March 6	44 pigs on 9 acres, 56 days Additional feed: tankage .28 lb., daily per pig Gain per acre—347 lbs. Daily gain per pig—1.37 lbs.
March 7 to March 26	44 pigs on corn and tankage (dry lot) Fed: corn 4.49 lbs., tankage .45 lb., daily per pig Daily gain per pig 1.44 lbs.
	Average weight per pig on March 26—207 lbs.

by Abruzzi rye and winter barley, respectively. In addition, oats has averaged nearly two tons of excellent hay per acre. Rye was more productive in the cold winters, however. All cereals grazed have averaged 2.2 pounds more milk per cow daily than permanent pasture. Advantage should be taken of the stimulating effect of these cereals on milk flow. Three bushels of oats and 15 pounds of vetch should be seeded per acre, or part of the oats should be replaced with rye or barley when grain is not saved. On alluvial land, oats should be seeded alone and Italian rye grass added in October to help get a sod that will bear grazing.

"Italian Rye Grass.—This grass is most valuable for adding to permanent pastures on low fertile land. It apparently withstands cold and wet weather better than cereals and legumes. Many failures have been reported when the seed were thrown out on heavily sodded pastures. Experience has shown that the seeds do not get covered and fail to germinate, or float off to lower ground. New pastures on flat land will not need discing, but scarifying of the sod should take place on other pastures. About 25 pounds per acre should be seeded in October or early November, and covered with a brush, or a manure drag should be run across the last cultivation.

"Vetches and Peas.—Winter cover crops cannot fur-

Hogs in Soybeans

nish much grazing and still produce sufficient growth to be turned under for early crops. When used in orchards or with late crops, they can be lightly grazed. The cereals or rye grass are preferable for winter grazing.

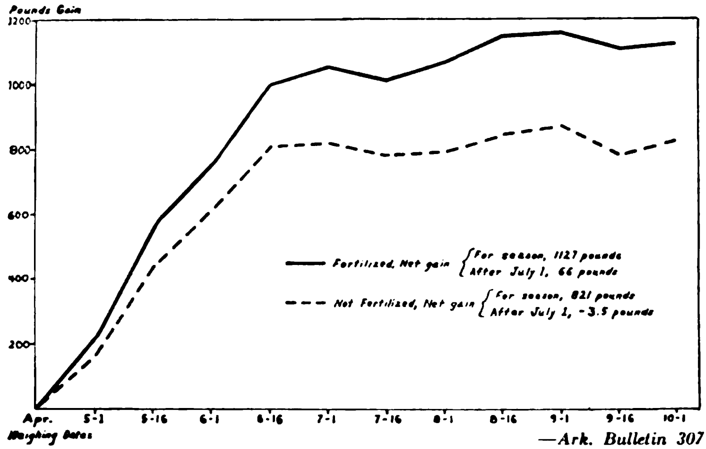
"Sudan Grass.—This is the best of temporary summer pasture. In experiments at Calhoun, this grass has produced more milk per acre than permanent pasture, soybeans, or kudzu. It can be planted any time from April to August, will withstand dry weather, and if not needed for pasture, will make excellent hay, if cut before heading. It is relished by all classes of livestock. The more it is cut the thicker the stand becomes. It does well on good land in any part of the state, but cannot be grazed after the first frost. This grass is usually ready for grazing within 30 days of planting. To permit one or two early cultivations, from 10 to 15 pounds of seed per acre should be planted in narrow rows. When planted late, it should be drilled or broadcast at a heavier rate. Planting in rows permits the livestock to walk in the space between rows with little plant damage and provides for drainage and weed control.

"Millet.—This plant has been used for pasture in very sandy soils of the South. The only apparent advantage over Sudan is that millet seed is sometimes less expensive.

"Soybeans.—Within the last few years soybeans have been used for grazing by several dairymen and by the experiment stations, also. If grazing is so regulated that only the top leaves and stems are eaten before the livestock are removed, a second and a third growth may be obtained, with a fair quality of hay the last time. Biloxi soybeans seem to be the most satisfactory, although other varieties may be used. There is no apparent advantage in the interplanting with Sudan or Millet over alternate grazing of separate fields. There should be planted in fairly narrow rows from 40 to 60 pounds per acre of Biloxis or 30 pounds of Laredoes or Otootans. They will be ready for grazing in about 60 days, weather permitting.

"Cowpeas.—These have not been compared directly with soybeans, but apparently will not furnish as satisfactory grazing. They can be grown later and on more sandy soil and will increase milk production in late summer over permanent pasture. They should be planted as for hay.

"Velvet Beans in Corn.—This is an old-time combination that should find renewed favor. Available at the close of permanent pasture but before winter grazing, an acre per animal will furnish all the roughage needed for two months. The usual procedure for corn should



—*Ark. Bulletin 307*

THE VALUE OF A PASTURE IS MEASURED IN PRODUCTION

The value of a pasture is determined in terms of the gains in weight made by meat animals and the gallons of milk produced by dairy cows. There is a period during the summer months in the South when pastures are of little value. It will be noted in this experiment in Arkansas that the gains were rapid from April until July. After that little gains were made. The fertilized pasture was superior at all times to the pasture not fertilized.

be followed, but only the best ears should be pulled out.

"Kudzu.—This is not a temporary crop, but it sometimes can be used for temporary grazing. Its greatest advantage is to prevent erosion on severe slopes. As a dairy pasture, it failed to increase milk flow in three trials at Calhoun. Moreover, it imparted a disagreeable flavor to milk. Mules like it, and doubtless cattle other than milk cows will do well on it. It is not available in winter and is very slow to start from rootstalks.

"Sweet potato vines.—For the past three years, light grazing of vines at Calhoun has not seriously affected the yield of potatoes and gives promise of furnishing much needed dairy pasture for September and October if plants are put out early. For two months previous to digging, the vines were alternately grazed, with an average increase of 2.9 pounds of milk per cow daily over permanent pasture. The pasture value was computed as $14.82 per acre in terms of feed saved. The cull potatoes also make excellent cow and hog feed.

"Alfalfa.—When grass comes into alfalfa impairing the quality of hay, it will make excellent pasture, but will not persist under intensive grazing. However, there is danger of bloat.

"Lespedeza.—This amounts to a temporary crop. Seeded or volunteer in an oat field on old lespedeza land or pasture, it furnishes excellent grazing in late summer when often needed. From 20 to 25 pounds per acre should be seeded in early March.

"Carrots, Turnips, and Stock Beets.—These root crops can be planted in the early fall to supply additional feed for all livestock when hand fed. In north Louisiana beets should be planted in early spring to escape the danger of freezing. All root crops should be cut up when fed to cattle. The labor in growing and feeding these crops makes them practicable only on small farms or where labor is cheap."

Crimson Clover.—Crimson clover, where it can be grown, is one of the best crops we have. It may be used for grazing, it may be included in hay mixtures, it is one of the best soil improvement crops that can be grown to turn under, and it will produce a crop of seed for sale or home use or both.

Seed production makes crimson clover an excellent crop. Unfortunately, many of the soil building crops cannot be produced from home-grown seed. This adds to the cost of growing them, and, consequently reduces the acreage that otherwise would be grown. We spend too much money in Southern farming on items which reduce the net income; when we can select a crop for

HARVESTING CRIMSON CLOVER SEED

which we can wisely produce our own seed, that crop has a distinct advantage. Crimson clover is such a crop. It is becoming increasingly popular. It is a winter legume. It is adapted to the Piedmont Region of the Southern states.

Crimson clover is seeded in the early fall at the rate of 40 to 50 pounds of seed in the chaff, or 12 to 15 pounds of clean seed. It must be inoculated. From 200 to 400 pounds of superphosphate per acre must be applied in most instances for best results.

Reference to the temporary grazing chart will show that crimson clover will provide ample grazing during March, April, and May. When once established on any farm, it provides a carrying capacity at this season of the year which compares favorably with the best pastures in any part of the country.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What is meant by the term *permanent pasture? temporary pasture?*
2. Why are temporary pastures necessary?
3. During what months are permanent pastures most productive?
4. Why should we grow crops in the winter months? What are the advantages of cover crops?
5. Do you think the South can produce livestock in competition with other parts of the country? Give reasons for your answer.
6. What is meant by a year-round grazing plan?
7. Give the plan for finishing hogs worked out at the Georgia Coastal Plain Experiment Station. What are the advantages of such a plan?
8. What are some of the supplementary grazing crops that may be used in the Piedmont region? in the Coastal Plain?
9. Which of these crops might be used at your home?
10. Tell all you can of the crops that are suggested for temporary pastures.

Selected References

Farmers' Bulletins, U. S. Department of Agriculture

1125—*Forage for the Cotton Belt.*
1126—*Sudan Grass.*
1254—*Important Cultivated Grasses.*
1433—*Cultivated Grasses of Secondary Importance.*
1699—*Growing Root Crops for Livestock.*

Leaflets, U. S. Department of Agriculture

23—*Sweet Clover.*
91—*Kudzu: A Forage Crop for the Southeast.*

State Publications

Georgia—Bulletin 457 (Pages 14-15) *Pastures for Georgia.*
Tennessee—Publication 188—*Winter Cover Crops for Pasture and Soil Conservation.*
Circular 44—*Sudan Grass for Summer Pasture.*
Bulletin 154—*Lespedeza Sericea.*
Circular 41—*Hop Clover.*
Circular 58—*All-Year Pasturing With and Without Concentrates for Dairy Cattle.*
Circular 49—*Korean Lespedeza.*
Oklahoma—Bulletin 103—*Korean Lespedeza.*
Texas—Bulletin 172—*Sudan Grass.*
Virginia—E—294—*Lespedeza.*

Suggested Activity

1. Work out a Year-Round Grazing Plan for your farm, making a chart showing the period when each crop may be grazed. Make a list of the crops that will be used in the plan giving (1) the date of seeding, (2) the rate of seeding, (3) the variety if necessary, and (4) the plan of management that will be followed. Work out one plan for cattle and another for hogs.

Chapter 37

PRODUCING QUALITY HAY

HARRY L. BROWN

ONE of the pertinent needs of Southern agriculture is a larger quantity of quality hay. The acreage devoted to the production of hay crops in the South has increased markedly for more than a decade, yet the supply is inadequate. It was pointed out that approximately one-third of the Southern farms have no livestock other than work animals, and that we are forty per cent short of the pastures needed for the stock we already have. The same statement may be made concerning the supply of quality hay. Hay crops must be increased if we are to achieve the goal of a self-sustaining agriculture.

Quality Hay.—Let us begin by giving specific consideration to what is meant by *quality* hay.

There is a vast difference in the feeding value of hays. A dry, stalky hay without leaves is worth practically nothing. Tests made with calves show that young animals fed a low-quality hay and skim-milk will not live. Such hay has little nutritive value; it is completely lacking in vitamins. On the other hand, calves fed a U. S. No. 1 grade of alfalfa hay together with skim-milk, grew at a normal rate. The difference was entirely in the quality of the hay. The feeding value of hay is determined largely by its quality.

Quality in hay is determined mainly by three considerations: (1) *color*, (2) *freedom from foreign matter*, and (3) *leafiness*, if the hay is a legume.

(1) As to color, the hay should be a bright green. The greener the hay, the better the quality. Green hay contains vitamin A; dark brown hay has lost its vitamin content. What determines the color of hay?

WINTER HAY

The farmers of the South should grow more winter hay. A mixture of plants is recommended. At this season of the year we are always assured an ample supply of moisture. The crop also utilizes plant food that otherwise would leach out of the feeding zone of plants and thus be lost.

Two factors determine the color of hay—the stage of maturity when cut, and the way in which the hay is cured.

To preserve the natural color of hay, the producer should get it into the stack, bale, or mow, with as little exposure to sun, dew, and rain as possible. It must, however, be dry enough that undue heating will not take place in storage, otherwise it will mold and the green color and vitamin content will be lost.

(2) Foreign matter refers mainly to weeds, which reduce the feeding value of the hay.

(3) Leafiness is important because the leaves contain much of the vitamin content and add to the palatability.

—Courtesy J. I. Case Co.

A LIVESTOCK REQUIREMENT

We should strive to produce more high-quality legume hay.

The time of cutting and the method of curing determine the leafiness of hay. Hay that is cut early has more leaves than hay cut over-ripe.

Much of our hay is cut too late. Most Southern farmers, seeking to get the greatest tonnage of hay from the too small acreages planted, wait till too late to cut the crop. Late cutting not only results in loss of protein but the hay becomes less palatable and more difficult to digest. Even with perfect curing weather, it is impossible to get high quality hay from late-cut over-ripe grass and legumes. Neither will livestock eat large quantities of such hay.

The proper stage for cutting hay varies in the different sections of the country. But there are some general rules:

Alfalfa—When from one-tenth to one-fourth in bloom, or about the time the first basal shoots appear.

Soybeans—Between the time when the seeds begin to form and when they are half developed.

Lespedeza—When in full bloom.

Cowpeas—When first pods begin to turn yellow but before any get ripe enough to shatter.

Oats and vetch mixed—When the oats are in the milk stage.

Johnson grass—When the first heads appear from the boot.

Oats and wheat—When the grain is in the milk stage (except that oats for horse hay may be cut when the seed is in the dough stage).

Bermuda and other grasses—Not later than full bloom.

Finally, it is well to keep in mind that to grow livestock economically, a supply of hay is necessary. The animals need and must have hay for roughage. In order that they may eat it in quantity and use it in their body functions, the hay must be good. Good hay means green color and a high proportion of leaf. Any other kind is low grade hay.

Classification of Hays.—Hay may be classified as grass-hay, or legume-hay. Grass-hays include the small grains, of which oats is the most important.

The grass-hays also include Timothy, Johnson grass, Sudan grass, and orchard grass. Rhodes, Para, Carib, Colorado, and tall meadow oat-grasses are of minor importance. Napier grass is a remarkable soiling grass (meaning that it is cut and fed to stock green), yields as high as sixty tons per acre having been recorded in Florida.

The grasses are often grown with the legumes. Timothy and red clover are grown more universally as a hay crop than any other combination. This is a hay crop for the upper portion of the South only.

Korean Lespedeza Is One of Our Most Valuable and Promising Crops. It Is Grown Extensively in Kentucky, Tennessee, and North Carolina

In the South, the legumes are more important as hay crops than the grasses. The more important legumes include alfalfa, soybeans, cowpeas, many of the clovers and the vetches. Many of these are grown in combinations which include the small grains. These make excellent cover crops and nutritious feeds.

The feeding value of a hay crop is determined by the pounds of digestible nutrients contained in a given quantity. This can be determined by a chemical analysis. The table on page 479 gives the percentage of each of the valuable nutrients in the various hays which can be utilized by the livestock eating it.

In all feeds, the protein (which is the most costly part of any ration when purchased as commercial feed) is the muscle-building and conditioning part. *It will be noted* *in this respect that the legumes are all superior to the grasses.* The carbohydrate part of the feed is that which supplies energy and builds fat or weight. The function of fat in feeds is the same as that of carbohydrates, except that fat is 2.25 times as valuable, that is, one pound of fat will do the work of 2.25 pounds of carbohydrate, which is commonly called starch. This information, and table, will give an appreciation of the relative value of equal weights of the more common hay crops.

DIGESTIBLE NUTRIENTS IN HAYS

In 100 Pounds

Hays	*Pounds Protein*	*Pounds Carbohydrates*	*Pounds Fat*
GRASSES			
Bermuda grass	2.8	48.5	0.9
Carpet grass	3.1	44.6	1.0
Crab grass	3.5	40.0	1.0
Johnson grass	2.9	45.0	1.0
Sudan grass	3.7	45.7	0.9
Timothy	3.0	42.8	1.2
Barley hay	4.6	48.2	0.9
Oat hay	4.5	38.1	1.7
Rye hay	2.9	41.1	1.1
Wheat hay	4.0	48.5	0.8
LEGUMES			
Alfalfa	10.6	39.0	0.9
Clover (red)	7.6	39.3	1.8
Clover (sweet-white)	10.9	38.2	0.7
Cowpea	13.1	33.7	1.0
Lespedeza	8.6	41.1	1.1
Peanut vine (mowed)	7.0	38.4	3.3
Peanut vine (pulled)	6.9	45.3	2.5
Soybean	11.7	39.2	1.2

The South's Opportunity.—It is impossible to have either a permanent or a balanced agriculture without livestock. To produce livestock successfully requires great quantities of roughage. This means pastures, silage, and hay crops. The South produces less hay than any other part of the nation, and makes the lowest yield per acre as indicated in the following statistics compiled by the U. S. Department of Agriculture:

THE PRODUCTION OF HAY IN THE UNITED STATES

Section	* *Acreage in Hay*	** *Yield Per Acre* (tons)
North Atlantic	9,766,000	1.18
North Central	26,741,000	1.24
South Atlantic	3,887,000	.87
South Central	5,537,000	1.01
Western	9,222,000	1.90
United States	55,153,000	1.29

* A five-year average.
** A ten-year average.

It will be observed that the two sections comprising the South, and embracing 16 states, do not together produce as much hay as any one of the other sections of this nation. This gives some index to the reason why these sections of the South are not self-sustaining in food production. It has a bearing upon the problem of low yields per acre of the cash crops, and upon erosion, for hay is a close-growing crop which reduces the losses of soil and water.

The South has an opportunity in the production of hay that is unequalled by any other part of the nation. It is possible to produce two crops of hay on the same land each year. This means two crops, not two cuttings.

In the winter a most excellent crop of hay may be produced by planting a mixture of oats, vetch, and crimson clover. Other combinations, suited to the locality, and including the same general type of plants may be used. There is a large number from which to choose.

There is no reason why the winter hay produced from such a mixture will not equal the average national production of 1.29 tons per acre. In fact, this average has been excelled many times. On land that has a goodly supply of organic matter in it, and which has been

THE SIDE-DELIVERY RAKE

This implement makes possible a better quality of hay by insuring more uniform curing.

fertilized with a liberal application of superphosphate, it is possible to produce two tons of winter hay per acre.

But this is only half the possibilities for hay production in the South.

As soon as this crop of winter hay has been removed, the land may be planted to a combination, let us say, of cowpeas and sorghum. This summer hay crop will produce approximately one ton per acre on good land. In other words, with two hay crops on the same land in the South, a generous supply of hay should be provided, the land improved, and erosion prevented. With such a plan for producing hay, the South should greatly exceed the national average in production per acre.

Based upon at least fifteen years of experimental work, the Alabama Experiment Station makes the following recommendations relative to the production of hay crops:

Alabama Recommendations for Hay Production

1. Plant late in September or early in October, a mixture composed of 2 bushels of oats or 1 bushel of wheat, and either 20 pounds of vetch or 40 pounds of Austrian winter peas.
2. After this crop is harvested, plant cowpeas, soybeans, sorghum, or Sudan grass, or a mixture of these on the same land.
3. Fertilize the fall-plant crop with 400 to 600 pounds of basic slag per acre. Basic slag supplies both lime and phosphate, which experiments have shown to be essential to the maximum growth of these crops. Apply 100 to 200 pounds of nitrate of soda per acre late in February or early in March.
4. Apply 400 to 600 pounds of basic slag for summer legumes at planting time. Top dress sorghum or sudan grass with 100 to 200 pounds of nitrate of soda per acre as soon as the plants are up.
5. Results of experiments show that by following this plan it is possible to produce two or more tons of hay per acre, as compared with from one-half to one ton when only an unfertilized summer crop planted after oats is used.

Alfalfa.—Alfalfa has long been regarded as the first-ranking forage crop of America. There isn't a state in which the crop is not grown. It is the standard by which all other hay crops are evaluated. Not only is the hay rich and palatable, but this legume will provide three or four cuttings a year and produce from three to five tons of hay per acre. Moreover, when once established, a good stand will last as a hay crop for from four to eight years and will then, if desired, serve as a pasture for an indefinite period.

One of the great needs of the southern section of the country is a good hay crop which does not require seeding annually. Where alfalfa can be grown, it meets this need. The crop may be grown anywhere in the Piedmont region. It cannot be produced successfully, as a rule, in the Coastal Plain.

Since alfalfa is grown in every state in the nation,

ALFALFA IN VIRGINIA

These hay cocks were probably made by hand with the aid of a sulky rake. The farmer with a small acreage will find this a most satisfactory method of curing hay.

it is evident that the plant has a wide range of adaptability so far as soil and climate are concerned. Deep, loamy soils with a pervious subsoil are the ideal type for alfalfa. Like most of the legumes, it will not grow in an acid soil.

Two conditions are essential in growing alfalfa. *First,* the soil must be neutral or slightly alkaline; *second,* the seed or soil must be inoculated.

In preparing soil for alfalfa, it is desirable to turn under a green manure crop, for example rye, vetch, or crimson clover. This may be followed by a crop of soybeans or cowpeas, which will help keep down the weeds. Before seeding to alfalfa, the land should be entirely free from weeds. No other forage crop requires so much lime as alfalfa. One ton of hay removes about forty pounds of lime. Think what a yield of five tons per acre for eight years would remove. From two to four tons of lime per acre should be applied before sowing alfalfa.

Like all legumes, alfalfa responds to phosphoric acid. A liberal application should be applied at the time of sowing.

Alfalfa is a small-seeded plant. This means that the land must be in excellent tilth at the time the seed is sown. Fall seeding is preferred, although spring seeding is practiced. If sown in the fall, the seeds should be planted early enough for the plants to get started before the coldest weather. Spring seeding should always be done early. From 20 to 40 pounds of seed are required per acre. Thin spots should be re-seeded the first year. If possible, the seed should be drilled. It may, however, be sown broadcast.

Alfalfa should be cut when from one-tenth to one-fourth of the plants are in bloom. This will mean from three to six cuttings in the South. It is best to cure in windrows. The second day, after the dew has disappeared, the hay may usually be taken up and put in small cocks. It should be stacked or put into the barn just as soon as it has cured enough so that it will not heat.

The relative value of alfalfa as a hay crop for the State of Georgia is shown in the table on page 485, taken from *Circular 264*. The same relative value will apply for every other state in the southern region.

The superiority of alfalfa, as based upon these figures which came from farms representative of the entire state, show that alfalfa should be the hay crop grown wher-

THE RELATIVE VALUE OF ALFALFA

Kind of Hay	Average Number of Cuttings	Yield Per Acre in Tons	Average Value Per Ton	Average Value Per Acre
Peavine	1	.65	$15	$9.75
Peas and Sorghum	1	.97	12	11.64
Soybeans	1	.83	15	12.45
Alfalfa	4.3	3.40	20	68.00
Meadow	2.4	1.86	10	18.60
Johnson grass	2.75	2.57	10	25.70

ever possible. If measured on a comparative basis in the barn or feed-lot, alfalfa would again be shown to be superior. It will cost from $15 to $25 per acre to establish a good field of alfalfa. This seems to be a relatively large sum. But if one considers the cost of seeding annual hay crops for a period of five or more years, it will be discovered that, where it can be grown, alfalfa is as cheap as any and will probably bring larger returns.

Lespedeza.—Lespedeza is perhaps the most valuable and important legume grown in America. It might appear that alfalfa holds first place in the legume family, but this is doubtful for the reason that the lespedezas have a wider range of adaptability and may be grown on soils and under conditions where it would be impossible to grow alfalfa.

There are many members of the lespedeza family including common, Tennessee 76, Kobe, Korean, and sericea.

Common lespedeza, or *Japan clover,* is a small plant grown mainly in pasture mixtures. On good soils it makes enough growth to be used for hay.

Tennessee 76 is a selection from common. Its upright habit of growth makes it a good hay crop.

Kobe is much like common except that it grows upright, the plants are taller and the leaves and stems larger. It is a good hay crop.

Korean is a good hay crop for the northern portion of the South. Its popularity is attested by the fact that in the State of Kentucky, for example, it is reported that Korean alone or with grasses occupies more than 3,000,000 acres of land—or as large an area as is devoted to hay crops in all the following states combined: Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, and Florida. These states comprise what is known as the South Atlantic group. The combined hay production of all the states in this group is about equal to that of Kentucky and Tennessee.

Sericea is a relatively new lespedeza. It was recently brought to this country from Japan by the U. S. Department of Agriculture. Investigation has shown, however, that this plant was imported by the North Carolina Experiment Station in 1896. The fact that it did not persist from this importation may mean that it was not regarded as a valuable plant. It is a perennial. For ten years the sericea field at Arlington has been in a thriving condition. This, of course, is a matter of importance. The sericea makes a rank growth. It has heavy, coarse stalks, as compared with the other lespedezas. It is striking in appearance. But there is great doubt about its value as a feed for livestock. Since it makes such a rank growth, it would, as a perennial, be a most valuable plant if it had the same merit as a forage as the other members of the lespedeza family.

The inoculation for lespedeza is no problem in the South for the reason that the same bacteria are required as for cowpeas.

The usual method of sowing lespedeza for hay is to sow 25 to 40 pounds of seed per acre on small grain in the early spring. Tennessee 76, Kobe, or Korean make the best hay. When lespedeza grows well and is thick on the ground, high yields are made. It is estimated that under such conditions a growth of 8 or 9 inches will make one ton per acre; 12 to 14 inches, two tons; and 24 inches, four tons.

Lespedeza is a valuable crop in pasture mixtures and for soil improvement. It can be grown in every state in the South. It fits into any farming program. The following rotation is recommended for Kentucky, where Korean is one of the important crops of the State:

First Year—Corn or tobacco followed by small grain.

Second Year—Small grain in which lespedeza is sown. The lespedeza may be used for hay or seed or may be pastured.

Third Year—Lespedeza for hay or seed. Small grain sown on stubble in fall and grass sown.

Fourth Year—Small grain; lespedeza and grass pastured.

Fifth Year—Lespedeza-grass pasture. The field may be kept in pasture several years, if desired.

The lespedezas are prolific seeders. The selling of seed adds to the income of the farmers who grow the crop. Yields of 500 pounds of Korean per acre are reported in Kentucky, and it is said that yields of 1,000 pounds have been made with sericea. Both are, of course, exceptional. Where these crops are produced for seed, the crop is best harvested with the small combine.

Common lespedeza seed is harvested by the use of seed-pans attached to the cutter bar of a mower. As the plants are cut they are pulled over the pan and most of the seed shatters out. A reel for pulling the plants over the pan may be used, or the work may be done by hand.

Kudzu.—Kudzu is a vigorous perennial vine belonging to the legume family. It is grown as a shade plant for porches, for grazing, as a cover crop in pecan groves, and as a hay plant. Since the soil conservation program developed, the popularity of kudzu has increased for the reason that it can be used effectively on banks and in gullies to prevent erosion.

It is said that C. E. Pleas, Chipley, Florida, discov-

—*Courtesy Caterpillar Tractor Co.*

CUTTING LAND TO SOW COWPEAS
Using a 16-24 Rome disk plow.

ered the value of kudzu as a forage crop for livestock.

Kudzu is exceeded only by alfalfa in the tonnage produced per acre. It will produce twice as much as cowpeas or soybeans.

This legume is usually propagated from roots which are two or three years old. They are called crowns. There has recently been a great demand for these crowns and they have proven an important source of income to those persons so fortunate as to have been growers of kudzu over a period of years. Kudzu is also propagated from cuttings, which may be secured from nurseries.

About 1,000 crowns are set per acre. This will permit eight-foot rows with the plants five and one-half

KUDZU
Showing rank character of growth by overrunning trees.

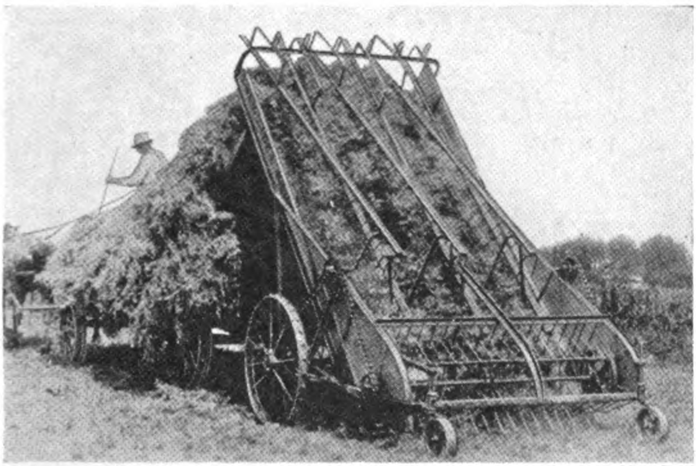
feet apart in the row. One plant will eventually cover an acre of land under favorable conditions. In establishing a field, corn may be planted between the rows the first year. This will aid in the control of weeds which are destroyed when the corn is cultivated. Land for kudzu is prepared in the same manner as for corn. On the best soils, the plant continues to make growth for a number of years without any kind of assistance.

Soybeans.—Soybeans are growing in national popularity. Recently new industrial uses have been discovered for the crop. The oil is used in making paints and the meal in making plastics, as, for example, certain parts on the Ford car. As an evidence of the increasing interest in the soybean crop, they have been listed on the Chicago Grain Exchange. The South is interested in soybeans not only because they are grown on Southern farms, but also because soybean meal is sold in competition with cottonseed meal for feeding livestock. The acreage devoted to soybean has been increasing throughout the nation for a number of years.

Soybeans rank above cowpeas in the yield and value of hay per acre. They have other advantages also in that (1) they are better able to withstand unfavorable weather conditions; (2) they will do better on heavy soils; (3) they are more certain to set seed; and (4) they are more easily harvested for either seed or hay. They may be interplanted with corn and hogged-off. They may be planted in rows, or broadcast for hay. They require the same seed-bed as cotton or corn. The variety to choose will be determined by local practices and the rate of seeding upon the variety.

The soybean may be cut for hay at any time after the setting of the seed. One should not wait too long for the reason that the leaves must be preserved to insure quality hay.

Cowpeas.—Cowpeas are grown as a home supply crop and for hay. In certain sections of the South sorghum and peas constitute the most popular hay crop. This is a nutritious hay and can be grown without difficulty. It fits into the farming program readily.



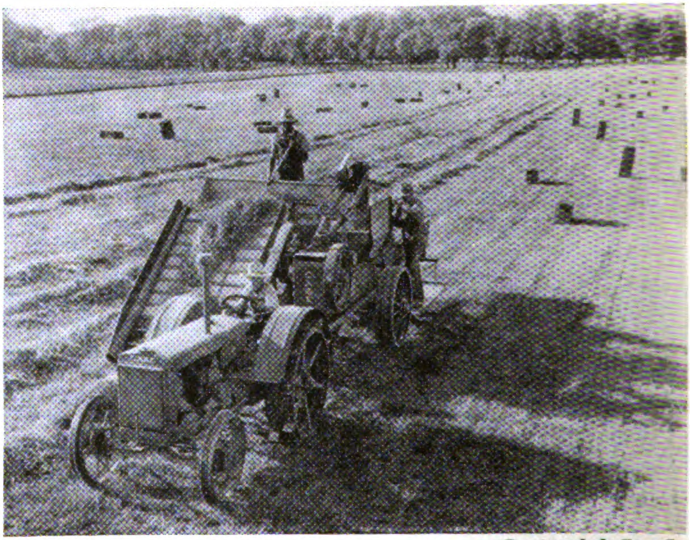
—*Courtesy New-Deal*

A HAY LOADER IS A VALUABLE LABOR-SAVING MACHINE

Johnson Grass Hay.—Johnson grass is regarded as a pest and a nuisance on most farms, yet it is one of the more important hay crops in the South. By a number of Georgia farmers it was reported as ranking second only to alfalfa in the value of the crop per acre. In Mississippi there is a great dairy industry in a section of the State that is supported, to a large extent, on an abundant production of Johnson grass as a hay and pasture crop.

This grass was introduced into America by Governor Means of South Carolina in 1830. It was observed by Col. William Johnson, a plantation owner of Selma, Alabama, who grew it so extensively that it was named for him. In South Carolina, however, it is still known as Means grass in some communities.

Johnson grass is vigorous. It grows luxuriantly. It will usually, where it has been grown, spread over a



—*Courtesy J. I. Case Co.*

PICK-UP HAY BALER
Bailing hay direct from windrow.

meadow without seeding. Where it is desirable to sow the grass for a hay crop, it may be drilled at the rate of 20 to 30 pounds per acre. The seeding should be done in the spring, as it is a summer-growing crop.

Some growers plow their Johnson grass meadows each fall and sow them to oats and vetch. This combination makes a hay crop which can be cut in April or May, then the Johnson grass begins to grow, and provides two or three cuttings of hay.

Often old meadows are plowed and planted to soybeans. This practice serves to thicken the stand of Johnson grass, a good crop of soybean hay is produced, and the later cuttings of grass are increased.

Sudan Grass.—Sudan grass belongs to the sorghum family. It was introduced into this country in 1909 by the U. S. Department of Agriculture and was first tested at Chillicothe, Texas. It can be grown anywhere that sorghums thrive. Its soil requirements are not unlike cotton. It is a large plant, attaining a height of five to seven feet. It will yield a larger tonnage than any other grass that can be grown over so wide an area.

Joseph F. Combs, in his book, *Growing Pastures in the South,* says of Sudan grass, "On the average soil, early plantings will mature three cuttings of hay in the lower South, two in the middle South, and one in the upper South. It requires about sixty days for the grass to reach the stage for hay. Broadcast seedings are common on fertile soil, and this is to be preferred. When planted in rows, from ten to fifteen pounds of seed may be planted. Broadcast seedings require from thirty to forty pounds to the acre."

Practically every experiment station in the South has commented favorably on Sudan grass. Tennessee, for example, says, "If cut early, and properly cured, sudan grass makes a highly palatable and nutritious hay. The chief drawback is the coarseness of the stalks, which cure slowly." Thirty pounds of seed per acre, planted in June are recommended.

SUGGESTIONS FOR STUDY

Questions and Problems

1. What is meant by quality hay?
2. What determines the vitamin A content of hay? Why is this important? In what feeds are vitamins found? In what feeds are they lacking?
3. How does the time of cutting affect quality?

4. When should the common hay crops be cut?
5. How should hay crops be cured?
6. What implements are required in producing hay?
7. Where should hay be stored?
8. What is the advantage of baling hay?
9. Does the South produce all the hay required for home use? How does it compare with the other regions of the country in hay production?
10. How does your state rank in hay production compared with other states in the nation? With other states in the South?
11. How may hay crops be classified?
12. In what respects are legume hays superior to grass hays?
13. By what is the value of a hay determined?
14. What is meant by the term *digestible nutrients? protein? carbohydrates?*
15. What is the average production of hay per acre for the United States? for the South? for your state?
16. Tell how the South may produce two crops of hay per year on the same land? What total annual yield should be made in the South?
17. What are some of the best winter hays for the South?
18. What are some of the best summer hays for the South?
19. What are some of the best hay mixtures for the South? for your state?
20. How should hay crops be fertilized?
21. What part does lime play in the production of hay?
22. At the present prices, how much would it cost per acre to carry out the fertilizer recommendations of Alabama?
23. Discuss the relative values of the hay crops reported for Georgia. Which of these hay crops are most popular in your community?
24. Why is alfalfa one of the best hay crops that can be grown?
25. What are the difficulties in growing alfalfa?
26. Compare alfalfa and lespedeza. Which do you prefer for your farm? Why?
27. What are the different kinds of lespedeza?
28. Is it necessary to inoculate for lespedeza? Why?
29. What are the advantages of a perennial hay crop? What are the perennials that may be used? How does the cost of seeding compare with the annual crops?

30. Select six of the most important hay crops and discuss the way in which they fit into a crop rotation adapted to your locality.
31. Discuss the relative merit of soybeans and cowpeas. Tell how each is grown. What varieties of each are popular in your community?
32. Are you familiar with kudzu? What are its advantages and disadvantages?
33. Tell how to start kudzu. Is it a legume?
34. Is Johnson grass found in your community? Is it grown as a hay crop?
35. To what family does Sudan grass belong? What advantages and disadvantages does it have as a hay crop?
36. What are the three best legumes that can be grown for hay in your community?
37. What is the best grass that can be grown for hay in your community? What is the best hay mixture?

Selected References

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312—*A Successful Southern Hay Farm*
726—*Natal Grass—A Southern Perennial Hay Crop*
1126—*Hay Caps*
1148—*Cowpeas: Culture and Varieties*
1153—*Cowpeas: Utilization*
1339—*Red Clover Culture*
1520—*Soybeans: Culture and Varieties*
1539—*High-Grade Alfalfa Hay*
1573—*Legume Hays for Milk Production*
1597—*Johnson Grass for Hay and Pasture*
1605—*Soybean Hay and Seed Production*
1615—*Hay Stackers and Their Use*
1722—*Growing Alfalfa*
1724—*Farm Practice with Lespedeza*
1731—*Alfalfa Varieties in the United States*
1740—*Vetch Culture and Uses*

Leaflets, U. S. Department of Agriculture

23—*Sweet Clover*
72—*Measuring Hay in Stacks*
91—*Kudzu*
100—*Lespedeza*

Department Bulletins, U. S. Department of Agriculture

977—*Marketing Hay at Country Points*
978—*The Weighing of Market Hay*
979—*Marketing Hay Through Terminal Markets*

SUGGESTED ACTIVITIES

1. From the most recent Yearbook of the U. S. Department of Agriculture, make a study of the statistics dealing with the production of hay. Find out how the particular section of the South in which you live ranks with other sections of the nation in the acreage and yield per acre of hay. How does your state compare with others in the region and in the nation?
2. From your state college of agriculture secure the recommendations relative to a program for hay production similar to the one for Alabama given in this text.
3. Make a study of hay production in your community to determine (1) how much winter hay is made; (2) how much summer hay is made; (3) what crops are used; (4) what mixtures are grown; (5) what cultural practices followed; (6) what the acre yield is; (7) the equipment used on farms; (8) the methods of curing used; and (9) whether or not your community is self-sustaining in hay requirements.
4. In your notebook make a list of all hay crops adapted to your locality, classify as to whether grasses or legumes, give the characteristics of each together with detailed information concerning cultural practices.
5. Select what you regard as the best hay crop for your community and make a detailed study of it securing from every possible source all the data that can be obtained.

Chapter 38

LEADERS OF SOUTHERN AGRICULTURE

IN THIS portion of the text will be found short biographical sketches of those men whose pictures appear at the beginning of each chapter. These men are leaders of Southern agriculture. All are successful according to any standard by which success may be measured. To all of them the South owes a great debt of gratitude. They, and countless others like them, are responsible for what progress is being made in this section of rural America. They are pointing the way to further progress. The young men of today, from among whom the leaders of tomorrow must come, can do no better than to study the lives of the leaders of today.. From their experiences and from the evidences of decisions which they have reached may be formed the patterns for the leadership of tomorrow. The inspiration, the confidence, and the courage which should come from a study of these biographical sketches may mean more to those who use this text than the scientific facts presented. For after all, man does not live by bread alone.

The men whose biographies and portraits appear in this text may, for convenience in study, be divided into two groups: (1) farmers; (2) men engaged in occupations related to farming in the South. All in the first group have been selected as Master Farmers *in the state where they live. All in the second group have been honored by the position which they hold, or by those with whom they have worked. Hundreds of others, perhaps thousands, might be added to the list who are* *just as deserving of recognition as those included. But it is significant that the men whose life stories are included are typical of today's agricultural leadership. They are among the men who are making Henry W. Grady's dreams of the* New South *come true. And in this period of our civilization, when it is sometimes erroneously stated that the opportunities for youth are not so encouraging as in former generations, it is gratifying to realize that there is an urgent need for hundreds of thousands of young men in the Southern States cast in the mold and engaged in the vocations represented by these selected leaders of Southern agriculture.*

CLARENCE POE

Clarence Poe of Longview Farm, Raleigh, North Carolina, is president of the Progressive Farmer-Southern Ruralist Company.

Since 1899, he has been an editor of *The Progressive Farmer.* From a weak, local farm paper, this publication, under his leadership, has become a rural-life magazine with a circulation of 1,000,000 copies each month.

Dr. Poe, as an editor and as a man, has greatly influenced the thinking of the people of the South. He has fought hard, yet sanely and modestly, for a better farm program. He has done many interesting things to aid Southern farmers, one of the most significant of which was to initiate, through *The Progressive Farmer,* the Master Farmer awards in the Southern states.

Many institutions and agencies have honored Dr. Poe. He was given the honorary degree of Litt.D., by Wake Forest; the L.L.D., by the University of North Carolina; the D.Sc., by Clemson College.

He is the past master of the North Carolina State Grange, past president of the North Carolina Dairymen's Association, a director of The Agricultural Foundation, a member of the Farm Tenancy Committee, a trustee of the University System of North Carolina, and holds countless other positions and honors too numerous to report.

Dr. Poe is the author of many books, most of which deal with Southern agriculture. These include the book, *How Farmers Cooperate and Double Profits.* Cooperative effort has been one of the hobbies of Dr. Poe for many years. He was one of the first to advocate cooperative activities among farmers. He saw the value of such activities in Europe, where he made a study of farming.

Dr. Poe uses one page in each issue of *The Progressive Farmer* to comment on the world news, and upon other matters of vital importance in the welfare and progress of the South. It is the belief of Dr. Poe that $500 can be added annually to the average farm income. In one of his frequent messages to farm boys he said, in part:

"I believe that by adopting the ten policies listed below we could reasonably expect to increase our income per farm somewhat as follows.

"1. By soil-saving (terracing, strip-cropping, etc.) and soil improvement through legumes regularly turned under. . . . . $ 75

"2. By live-at-home farming—reducing costs of bought food, feed, etc. 150

"3. By 'adding animal production to plant production' —working and planning to get just as large profits from livestock, dairying, and poultry as from cash crops. 250

"4. By more 'winter farming'—keeping land busy not only in summer but also in fall and winter, growing more wheat, oats, rye, barley, etc., for grain, and more clover, vetch, Austrian peas, etc., for soil improvement. 75

"5. By making timber a real crop—working always for 'a good stand,' not too thin or too thick, keeping out fires, etc. 60

"6. By adding processing profits to production profits —putting each product into as nearly finished a form as possible for consumers. 50

"7. By greater marketing skill—by knowing what grades will bring most, producing those grades, and cooperating with others to get topmost market prices. 60

"8. By joining with neighbors in making the community famous for excellence for some high-quality crop, variety, or breed. 40

"9. By using the power of organization to help get both direct business benefits and a square deal from all forms of government. . . . . $ 60

"10. By more business skill—planning income and outgo so as to have a balanced budget, by trying to save at least 10 per cent of all earnings in good years and investing wisely. 100

"Here we have a sum total of $920 that the average intelligent Southern farmer under most favorable conditions might add to his yearly income. We can lop $420 from that $920 figure and still have $500 extra income per year as something for the average farmer to aim at.

"And we repeat that, in order to have the automobiles, radios, electric current, and other advantages of a twentieth century civilization, you can't begin too soon in getting help—help from 4-H club leaders, vocational teachers, farm magazines, and all other agencies—in training yourself to get that '$500 more' you will need when you marry some fine girl and start farming for yourself."

I. W. DUGGAN

I. W. Duggan, director, Southern Region, Agricultural Adjustment Administration, U. S. Department of Agriculture, Washington, D. C., was born at Sparta, Georgia. He has had experience in many phases of agriculture and agricultural education work.

In 1919, he was graduated from Clemson College with the B.S. degree. For one year following, he taught vocational agriculture in the high school at Greer, South Carolina; for two years he was in business in Anderson.

Dr. Duggan taught vocational agriculture at Ashburn, Georgia, for two years. This was during the period when the Turner County (Live-at-Home) Program was being developed. After Hamilton Ralls (now State Director, Bureau of Markets, Department of Agriculture, Atlanta) gave up his work as the county agent of Turner County, Dr. Duggan succeeded him and served for a period of two years. In the meantime, he was awarded the M.S. degree at Ohio State University.

For four years he was a teacher-trainer at Clemson College. Later he was a member of the staff of the Department of Agricultural Education at Mississippi State College, where he served for four years, but he gave up this position to go with the Agricultural Adjustment Administration in 1934. Upon the resignation of Mr. C. A. Cobb, Dr. Duggan was made acting director for the Southern Region.

In the summer of 1936, Clemson College honored Dr. Duggan by conferring upon him the degree of Doctor of Science.

Because Dr. Duggan had worked with boys and had had a wonderful opportunity to become familiar with conditions in the South, he was asked, "What advice would you give the farm boys in the Southern states who are interested in making plans for a successful career?"

This was his reply:

"The remarks made to me by a Texas ranchman would seem to be very apropos.

"He said 'There isn't much difference between men and steers.

" 'On every drive there are a few steers, generally one, which can be found out in front.

" 'At the first this steer will take the lead, and, thereby will always have fresh, clean water to drink.

" 'The steers in the rear will travel all day in dust, the one in front will be free from such annoyances, and at the end of the day, in spite of all their inconveniences, the steers in the rear will have traveled the same distance as the one in front.' "

GEORGE W. COLLETT

George W. Collett, Edmond, Oklahoma, in 1938, was president of the MASTER FARMERS OF AMERICA. This is an association of all the farmers in the nation who have been given "Master" awards in their own state. They meet once each year, usually, in Chicago during the week of the International Live Stock. Exposition.

Mr. Collett tells the following interesting story about himself and his farm:

"I have been in Oklahoma ever since the opening for settlement by white people. I made the run for a homestead in '89, when I was 26 years old. I still live on the original homestead, but have added to it by purchasing adjoining farms. The land I now own consists of 520 acres. It is creek bottom and upland, making a good stock farm.

"The main business of the farm is breeding milking shorthorn cattle and raising feed for them and some wheat as a side line, of which 2,000 bushels were threshed this last season. In the way of feed, I use alfalfa hay, sheaf oats and ground oats and some cane hay, also cottonseed meal.

"I followed as a source of income in years past the butter business, supplying private customers. During that time I bought two adjoining farms and one residence house in Oklahoma City and built a ten-room house on the farm. Since then I have acquired some additional land and two residence houses in Britton, Oklahoma.

"My main business is breeding milking shorthorn cattle and selling breeding stock. I sold 24 bull calves this past year. The herd now consists of 26 breeding cows with some yearling and two-year old heifers coming on.

"I was born in Missouri, near Palmyra, and acquired a common school education. I worked for my stepfather until I was 21 and then farmed the home place for four years. At that time Oklahoma was opened for settlement, and I made the run and got my homestead here.

"One of the essential things I found in starting out was to keep out of debt. I had very little money when I settled on my own homestead, but, by practising strict economy and working hard and paying cash as we went, we have gotten ahead. We made it a strict rule never to buy anything we couldn't pay for and have been able to practise that and have bought but one bill of groceries on time, and that was just at threshing time. I think one of the essential things in getting started is to go on a cash basis."

Mr. Collett has always produced his own feed. In 1934 when there was a severe drought, he sowed oats which took care of his cattle, while the Federal government was buying "relief" cattle from other farmers and shipping them out of the section. In 1936, however, he was forced to buy some hay for the first time in his life. It is too bad that more farmers do not appreciate the need for living-at-home, both for their families and their livestock.

D. M. CLEMENTS

Dudley Murfee Clements, is the Federal Agent in Agricultural Education for the Southern Region. He is employed by the Office of Education, Department of the Interior, and has headquarters in Washington, D. C.

It is the duty of Mr. Clements to supervise the vocational agricultural program, for the Federal government, in the Southern states. He visits all the states in the Region several times each year. He is personally acquainted with hundreds of teachers and thousands of F. F. A. boys.

Mr. Clements is admirably qualified to discharge the duties of his present position because he was a pioneer in *Smith-Hughes* agricultural education.

After working as superintendent of a farm, Mr. Clements taught agriculture for several years prior to the passage of the National Vocational Education Act in 1917; after the passage of this act, he taught vocational agriculture until 1919 when he became state supervisor of agricultural education in Tennessee. He held this position for sixteen years, or until entering upon the duties of his present position.

Mr. Clements was born in Alabama; his father was a farmer. He was graduated from the Alabama Polytechnic Institute with the B.S.A. degree, and studied at the University of Wisconsin. Later he secured the M.A. degree from Peabody College, Nashville, Tennessee.

This is the message Mr. Clements brings to the boys of the South:

"There are unlimited opportunities for the young man today who wishes to farm in the South. Climate, rainfall, and sunshine have always been present, but the opportunity for acquiring a knowledge of the right use of these blessings of Nature has not been available before. Any boy who has a love of the farm, who has parents to give him a lift, and who is a student of vocational agriculture with active membership in the *Future Farmers of America* can be a successful farmer in the South."

H. H. BENNETT

H. H. Bennett, chief of the Soil Conservation Service, U. S. Department of Agriculture, is the man who, more than any other individual, is responsible for the fact that America is soil erosion conscious.

Mr. Bennett was born on a farm near Wadesboro, North Carolina. As a boy, he had all the usual experiences of a lad on a small farm in the South.

"I recall that on one occasion in 1892 when I was about eleven years old I helped my father mark off field lines for guiding the construction of soil-holding terraces," he says. "I remember that we used an old-fashioned, wooden-frame leveller to establish the grades."

As a boy, he considered farming, pharmacy, and chemistry as vocations for his life's work. He is, and has always been, a farmer. He was one of nine children. After staying out of school for two years to work in a drug store, he entered the University of North Carolina. He now holds the following degrees: B.S., LL.D., D.Sc.

When 22 years of age he secured a position as assistant in the Division of the Soil Survey, Bureau of Soils, U. S. Department of Agriculture.

While doing soil survey work, which he greatly enjoyed, Mr. Bennett first realized that soil erosion was robbing us of our most priceless heritage. He thought and studied about the matter for years. He talked to others about it in an effort to get them interested in helping to form some action program that would lead to a control program. The poor response was, of course, very discouraging to a man who fully comprehended the consequences of neglect. But he never gave up the fight. He talked and wrote about soil erosion for years. Very few people, in the beginning, shared his interest.

Finally, on the 21st of November, 1928, Mr. Bennett was called before the House Committee on Appropriations to make a statement about erosion. As a result, $160,000 was made available to study the matter of the loss from soil erosion. This was really the beginning of the work that is now being carried on under the Service of which Mr. Bennett is chief.

"Interest in soil erosion was greatly accelerated on the 12th of May, 1934," stated Mr. Bennett. "On that day, for the first time since white men came to America, a great dust storm, originating in the plains country just east of the Rocky Mountains, drifted two thousand miles to blot out the sun over the Nation's capital, and hundreds of miles out over the Atlantic Ocean. When particles of soil, driven from the heart of the nation, grated upon the teeth of city people along our eastern seaboard, these people realized that something had gone wrong with the agricultural domain of the West."

In 1935, the Soil Conservation Act was passed by the Congress of the United States. It is now the declared policy of this nation to provide permanently for the control and prevention of soil erosion.

Mr. Bennett has participated in soil surveys in all parts of the United States and in other countries. He has studied the soils of Alaska, Cuba, parts of South America, the West Indies, and the whole of Central America and the Canal Zone.

He has never lost interest in the land of his youth as is evidenced by his book, *The Soils and Agriculture of the Southern States.*

"We of the present generation cannot claim credit for being the first to discover the dangers of soil erosion," said Mr. Bennett. "Long ago we were warned about the evil of erosion by Washington, Jefferson, Edmund Ruffin, Sheler, and others, but unfortunately, regardless of these warnings, erosion has been permitted to continue in this country, not merely progressively, but at an accelerated rate. We are now engaged in a coordinated program designed to save the soil. This job must be carried through to completion. The physical facts involved show conclusively that there is no other way out if the agricultural land of the nation is to be saved."

MARK L. NICHOLS

Mark L. Nichols is an agricultural engineer. He now holds the position as chief of the Division of Research, Soil Conservation Service, U. S. Department of Agriculture, Washington, D. C.

He has many distinctions but none of them so important to the South as that which came because he originated a new type of a terrace—the Nichols terrace (See Farmers' Bulletin 1790) —which is said by all authorities to be the best broad-base terrace ever designed for use in the Southeast. It is not a terrace at all, in one sense of the word, but a plan for developing a water channel which will handle the run-off and not take any of the land out of cultivation. It has the advantage, over all others, that in constructing it soil is moved only downhill. And, it is said, that the "terrace" gets better with use. The Nichols terrace has been used in Alabama for years, but in 1937 was recommended by the U. S. Department of Agriculture for general use throughout the Southeast.

Several years ago the American Society of Agricultural Engineers began awarding what is known as the *McCormick*

Medal to the agricultural engineer who made the greatest contribution to society in the line of his professional work. The first one to receive the award was Dr. Mark L. Nichols.

Dr. Nichols selected his occupation when he was twenty years old. He entered upon the work of his chosen profession when he was twenty-five. He considered specializing in agronomy and soils, but finally chose the then new profession of agricultural engineering.

He is a graduate of Ohio State University, holding the degrees of B.S., M.S., D.Sc. He was selected for membership in three honorary fraternities Alpha Zeta, Phi Kappa Phi, and Gamma Sigma Delta.

From 1912 to 1915 Dr. Nichols was engaged in farming. He taught agricultural engineering and agronomy for one year in the college of agriculture in Vermont. For one year he was with the State Experiment Station in Delaware, then he was engaged for a year in work for the Agricultural Extension Service in Virginia. In 1919 he became head of the Department of Agricultural Engineering at the Alabama Polytechnic Institute at Auburn and served in this position until 1936 at which time he became connected with the Soil Conservation Service.

Agricultural Engineering is a comparatively new field. The opportunities in it are unlimited, according to the viewpoint of Dr. Nichols. There are many problems to be solved.

To boys who are interested in this field, Dr. Nichols advises a good foundation in the sciences, while, of course, securing experience which will make him thoroughly familiar with the problems of the farmer. He says that a boy should take any position that is open to him and study the particular line which he expects to make his life's work until he is an authority in it. He has achieved the goal that he has set for others.

F. P. LATHAM

F. P. Latham, proprietor of the Circle Grove Farm, Belhaven, North Carolina, writes on stationery which informs the reader that this farm is the home and source of LATHAM'S DOUBLE SEED-CORN; and that the farm produces Hereford cattle, Duroc Jersey hogs, Shropshire sheep, potatoes, soybeans, and pecans.

When asked about his career as a farmer, he made this very interesting and inspiring reply:

"My father died when I was 16 and I took over the management of the farm to support my mother and a younger brother and sister.

"There was allotted to me in a later division 61 acres of the home farm. I bought out the interests of the others and became the owner of the farm on which I was born when I was 35 years old.

"To this I have added acreage as needed until today I have 1,450 acres, part in timber that has not been touched for 25 years, the balance in crops and pastures.

"I am 65 years old and still enjoy my work, and continue in active and absolute management of the whole farm.

"There is not now, and never has been, a mortgage on any part of the farm. It has been operated on a pay-as-you-go plan. All the work is done with hired labor which is paid cash each week in the year. We do not have any shutdown season, and work 12 mules, 2 tractors, and 8 men all the time. During busy seasons, we hire more help.

"Unless the young men who are to take up the work of those of us who are dropping out are willing to undergo some strenuous hardships, my thought is that they will move along with the general tide. However, the opportunities today are far greater than ever before and farming is really easier than when I was a boy. There should be great strides made in the next span of an ordinary life."

Mr. Latham made an observation that should be of interest to all Southern boys—that a man had to grow into the successful operation of a big undertaking; that he must be willing to start in a small way and grow with his work. That is what Mr. Latham has done.

OSCAR JOHNSTON

Oscar Johnston, as president of the Delta and Pine Land Company, Scott, Mississippi, is perhaps the "biggest cotton farmer" in America. At any rate, the organization of which he is president is the *largest staple cotton plantation in the world.*

Mr. Johnston is not only a farmer but a lawyer and banker as well. After graduating from Cumberland University with first honors, he practiced law for nineteen years. Following this experience he engaged in banking for five years. Since 1926 he has been engaged in the work which has made him an outstanding figure in the cotton production history of America.

The company with which Mr. Johnston is associated is an old one, having been organized in 1886. At that time, however, the purpose of acquiring the land was quite different from that of the scientific, cooperative farming which has made *D. & P. L. Co.* known wherever cotton is grown or utilized.

The achievements under the direction of Mr. Johnston were summarized in the *Cotton Trade Journal* (International Number—1937) as follows:

A. *Conditions prior to consolidation*

15,000 acres cleared out of 22,000.
10,000 acres in cotton.
5,000 acres in corn, feedstuff, and pasture.
20 white families.
500 negro families.
5,000 bales of cotton average production, mixed quality and staple and varied ginning.

B. *Conditions under present management*

20,000 acres cleared out of 22,000.
10,000 acres in cotton.
4,000 acres in corn.
6,000 acres in "soil building" crops.
2,000 acres in woodland.
40 white families.
850 negro families.
10,000 bales of cotton, on the average, standardized, even running $1\frac{1}{16}$ staple and developed on the plantation.

Comparing present conditions with those prior to consolidation it is found that the white families have been increased 100 per cent; the negro families 70 per cent; the acreage in cotton has remained unchanged; the cotton produced has increased 100 per cent and the improved quality of the cotton has added greatly to its value. As a matter of fact, in 1937 the average yield of lint cotton was 650 pounds.

The *Cotton Trade Journal* says, "In theory nothing has been done which the original twenty owners could not have done on a cooperative basis."

As a matter of fact the Delta and Pine Land Company is operated on something of a cooperative basis. The Negro families work on a share basis not unlike that which is common to the Cotton Belt, the main difference being that they each made about three times as much cash in addition to certain perquisites that are not available to the average farm family.

The cotton produced on the plantation is marketed through the Staple Cotton Cooperative Association, Greenwood, Mississippi.

"The Delta and Pine Land Company of Mississippi may give us a glimpse into the future of farming operations," said an economist in reviewing their work. "The average individual is not an executive; the average clerk in a store would not care to assume the responsibilities of management or be capable of doing so. Is there any reason then to believe that every person now farming is an executive and a good manager of capital and labor? Perhaps the 'Delta' company has pointed the way to a solution of the so-called tenant problem."

DAVID R. COKER

David R. Coker was nominated by *The Progressive Farmer* as the man in South Carolina who in 1937 had rendered the greatest service to agriculture in his state. This was a great honor, and one richly deserved. But it was by no means the first time that Mr. Coker had been honored for making a significant contribution to the progress of farming in his own state and throughout the entire South.

"If greatness be measured by usefulness to others, then David R. Coker is the greatest man in my State of South Carolina," is the opinion of James C. Derieux, which is expressed in an article about Mr. Coker that appeared in the *Country Home* magazine under the title: "The Greatest Man in My State."

"David R. Coker is South Carolina's greatest farmer," said Mr. Derieux. "He has made money at farming himself, and has added several millions a year to the aggregate income of other Southeastern farmers. He knows more about cotton from seed to shirt, than any other man in the Southeast, is equally acquainted with grains, and knows something about cattle."

This opinion concerning Mr. Coker is shared by the thousands who know him as the founder and president of the Coker Pedigreed Seed Company, Hartsville, South Carolina. On his farms he has developed, with the aid of the best plant breeders available, varieties of cotton, tobacco, oats, wheat, soybeans, and other crops adapted to the South. Each year thousands of persons from all parts of the world visit the Coker farms. Representatives come from China, Russia, Japan, and most of the countries of the earth so that they may learn of the breeding work done with the crops in which they are interested.

Mr. Coker lives in the county in which he was born. He has made a life-long study of Southern farming and Southern economic conditions. When asked the question—What is the matter with Southern Agriculture?—this is, in part, his reply.

1. We buy one billion dollars' worth of products from outside the South. We should raise most of these things.
2. We depend too largely on cotton and tobacco—six months' crops—and are idle too much of the time.
3. We do too little rotating of crops.
4. We need to develop the livestock industry and build up our soils.
5. We do not usually produce the best quality and maximum quantity per acre in our money crops.
6. We need to quit planting many millions of acres of our poorest lands and put them back into forests.
7. We need to learn more of the new and proved facts of scientific agriculture and demonstrate them more widely.

Mr. Coker points out that we need to increase our yields per acre. He says that we should produce per acre from one to two bales of cotton, 300 to 500 bushels of sweet potatoes, 15 to 20 tons of silage, 500 bushels of turnips. And Mr. Coker demonstrates on his own farms that these large and profitable yields can be made. He has pointed the way for others to do the same thing.

Mr. Coker is in the seed business; he knows that business thoroughly. In connection with it he made a statement which every young man interested in farming should learn and never forget. *The farmer who plants as much as 100 bushels of seed can employ the best seed breeder in the world for the small cost of 10 or 15 cents an acre.* Pedigreed seed is the smallest cost in growing a crop; it pays a larger dividend than any other investment which a farmer can make.

After David Coker finished college, he faced, as every boy does at some time in life, the question: "What kind of work offers the best chance for a satisfactory life?" He decided upon farming. He has made a great success of his chosen occupation. The best thing about his career is that he has helped others and is pointing the way to a more prosperous agriculture for the South. No greater service than this can be rendered by any man.

J. S. MOGFORD

J. S. Mogford, professor of agronomy, Agricultural and Mechanical College of Texas, College Station, inaugurated and developed a plan unique in the land-grant colleges of the South in teaching COTTON.

Several years ago he recognized that while cotton is the major source of income for the majority of the farmers of the South, that boys in our agricultural colleges devoted very little time to the study of the crop. He realized too that to know cotton we must know about it as a world crop; we must know about production in the other countries where it is grown, and about utilization in the other countries.

With these thoughts as a background, he conceived the plan of taking students in the Texas A. & M. College to other countries of the world where they might learn about cotton at first hand.

As a result, during the past six years tours have been conducted to England and other European countries four times. One group visited Japan and China. The 1935 tour included Portugal, Spain, France, Egypt, and Italy.

The policy has been fixed; it will be continued. Trips will be made to all the countries already visited and to South America, Russia, and all other places on the globe where cotton is a factor in the economic life of the people.

Three students are selected annually for the trip. They are chosen on the basis of an examination from the members of the junior and senior classes. The examination covers every aspect of cotton production from the botany and genetics of the plant to the marketing of the crop, also every phase of manufacturing and utilization. Every boy who acquires enough information to pass the series of examinations has been well repaid for the effort expended. The three, who stand at the top, are rewarded, in addition, with the learning acquired only through travel. In the beginning, the plan was launched with outside financial assistance; now methods of raising the money have been developed within the college community. Even the means of raising the money embrace cotton promotion, for the major source of revenue is that of a cotton pageant and ball.

Professor Mogford was born at Streeter, Texas, the son of a rancher. He graduated from the Texas A. & M. College with B.S. and M.S. degrees.

"Jo Mogford knows more about cotton than any man I have ever met," said an acquaintance in Texas. That he is well informed cannot be doubted. Not only has he conducted exhaustive studies through his teaching, but he has conducted most of the Texas Cotton Students' Tours. He has worked in scientific cotton work all of his life, including breeding work for the Mebane Cotton Breeding Association.

"What advice," he was asked, "would you give boys who wish to understand cotton thoroughly?"

"I would suggest that they not only study cotton, but also the fundamental sciences," he replied. "But the study should be supported with practical work of every kind related to cotton. They should keep up with what's going on, use initiative, and work hard. Cotton is our most important crop. We have many unsolved problems related to the crop and we need young men prepared to solve them."

H. W. BARRE

H. W. Barre, principal pathologist, in charge of the Division of Cotton and Other Fiber Crops, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C., was born at Lexington, South Carolina, and educated at Clemson College and the University of Nebraska. He holds the degrees B.S., A.M., D.Sc. For eighteen years he was director of the South Carolina Experiment Station, and, prior to that, served for twenty-one years as a teacher in Clemson College and as a plant pathologist for the South Carolina Experiment Station.

Dr. Barre has done many things to aid the farmers of the South, but perhaps the most important is his work which led to the control and practical extinction of anthracnose.

In 1908, when Dr. Barre began his work, little was known about the life history of the organism responsible for anthracnose, except that it caused the rotting of the cotton bolls. His studies developed the fact the disease is carried in the seed and that diseased seed is the principal source of infection and the principal mode of distribution. He also found that the organism did not live for more than a year in the diseased plants in the field, especially when they were plowed under, and that the organism does not live in the seed for more than two years. From these facts control measures were worked out. At that time the annual loss from anthracnose was 10 or 15 million dollars a year. Today it is practically nothing.

Dr. Barre was also among the first men to work on cotton-wilt and angular leaf-spot.

He has added greatly to the income of the cotton farmers of the nation through his work. Now he is in charge of the cotton investigation work of the U. S. Department of Agriculture. With respect to that work, Dr. Barre made the following statement:

"Cotton ranks first among all of the crops in American agriculture as a direct source of farm income. It furnishes employment to more farm people than any other one crop. It leads all other farm products in total value of exports.

"The consumption of American cotton in world markets has decreased materially during the past year. We still import some special types of cotton that it seems might be produced in America. We need to do fundamental research with cotton, therefore, along two main lines: Researches that will contribute to improvement in quality; and researches that will point the way to more economic production.

"Cotton spinners are becoming quality conscious. In many of the more highly specialized fields of manufacture, cottons with specific fiber properties are being sought. Work done by the Cotton Marketing Division of the Bureau of Agricultural Economics now enables us to measure and define cotton fiber properties. From their work we are now able to determine the proportion of fibers of different lengths in a given sample of cotton. We can define and measure fineness, strength, degrees of maturity, porosity, flexibility, etc. These methods of measurement now enable those engaged in cotton plant research to determine progress made through the different steps of selection, breeding, and improvement.

"Cotton plant research in this country has lagged far behind the types of fiber research referred to above. We know very little about the factors which are responsible for the differences in specific fiber properties. We know that there is great variation in the number of fibers of different lengths in different samples of cotton, but we do not know definitely what the factors are that contribute to this lack of uniformity in length. The same thing is true of fineness, of strength, of color, and of many other properties which go to make up quality in cotton. To form a sound basis for improvement in the quality of American cotton it is, therefore, necessary that thoroughgoing researches be conducted in plant physiology, ecology, pathology, genetics, and agronomy.

"To hold our foreign trade and satisfy our own textile demands, we must not only produce better cotton than any other country produces, but we must produce it at a price that will compete in world markets. There are several different fields in which research must be conducted in order to insure the most economic production of cotton. In the field of genetics, fundamental studies of inheritance of characters important in breeding, the linkage of characters and the nature and behavior of chromosomes must be thoroughly investigated to provide a ground-work for breeding and developing new varieties and for stabilizing existing varieties.

"Botanical and physiological researches are needed to determine more definitely the growth and fruiting habits of the plant. Disease control will always be an important factor in economic production of cotton. The total number of bales destroyed by diseases is not important when there is a surplus of cotton on hand, but the important point is that diseases reduce the acre yield and take the profit out of production for the individual farmer.

"Under the plan for a coordinated research program, which has just been worked out by the Bureau of Plant Industry in cooperation with the directors of the experiment stations of the several Southern States, it is proposed to tie in all phases of research and coordinate these in such a way as to make the most rapid progress possible at a minimum cost. To carry out such a plan the Division of Cotton and Other Fiber Crops and Diseases would employ outstanding scientists, especially qualified for work in the several fields, and station these at the colleges and experiment stations throughout the Cotton Belt. Besides fundamental research in physiology, pathology, genetics, agronomy, etc., it is the purpose to employ fiber technologists and morphologists who will study technical phases of fiber quality and maintain a service organization and laboratory in Washington for studying and analyzing samples of fiber sent in by the scientists working in all parts of the belt. All of this work is expected to be fully cooperative between the United States Department of Agriculture and the agricultural colleges and experiment stations. It is expected that the different lines of work will be located at colleges where there is already leadership in the special fields, in which case the Department would strengthen and supplement the researches already under way at these points rather than initiate new lines of work. The details of the program will be worked out as funds become available and as plans develop."

WILMON NEWELL

Wilmon Newell is dean of the College of Agriculture of the University of Florida, Director of the Experiment Station, and Director of the Agricultural Extension Service.

It was through entomological work that he came to the administrative positions he now holds.

Dean Newell is the man who first demonstrated that arsenate in the dust form could be used successfully and profitably in the control of boll weevil.

At the time that this discovery was made, Dr. Newell was engaged in crop pest control work in Louisiana. His achievement in boll weevil control was of such vital importance, not only to that state but to the Cotton Belt and to the entire nation, that the following facts have historical significance:

Prior to 1908 statements were frequently made that the boll weevil could not be poisoned profitably. The South was in a panic-stricken condition. The conclusion reached by various investigators was that water soluble arsenate in Paris green exerted a toxic effect on the cotton plant to an extent which offset any increase in yield due to killing some of the weevils with the poison.

In 1906 and 1907 Dr. Newell attempted to produce arsenate of lead in the form of a powder fine enough to be applied in dust form. Previously, lead arsenate had been available only in the paste form and could be used only as a liquid spray.

Dr. Newell's efforts were successful. In 1908 cage experiments with dust showed a weevil mortality of 70.8 per cent, as compared with a mortality of 34.5 per cent with Paris green. (Circular 23, Louisiana Crop Pest Commission, July, 1908.)

Arrangements were then made with a leading chemical company to manufacture the powdered lead arsenate in quantity. In 1909 Dr. Newell, assisted by George D. Smith, tested the powder in thirteen cotton fields in Louisiana. The average yield of cotton where the dust was applied was 673.8 pounds per acre, and of non-poisoned cotton used as a check, 392.6 pounds per acre, or an increase in the poisoned cotton of 71 per cent in yield.

After deducting all costs of poisoning, including labor, from the value of the increased yield, a profit from poison was shown which ranged from 27 cents to as high as $23.54 per acre. The average for all fields for the year was $9.39 per acre. (Circular 33, Louisiana Crop Pest Commission, December, 1909.)

This is a very brief summary of the work that led to the present method of controlling the boll weevil which is used wherever cotton is grown. And this work represents one of the greatest and most significant contributions which science has made to the improvement and progress of agriculture.

But this is not the only contribution for which Dr. Newell is noted. He is also responsible for the eradication of citrus canker and the Mediterranean fruit fly. In the annals of Southern agriculture, the work of Dr. Newell will live forever.

Dr. Newell was born in Iowa. He was graduated from the Iowa State College with the degrees B.S., M.S., and D.Sc. He has been honored by being awarded a Doctor of Science degree from Clemson College also, and his work has been done largely in the South.

In 1902 he came to Texas as assistant entomologist and apiarist of the Texas Agricultural Experiment Station. Since that time he has not only worked in Louisiana, but also in Georgia, where he served as State Entomologist in 1903-04.

In 1915 he went with the Florida State Plant Board and in 1921 to his present work. Few men, if any, have made a greater contribution to the progress and development of Southern agriculture than has Dr. Wilmon Newell.

HARRY B. BROWN

Harry B. Brown, Research Professor of Agronomy, Louisiana Experiment Station, Baton Rouge, is the author of a book, *Cotton Production*, which is widely used in the Land-Grant Colleges of the South. Our Southern people have written so few books dealing with farming and other phases of our economic life, and we need such literature so much, that any person who makes such a contribution is to be commended for rendering a public service.

In studying the life and work of Dr. Brown, many "vocational guidance" lessons are revealed. For example, he selected the field of specialization in which he is now engaged at the age of 26, and entered upon it at the age of 35. Many boys are in such a hurry to enter upon an occupation that they are not willing to make adequate preparation. Of course, Dr. Brown did not wait until 35 to begin work. On the contrary, he was led to his final choice of a career through work experiences.

Below are listed, in chronological order, the positions he has held together with the time devoted to each:

Position	*Length of Service*
Teaching in common schools	5 years
Teaching in high schools	3 years
Asst. college instructor	2 years
College instructor (Cornell)	4 years
Professor of Botany (Mississippi)	3 years
Plant breeder (Miss. Exp. Station)	7 years
Plant breeder (Stoneville Seed Co.)	5 years
Cotton breeder (La. Exp. Station)	2 years
Cotton breeder and agronomist (Louisiana Experiment Station)	9 years

This is an interesting vocational progress ladder.

Dr. Brown holds the degrees, A.B., A.M., and Ph.D. He earned nearly all his college expenses.

He says, "Plant breeding as a science is very young. Hardly a start has been made, yet we see gratifying results of the work done. It is a field with a favorable outlook. We are in need of such work in the South."

To boys interested in preparing for such work, he recommends a good foundation in the sciences—chemistry, botany, and genetics.

With respect to cotton with which he has worked successfully for many years, he says: "The greater part of the human race will probably continue to look to cotton as a source of clothing for centuries to come. The fiber is easily produced, making it low in price, and easily made into comfortable and fairly durable clothing. Synthetic or artificial fibers may be produced and used in quantities, but it will be hard for them to compete with cotton in respect to the cost of production."

WILL CLAYTON

William Lockhart Clayton is chairman of the board of Anderson, Clayton & Company who are the greatest cotton merchants in the world.

Anderson, Clayton & Company have offices in Houston, Atlanta, New Orleans, Memphis, Los Angeles, Mobile, Savannah, Boston, Providence, New Bedford, Charlotte, Gastonia, Greenville, Dallas, and many other points in the United States.

In foreign countries they have offices at Alexandria, Egypt; Bombay, India; Mexico City, Mexico; Sao Paulo, Brazil; Buenos Aires, Argentina; Lima, Peru; Asuncion, Paraguay; and other points.

In addition this great firm of cotton merchants have representatives in Austria, Belgium, Canada, China, England, France, Germany, Holland, Italy, Japan, Poland, Portugal, Spain, Sweden, and Switzerland.

Wherever cotton is sold the name of Anderson, Clayton & Company is known. As was said about the British Empire, "the sun never sets" on the business of Anderson, Clayton & Co.

This firm was started in 1904 in Oklahoma City with a capital stock of $9,000. It was then a partnership. In 1920 a joint stock association, under the laws of Texas, was formed. In 1920, it opened an office in Mexico; in 1930 in Egypt; in 1932, in South America. The "home" office is now in Houston, Texas.

Within two or three years after the firm was organized, it extended the scope of its activities to the ginning and compressing of cotton and the milling of cottonseed, and today these related activities constitute a considerable part of the firm's business. Its principal business, however, always has been the merchandising of raw cotton. In recent years, the firm has also gone into the business of financing the production of cotton, especially in irrigated regions, including Arizona and California.

Will Clayton, as he is known throughout the world, began his career in the cotton business at the age of 15 years as a stenographer. He worked for the Cotton Ginners Compress Company and its successor, The American Cotton Company.

His first salary was $65 a month.

Starting as a stenographer, he held a number of positions over a period of years including that of invoice clerk, manager of the sales department, assistant treasurer, and treasurer.

In 1904, at the time he resigned to organize, with his associates, the firm of Anderson, Clayton & Co., he was assistant general manager of The American Cotton Company in New York.

Mr. Anderson was born at Tupelo, Mississippi. He attended the public schools of Jackson, Tennessee, until he had finished the 7th grade. Aside from a period in night schools, this is the only formal education that Mr. Anderson received. But he has spent his life in study, particularly the study of economic subjects.

Education is important in the life of any successful person. The point that some people fail to appreciate is that education is a matter of personal attitude and effort. Education is not always acquired in school; in fact, many people who go through college have little or no education.

Mr. Anderson recognizes, however, that it is easier to get an education in school and for that reason recommends a college education, with a major in economics.

"Character, hard work, and the ability to get along with people are the essentials for success in any line of work," is the opinion of Mr. Anderson, who, as a self-made man, became the greatest cotton merchant in the world.

CHARLES M. MEACHAM, JR.

Charles M. Meacham, Jr., KOREANDALE FARM, Morganfield, Kentucky, is one of the best farmers in his State, in the opinion of all the people who know him.

He is a seedsman as well as a farmer and sells Korean Lespedeza and Hybrid seed corn. He is a pioneer grower of certified field seeds. He is also a breeder of registered Shorthorn cattle and pure bred Poland-China hogs. He has won many honors; his farm exhibits have won first prizes, at the Kentucky State Fair.

Mr. Meacham HAS MADE 65 BUSHELS OF CORN PER ACRE FOR THE LAST FIVE-YEAR PERIOD. HE MADE AN AVERAGE OF 80 BUSHELS PER ACRE IN 1937. He has made 25 bushels of wheat per acre for the past five years. He has made 45 bushels of barley. He MAKES 2½ TONS OF LESPEDEZA HAY PER ACRE. He makes 4 tons of alfalfa hay per acre per year—four cuttings, averaging one ton each.

Koreandale farm contains 514 acres; 322 in cultivation, 30 acres in woodland, and 120 acres in permanent pastures.

The yields made on Mr. Meacham's farm are remarkable. They are due to many things, including the practice of a three-year rotation and the use of soil-improvement crops. His rotation is:

First Year: Corn
Second Year: Small grains with Korean seed or hay
Third Year: Same as second

To the farm boys of the South, Mr. Meacham sends this message: "I feel that agriculture has great possibilities for the young man of today. Energy, thought, and common-sense application of the new developments will pay better than anything in the South that I know anything about. It is my opinion that hybrid corn will play an important part in the agricultural progress of the South. To the young man with education and energy, I would advise careful consideration of this new development in corn."

ROBERT FLAKE SHAW

Robert Flake Shaw, a Master Farmer of North Carolina, lives at Greensboro, Route 2.

When Mr. Shaw received his award, *The Progressive Farmer* told of his achievements in the following way:

"Speaking of difficulties overcome by Master Farmers, there's Guilford County's R. Flake Shaw. He started as an orphan boy with absolutely nothing—no living father or mother, no money, and no school advantages.

"Now he has two farms totaling 387 acres, with a program developed that includes about 40 head of cattle, with a milking herd of 20 cows (largely Guernseys), 500 laying hens, and a weekly income of about $100, and has already sent three children through college, with three more to follow—all the result of good farming.

"When the Federal Soil Conservation Service entered the territory in which Mr. Shaw lives, he didn't have to change his farm program to meet the ideal plans which the Service advocated. Years before he had adopted a soil-improvement and five-year rotation system.

"In ten years' time this five-year rotation doubled his crop yields. This is his rotation—

First year—Corn
Second year—Wheat
Third year—Lespedeza, clover, and grass mixture for hay.
Fourth and Fifth years—Lespedeza, clover, and grass mixture pastured.

"With more such programs we would have higher acre yields, more profitable farming, and we would live-at-home.

"Mr. Shaw makes $2\frac{1}{2}$ tons of winter hay per acre by using a mixture of wheat, oats, barley, winter peas, and vetch. This yield is twice the national average for hay production in the winter, and is as rich and valuable feed as can be produced anywhere in the country.

"My definition of a good farmer," says Mr. Shaw, "has always been a man who could buy his farm on credit, improve and pay for his land, and educate his family."

R. W. ROYSTER

R. W. Royster, Clover Leaf Farm, Riddleton, Tennessee, has outlined ten rules for operating his 600-acre farm on which he makes a gross income of more than $10,000 a year. These are:

1. We employ the best of tenants.
2. Compel them to raise what they live on.
3. Diversity farm production.
4. Make our land better each year.
5. Market all hay and grain through livestock.
6. Grow what we eat on the farm.
7. Raise pure bred livestock.
8. Have something to sell the year round.
9. Keep farm well stocked at all times.
10. Keep farm records with the Tennessee Extension Service.

Mr. Royster is largely a livestock farmer, although he sells about $3,200 worth of tobacco each year. He keeps a few Jersey cattle, and a rather large number of Angus. Each year he sells about 225 Duroc hogs. He keeps Southdown sheep and Rhode Island Red chickens.

He grows about 200 acres of lespedeza in his farming plan, and 100 acres of clover including, red, alsike, and crimson. He turns under about 125 acres of legumes annually.

His average acre yield of corn, on 125 acres, is more than

50 bushels. This is four times the average acre yield of many of the Southern states. He makes about 35 bushels of oats to the acre; and 5 tons of sweet sorghum per acre.

Mr. Royster is a director in the Farm Bureau. From the list of publications to which he subscribes, it is evident that he is well "posted" about agricultural problems and progress. He has the well-balanced type of farming which is essential to economic safety. And he has chosen a most appropriate name for his farm.

C. B. WILLIAMS

C. B. Williams is the Head of the Department of Agronomy, North Carolina State College of Agriculture and Engineering, Raleigh. He has written so much in his special field that many pages are required merely to list the titles of his articles and bulletins.

He holds the degrees of B.S. and M.S. awarded by North Carolina State College. He studied at Johns Hopkins University and the Ohio State University. At one time he made an extensive tour of Europe and was chairman of a committee that prepared a report on European Agriculture.

He has served as dean of the College and director of the Experiment Station. He has been chairman of the Southeastern Tobacco Research Committee, and chairman of the Southeastern Research Committee.

He is a member of Phi Kappa Phi, Pine Burr, American Society of Agronomy, American Society for the Advancement of Science, and the National Grange.

To boys who are interested in making some phase of agronomy their life's work, Mr. Williams makes the following suggestions:

1. Secure good foundation training in chemistry, geology, botany, physics, economics, mathematics, and English.
2. Decide early in college—by the end of the first year—what special phase of agronomy work you want to select as your life's work and center upon thorough preparation for it.
3. Determine to be the best in your chosen field.
4. Do not let anything swerve you from your chosen goal.
5. Do not be afraid of hard, diligent work, because this will be required for marked success in your chosen field.

It is the business of an agronomist to help solve crop problems. "This," says Mr. Williams, "would seem to be work that has a favorable outlook, so far as we can see into the future."

WILLIAM N. HENDERSON

William N. Henderson, Ninety Six, South Carolina, operates a farm which cost him $45,000 and upon which he has expended $15,000 for improvements.

In this farm of 410 acres, 300 are in cultivation, 50 acres in woodland, and 60 acres in permanent pasture.

The principal sources of income from this farm are cotton, grain, and livestock. The livestock consist of grade beef cattle, hogs, and sheep. In addition, about $2,000 a year is realized from the sale of pedigreed seed.

Like all outstanding farmers, Mr. Henderson makes high yields per acre. Over a five-year period he has averaged 450 pounds of lint cotton per acre, 35 bushels of corn, 200 bushels of sweet potatoes, and 50 bushels of oats. He uses about 400 pounds of fertilizer per acre.

Mr. Henderson sells most of his crops in the form of livestock, which, by the way, is a form of marketing practiced too little on Southern farms.

The best hay crop on this high-priced farm is alfalfa. Mr. Henderson reports about 3½ tons of hay per acre.

He believes in feeding silage, and dug the first trench silo in the State of South Carolina.

He practices a three-year rotation; uses as cover crops oats and vetch, and lespedeza and peas; turns under some of his legume crops; and produces an abundance of hay.

In telling the story of his farming experience, Mr. Henderson said, "I was reared on a large cotton farm. I attended Clemson College until the junior year and then returned home to begin farming on a poor 160-acre farm that was given to me by my father. The farm cost $15 an acre. After building it up to a high state of fertility, I sold it for $150 an acre. I bought the farm on which I am now living. I have five children; two have graduated from college, one from Emory and one from Clemson; my youngest girl is now a senior at Winthrop College; the second boy is a freshman at Clemson; and the youngest is in the 10th grade of high school."

On being asked what advice he would give to boys interested in farming, Mr. Henderson said, "Get a good farm or leave farming alone." He did not mean that it was necessary to pay $45,000 for a farm for he believes that this was too much.

EDWARD A. O'NEAL

Edward A. O'Neal, president of the American Farm Bureau Federation, was born near Florence, Alabama. He was reared on a large cotton plantation, and now operates a plantation of 2,600 acres on the Tennessee River.

Mr. O'Neal was graduated from Washington and Lee University with an A.B. degree. Years later, after he had become a leader in American agriculture, he was awarded the honorary degree of *Doctor of Agriculture* by the Alabama Polytechnic Institute, Auburn.

After finishing college, Edward O'Neal returned to the farm. For more than 25 years, he devoted his entire time to farming. Not being trained in agriculture, he turned to the Alabama College for guidance and followed the recommendations given. He grew cotton, but also legumes, livestock, and grain.

He is not a Master Farmer, but along with the men given this recognition Mr. O'Neal was awarded a gold medal, by the Alabama College and *The Progressive Farmer*, for DISTINGUISHED SERVICE IN FARM LEADERSHIP. This is the only medal of its kind ever awarded.

As the need for organization on the part of farmers became more apparent, Mr. O'Neal devoted more and more of his time to this work. Since 1922 he has been an official in the American Farm Bureau Federation and, as its national president, has played an important part in all the farm legislation that has been passed in the nation for the betterment of agriculture. He was a charter member and first president of the Lauderdale County Farm Bureau. For seven years he was president of the Alabama Farm Bureau.

Out of his broad experience, Mr. O'Neal brings to the young men of the South the following message:

"My advice to young men who love the land would be to make farming their life work. I am convinced that public opinion will ultimately, and perhaps sooner than we think, demand that inequalities between farmers and other groups be removed by legislation.

"I base this statement on observation and experience through many years. Only recently *Fortune Magazine*, in its analysis of public opinion on important issues, reported that nearly 50 per cent of the people of this country favor guaranteed prices for farm commodities. I am not an advocate of fixed prices, but I mention this as important in showing how people generally are thinking on this problem.

"I believe further that farmers have become strongly organization-conscious in recent years, and that they will work together much more effectively in the coming years than they ever have in the past. That means that they will be able to accomplish some of the reforms that they have fought for so strenuously in the past. They have the power, if they will but organize more completely, to bring about almost any reform that they desire. It goes without saying that only so long as their demands are reasonable, can they expect public support; but I believe that farmers are the most reasonable class in the country when it comes to asking for legislative helps, and that we have, as yet, nothing to worry about on that score.

"I believe that this nation, for the sake of its own future welfare, must encourage better conditions on the farm, because population replacements for the cities must come from the farm, and it is to the interest of the cities and the nation that those replacements be well born, well educated and physically fit to withstand the rigors of life in the cities.

"In the past, agriculture has suffered because farmers operated their business under a system of free and open competition, while industry and labor operated under a fixed economy. The tariff, monopoly privileges, the corporate form of organization, legislation such as the Guffey Coal Act and the Miller-Tydings Act, the principle of collective bargaining and many other artificial devices have helped other groups to stabilize their prices and their wages. In order to maintain fair economic balance between the different groups, agriculture must be given equivalent help. I am certain in my mind that this will be done, for the simple reason that the nation must stabilize agriculture in order to supply buying power sufficient to keep our mass-production industries going.

"Life on the farm gives people a wholesome attitude on social problems. The warped thinking that is a by-product of tenement living must be offset by the sound, clear thinking of people in rural areas if this country is to maintain philosophical balance. Industrial leaders are becoming more and more aware of this, and eventually industrial leadership must be influenced by such considerations to adopt a constructive attitude on the farm problems.

"On the whole, I am convinced that the outlook is more favorable for equality for agriculture than it has been in many years. So I would say that any young man who is at heart a countryman can prepare to follow his chosen profession with a fair prospect that he will be able to live well and educate his family on the income from his farm. There will never be opportunities for accumulating great wealth on the farm, but there will be abundant opportunities to live purposefully and constructively, and to achieve a fair measure of financial success."

M. J. FUNCHESS

M. J. Funchess, Auburn, Alabama, is dean of the School of Agriculture, and director of the Alabama Experiment Station.

In January, 1938, he was selected by *The Progressive Farmer* as THE MAN OF THE YEAR in service to agriculture for the State of Alabama.

In the citation that conferred this honor upon Director Funchess he was credited with having directed the experimental work which led to the breaking of all cotton-producing records in the year of 1937. This, in brief, is the story of what the farmers of Alabama did:

"By averaging 294 pounds of lint per acre, Alabama farmers produced the highest per acre yield ever recorded in the state. In 1936 the average yield was 236 pounds. The previous ten-year average was 194 pounds. The total yield in the state was 1,610,000 bales, the highest since 1914 when 1,751,000 bales were harvested.

"Much of this increase in cotton yield is attributed to the use of better varieties, and the following improved fertilization practices. Statistics show that farmers in 1937 used 181,040 tons of 6-8-4 fertilizer (see Chapter 10—Fertilizers for Cotton) as recommended by the Alabama Experiment Station and Extension Service. They also used 145,700 tons of 3-8-5, most of which was side-dressed with nitrate."

This is but one of many evidences of the value of practical application of the results of experimental work directed by Dean Funchess.

Dean Funchess was born at Orangeburg, South Carolina. He studied agriculture at Clemson College and at the University of Wisconsin, and he has studied it ever since he completed the requirements for the B.S. and M.S. degree. He is sometimes called Director "Facts" Funchess because he has accumulated many facts of great value to Southern farmers. The bulletins of Auburn are read with great interest in all the Land-Grant Colleges of the South. He richly deserved the honor conferred upon him by *The Progressive Farmer.*

R. P. BURSON

R. P. Burson, Monroe, Georgia, is a Master Farmer who has won many distinctions as a farmer and outstanding citizen of the state.

In 1929 he won the first prize of $1,000 in the MORE AND BETTER PER ACRE COTTON CONTEST. A bulletin of the College of Agriculture in reporting the contest (Bulletin 383) contains the following statement:

"Mr. Burson produced 5,283 pounds of lint cotton on five acres, which returned a profit of $610.89. His net cost of production was six cents per pound of lint. The cotton was fertilized with 845 pounds per acre of a home mixed fertilizer analyzing 4-12-5, which was derived by mixing Chilean nitrate of soda, superphosphate, and muriate of potash. After chopping time, the cotton was side-dressed with 200 pounds of nitrate of soda and 100 pounds of muriate of potash per acre. On the 16th of May, 8 bushels of Burson's Cleveland cotton seed were planted in 3½-foot rows and thinned to 12 to 15 inches, one to two plants to the hill. The cotton was mopped with sweetened poison on June 10th to kill the first crop of weevils. Two applications of poison dust were made in August and September."

The crops from which Mr. Burson derives his major income rank as follows: cotton, wheat, peavine hay, and sweet potatoes.

"I made on 30 acres of wheat last year 590 bushels and sold it for $1.35 per bushel and on the same land made 55 tons of good peavine hay which I sold for $18.00 a ton," said Mr. Burson in discussing his plan of farming.

He makes from 250 to 400 bushels of sweet potatoes per acre. About three-fourths of these, he reports, are of such a size and quality that they can be sold on the markets. The jumbos are fed to hogs and cattle. The small ones are sold for bedding.

"I sow about one-half of my land in wheat, oats, and rye," said Mr. Burson, "and then follow with Iron peas for hay. I also sow peas in the corn. This is about all the cover crops I use, but I follow a system of rotation on my farm."

From the production figures given it will be seen that he is a good farmer. But, if possible, he is a better salesman.

Mr. Burson knows all the men on the wholesale fruit and vegetable markets in Atlanta and they all know him.

With these men his products have a good reputation. They know that anything from the farm of Paul Burson will be graded and of good quality. But they know more than this—they know that he is to be depended upon for deliveries at any time.

Often these men on the Atlanta markets call him in the night to ask if he can have a truckload of potatoes on the market at 3:00 or 4:00 A.M. If he promises them, the potatoes will be there. The same principle is applied to the marketing of all the crops produced on the Burson farm. This ability to market his products, in the opinion of those who know him best, is perhaps one of his greatest assets as a successful farmer.

Mr. Burson is active in the affairs of his community, county, and state. He is interested in education and, at one time, had three daughters in the University who graduated in home economics. He was appointed by the governor as one of the members of the Board of Regents of the University System of Georgia. He served during the formative period of the development of the state-wide system of higher education, and was recognized as the agricultural representative on the Board.

EUGENE G. MOSS

E. G. Moss is director of the Tobacco Experiment Station, Oxford, North Carolina, and Senior Agronomist for the U. S. Department of Agriculture.

Director Moss is, in reality, a chemist. As a lad he was interested in chemistry in relation to soils and plants. He attended the University of North Carolina and made a study of science after which he became a chemist for the U. S. Steel Corporation at Birmingham, Alabama.

After working as a chemist until his salary had increased from $50 to $300 a month he gave up this work to return to the farm. In all the years that had intervened since he left college, Mr. Moss had been .studying agriculture, especially chemistry in relation to soils and plants. After farming for two years he entered the service of the government.

In 1911, he was appointed Tobacco Specialist for the U. S. Department of Agriculture. In 1914 he became director of the Tobacco Experiment Station. In the years that have elapsed, almost a quarter of a century, he has come to know many tobacco growers of the South and countless thousands know him through the bulletins and articles he has written about tobacco. Among his bulletins are included the following:

Tobacco Culture in North Carolina
Tobacco Wilt (Bacillus Solanacearum)
Tobacco Wildfire
Crop Rotation Systems Adapted to Sections Infested with Tobacco Wilt
Nutritional Problems of Bright Tobacco
Downy Mildew of Tobacco (Blue Mold)
Fertilizer Experiments with Flue-Cured Tobacco
Fertilizer Tests with Flue-Cured Tobacco
The Culture of Flue-Cured Tobacco in North Carolina
Flue-Cured Tobacco Varieties

Mr. Moss' acquaintance with tobacco growers has been increased through his affiliation with organized groups. He served for two years as secretary-treasurer of the North Carolina Tobacco Growers Association; he was director and member of the executive committee of the Tri-State Tobacco Growers Association, a member of the AAA Tobacco Committee, and a member of the Research committee for the Southeast tobacco growing states.

Willingness to work hard and to keep up with what others are doing are, he thinks, essentials of success.

He believes that the outlook for agriculture is good, and that in the years to come research work will be needed and supported as never before. It is his opinion that some of the young men, now in the high schools of the South, should prepare themselves for work in this field.

J. HURT WHITEHEAD

J. Hurt Whitehead, president of the Planters Bank and Trust Company, Chatham, Virginia, received one of two *Certificates of Merit* awarded by the Virginia Polytechnic Institute in 1936 for the greatest contribution to the development of agriculture in the state during the year.

Mr. Whitehead is chairman of the Virginia Soil Conservation Committee. As president of the Whitehead Company, Incorporated, he is engaged in an extensive business which includes the operation of about 30 farms, comprising more than 6,000 acres of land.

In addition, Mr. Whitehead operates his own farm of 190 acres on which he grows flue-cured tobacco as the principal cash crop. He has about 25 acres in alfalfa, which is the best hay crop that can be produced. He has 30 acres in permanent pasture in which he grows lespedeza and orchard grass. For soil-improvement crops he prefers lespedeza, field peas, soy beans, and some mammoth clover.

When asked if he thought that the Southern farmer should so organize his farm that he could live-at-home, Mr. Whitehead answered, "Most assuredly he should."

When asked what advice he would give boys who were interested in making a success of farming his reply was, "Give the same time and thought to it that men give to managing banks, stores, and manufacturing plants."

Mr. Whitehead was educated at Richmond College and the University of Virginia. He is a deacon in the Chatham Baptist Church, and has taught the Whitehead Bible Class for thirty years.

GEORGE ROBERTS

George Roberts is an agronomist. He is also a chemist. For thirty years he has served as head of the Department of Agronomy at the University of Kentucky. In this capacity he has directed the soil improvement work of the College of Agriculture and the Experiment Station. He has also taught hundreds of young men the fundamentals of soil management and crop production.

When a young man Dean Roberts—he is also Assistant Dean of the College of Agriculture—wanted to be a farmer. But having no capital, and no way of securing a farm of his own, he turned to the science of agriculture as a vocational objective. In so doing he was following in the footsteps of other American boys whose work, for a time at least has been determined by circumstances.

You may remember, perhaps, that Benjamin Franklin wanted to become a sailor. His father hoped that he might enter the ministry. But, finally, he was apprenticed to his older brother so that he might learn the printer's trade.

Young George Roberts realized that for his chosen work he must have a good education. For several years he taught in the rural schools during the regular terms and went to school himself during the summer months. He finally worked his way through the University of Kentucky.

After completing the requirements for his first college degree, George secured a position as chemist for the Kentucky Agricultural Experiment Station. After two years of service, he moved to California to fill a similar position. Then, after three years on the Pacific Coast, he was called back to his native state where again, as a chemist, he worked for two more years. He was then placed in charge of the teaching and experimental work in soils and crops.

It is safe to say that no man knows the soils problems of Kentucky better than Professor Roberts. He is familiar with the various kinds of soils in the State, knows their limitations and possibilities and understands what is needed to restore and maintain their productiveness.

Thirty-five years ago Professor Roberts began the establishment of test fields on the various types of soils in Kentucky. He has directed extensive experiments on the main experimental farm at Lexington. From time to time he publishes reports of the progress made in rejuvenating the land through the use of lime, essential fertilizers, and the proper rotation of crops, including the use of legumes and grasses. A study of these reports convinces one of the great possibilities in transforming unproductive soils to a high state of productivity at a cost that yields profitable returns.

Under most conditions in Kentucky, Professor Roberts would keep much of the land in grass. Tests have convinced him that grass can be grown luxuriantly in most of the State, and with grass and livestock fertility can be maintained. He often cites the example of Bourbon County—one of the most fertile in the State. Yet 80 per cent of the crop and pasture land remains in grass, because farmers believe they can make more money from grass and stock than they can from corn and other grains.

Were he a young man again, Professor Roberts would probably remain on the farm. He thinks there are, under the present conditions existing in this country, very great inducements for young men who like farming to enter that vocation. "And if you take care of your soil," he tells the young men in his classes, "it will take care of you."

E. L. BOTELER

E. L. Boteler, Grenada, Mississippi, owns 850 acres of land of which 600 acres are in cultivation, 90 acres in woodland, and 160 acres in permanent pastures.

His main sources of income include cotton, corn, beef, hogs, eggs, and potatoes.

Like practically every good farmer, he grows soil-improvement crops, follows a rotation system, and lives-at-home.

He started in farming by going in debt for a horse, feed, and plow tools. He made a crop in this way—once. Since that time he has never made a crop on land that he did not own.

Now Mr. Boteler uses a tractor, grain drills, 2-row planters, and several double-row cultivators. In fact, he believes that good machinery is necessary for successful farming. It is one good way to reduce labor costs.

His five-year average production of lint cotton per acre has been 449 pounds. This year he made 600 pounds per acre. For five years he has made 50 bushels of corn to the acre, which is four times the average acre production for many of the Southern states. He made 200 bushels of sweet potatoes to the acre this year and has averaged making 180 bushels for the most recent five-year period.

As a message to farm boys Mr. Boteler says, "YOU WILL ONLY BE AS RICH AS YOUR LAND."

He has acted upon this theory himself by growing peas, beans, clover, and crotalaria, and turning them under. This accounts, no doubt in large measure, for the remarkable yields that he has been able to make. And still, he says, he has used less commercial fertilizer than his neighbors.

Mr. Boteler also advises young farmers to keep in touch with their county agent, to keep books on their farming operations, and to live-at-home.

JOE M. CHAMBLEE

Joe M. Chamblee, Mobank, Texas, is a public spirited farmer who has made a success of farming and has found time to serve the farming interests of his county in many ways.

He is road commissioner for Vanzandt County, was chosen on the first county AAA committee, served as the first committeeman on the Federal Seed Loan, and has taken part in all cooperative and county activities.

He borrowed money to buy the farm which he operates. The improvements on the place were started with money he saved from buying and selling cattle. He now has electricity and all the conveniences which it makes possible—a sweeper, fan, iron, churn, lights, a water pump that supplies the needs of the entire farm, and several other things which would be impossible without this labor-saving convenience.

The farm of Mr. Chamblee contains 175 acres of which 115 are in cultivation, 15 in woodland, and 45 in permanent pastures.

The sources of income include cotton, peanuts, cattle, hogs, truck crops, chickens, ribbon cane, and sorghum.

Mr. Chamblee does not use a tractor, but uses four mules on some of his implements.

Like so many of the Master Farmers, he reports that he uses less fertilizer per acre than his neighbors, but he does—like all of them—grow legumes for hay and soil-improvement. He follows a rotation system which helps keep up the fertility of his land.

He keeps *registered* Herefords, *registered* Jerseys, and *registered* Poland China hogs.

On his permanent pasture, he uses a mixture of Bermuda, Dallis grass, lespedeza, and carpet grass.

Mr. Chamblee grazes his cattle ten months in the year and makes more hay than he needs at home. He follows the live-at-home plan practically 100 per cent, and advises all young farmers who expect to make a success, to do the same thing.

P. M. MUNGLE

Paul Milton Mungle, Atoka, Oklahoma, is another of the Master Farmers of America who has made a success because he follows the live-at-home plan of farming. He says that each year they can enough food for their own needs and sell enough to other people to pay for all the cans and all the expense of canning.

This brings out another characteristic of Master Farmers—they make every operation on the farm pay its own way. If it doesn't pay, then out it goes to make way for a better plan.

Some years ago, before Mr. Mungle owned as much land as he does at present, his local paper had this to say about him:

"P. M. Mungle, 36 years old, has been on his farm eight years. In 1923, he accumulated $500 which he used as a down payment on 80 acres of land south of Atoka, priced at $2,200. This tract is all the land he owns, but he makes it yield an income many farmers fail to get from much larger farms. Often he has pulled through hard times because he owns a garden, poultry, hogs and milk cows. According to information submitted, Mungle earned 8 per cent or better on his investment of $10,000."

Since the above statement was written, Mr. Mungle has not changed his plan of farming but has increased his operations. He now owns 120 acres.

He is a dairy farmer, with 150 head of cattle, Jerseys and Guernseys. He grazes most of his land; he grows 40 acres of oats, 40 acres of barley, 80 acres of Sudan grasses. He makes 40 bushels of corn per acre. His gross income is $65,000 a year.

Paul Mungle is a big business man. His plan of operation provides something for boys to think about who expect to go into farming in the South. Of course, the care of 150 head of dairy cattle means hard work, but if there is any way to make a success other than through hard work, few, if any, honest people have discovered it.

ELGIE HAYES

Elgie Hayes, one of the Master Farmers of Alabama, lives at Huntsville in Madison County.

At the time he was married, Mr. Hayes had to borrow $50. Within two and one-half years after he was married he and his wife had saved $1,700. They have been doing well ever since. In fact, there is not a year during the depression period of 1931-32, when they failed to make some profit from farming. They now own 835 acres of land, valued at $60 an acre, live in an $8,000 brick house, have $8,000 invested in other buildings, and own $8,000 worth of farming implements. All this has been earned out of farming operations.

About half the income on this farm plant is derived from cotton. The other half comes from corn, lespedeza, oats, wheat, hay, and hogs.

On land where a three-year rotation has been practiced, the corn yield has been doubled, the cotton yield increased one-third.

Mr. Hayes is a great believer in the value of lespedeza. He has been growing this crop for almost twenty years.

This Master Farmer has found it a good practice to sow 2 or 2½ bushels of oats late in February or early in March. After the oats have been sowed and covered lightly, 1 to 1½ bushels of lespedeza seed per acre is sowed on the same land and left uncovered. Thus the land grows two crops—lespedeza and oats—at the same time. After the oats is harvested, the lespedeza produces hay or seed.

Mr. Hayes lives in a community where one variety of cotton (D. P. L.) is grown. The farmers of his community obtain 75 or 100 points premium on their cotton.

Practically all the cotton seed used in planting are produced on the place, but Mr. Hayes goes back to the breeder every other year for seed corn—Neal's Paymaster.

Mr. Hayes inspires those who work with him with a fine spirit and morale. They have developed many unique practices, the most unusual of which is that each morning the tenants gather to hear a report of the "news" of farming and of the state and nation from Mr. Hayes. In this way they not only "keep up with what is going on" but they also develop a fine spirit of co-operation and general goodwill. Mr. Hayes is a public-spirited man, always "for anything that will help his community."

B. M. HAGER

B. M. Hager, Elk City, Oklahoma, is the youngest Master Farmer in his state to date. The honor came to him when he was 33 years old.

Young Hager went to the Oklahoma A. & M. College for two years, but at the end of that time he was without funds. He thought of getting a job as a school teacher, as so many boys do under the same circumstances. Had he succeeded, he might be a school teacher today, but he was too young to be a teacher so he started farming.

He began farming by buying an 80-acre farm in partnership with his father. After seven years, he traded this tract for a 160-acre farm and bought out his father's interest.

Mr. Hager has never been a one-crop, cotton farmer and says this kind of farming wears out the land. He has always grown a variety of crops because he believes in having a diversified income by diversifying his crops.

He has earned more than $200 a month net for the past five years.

Mr. Hager is a member of his county AAA Committee and is chairman of the Farm Security Administration Committee of his county. He also takes an active part in all other movements for the improvement of agriculture in his community, county, and state. It is a fortunate thing for him no doubt that he did not get a job as a school teacher.

J. B. SHACKELFORD

J. B. Shackelford, Jones, Louisiana, has a farm of 3,250 acres of which 2,030 acres are in cultivation, the balance is in woodland.

The principal sources of income on this big farm are cotton, oats, and hay.

For a period of five years, Mr. Shackelford has made an average yield of between 450 and 550 pounds of lint cotton, or a bale, to the acre.

Perhaps the explanation of the large yield lies partly in the fact that he believes, as do all good farmers, in the protection and improvement of the land, and his two main sources of income other than cotton, are, in reality, soil-conserving crops.

The rotation, as expressed by Mr. Shackelford is—cotton—to vetch—to oats—to soy beans or peas.

He grows lespedeza for hay and makes an average production of 1½ tons to the acre.

"I was reared on a farm and will always remain on one."

said Mr. Shackelford. "The first farm I owned was small and I have added additional farms as I was able.

"Any machinery that fits into my plan of farming and is a labor-saver, I use. My equipment includes tractors, disk harrows, two-mule cultivators, tractor cultivators, combines, and power hay machinery.

"I plant all my cotton land that has sufficient drainage to winter legumes to be turned under in the spring.

"I believe that farming must be done like manufacturing—it must keep step with industry. We must adopt improved methods of doing our work."

To boys interested in farming, Mr. Shackelford, whose son has just graduated from the College of Agriculture at L. S. U., says, "Locate some good productive land. Use the best tested seed adapted to your community. Rotate your crops. Use all the summer and winter legumes possible. And don't try to grow too fast—you have to season in this game and it takes years to do it."

GILBEART H. COLLINGS

Gilbeart H. Collings, acting head of the Division of Agronomy, Clemson Agricultural College, is one of the very few scholars of the South who has written college textbooks in agriculture and related fields.

It is an interesting and perhaps significant fact that the vast majority of our school texts were written and published in other sections of the nation. Often these books do not deal specifically with Southern conditions. We are therefore greatly indebted to the men who have contributed to the literature which deals with the economic problems of the South.

Doctor Collings is the author of *The Production of Cotton.* This was the first college text written on cotton production. In 1938 he brought out a new book entitled, *Cotton Fiber Production in America.* He is also the author of a book dealing with fertilizers—*Commercial Fertilizers: Their Sources and Uses*—(revised in 1938) which is the standard text used in many colleges throughout the country and in practically all of those in the South.

"Why did you write these books?" Dr. Collings was asked.

"Because I was called upon to teach these subjects, but found no available texts in the field in spite of the importance of cotton and fertilizers in Southern farming," he replied.

"Writing college textbooks is a labor of love," he explained. This is correct. The sale of such books is so limited that the men who write them never realize anything like an adequate return from their labors. Often they spend more money in gathering the material than they receive in royalties. It is worth while for the general public to be informed about matters like this in order that they may have the proper attitude toward texts dealing with Southern problems in specialized fields.

Dr. Collings was born in Virginia. He was educated at the Virginia Polytechnic Institute, the University of Illinois, and Rutgers University. He holds the degrees of B. S., M. S., and Ph. D. Since completing his college training, Dr. Collings has been engaged in teaching and research in agronomy at Clemson College. Additional facts concerning his work may be found in *Who's Who in America, Rus,* and *American Men of Science.*

THOMAS STEPHEN BUIE

Thomas Stephen Buie, Regional Conservator, Soil Conservation Service, Spartanburg, South Carolina, was graduated from Clemson College with the B. S. degree in 1917. Ten years later he was awarded the M. S. degree at Iowa State College and the following year met the requirements, in the same institution, for the Ph. D. He has since been given an honorary Sc. D. degree by his alma mater, Clemson.

Born near Chersaw, S. C., Dr. Buie grew up with a love for the soil and for growing crops. This led to the selection of his vocation. After being in college for four years, young Buie joined the army and served for a period of two and one-half years during the World War.

Upon returning to civil life, Dr. Buie took up the work for which he was prepared as a member of the staff of the South Carolina Experiment Station. In this work, which covered more than a decade, Dr. Buie was engaged in research work with fertilizers and crops. He is the author or joint-author of more than a dozen bulletins, in the Clemson list. His doctor's thesis was *Fruiting Habits of the Cotton Plant.*

As a man highly esteemed in his chosen field of work, it is interesting to note that Dr. Buie gives the following suggestions to Southern boys, "Select a type of work in which you are interested, prepare yourself for this work, and get practical experience as early in life as possible. Do not look too closely at the immediate situation, but always endeavor to think about ten years ahead. Work hard, always looking ahead, without regard to immediate credit. Remember, the one who never does more than he is paid for doing, will never be paid for doing more."

Dr. Buie was one of the pioneers in the work of the Soil Conservation Service. With respect to this work he made the following statement:

Soil Conservation in the Southeast

"The early settlers in the Southeast did not follow farming practices which would conserve the soil because the abundance of land and their lack of appreciation of the soil losses made such appear unnecessary. Hillsides were cleared of trees, put into cultivation, and after a few years abandoned and additional areas cleared.

"A few far-sighted individuals even in Colonial times recognized the need for adopting adequate soil conserving practices and many of them spoke and wrote in defense of the soil. For the most part, however, their advice was not heeded and the destructive methods continued. With the development of the agricultural colleges and affiliated Experiment Stations and Extension Service, much attention was directed to an adequate program of soil management and utilization. Despite the work of such institutions, however, soil erosion continues to be a serious menace to Southern agriculture, and its control remains a challenge to all agricultural agencies.

"In 1933 the Soil Erosion Service was organized in the Department of Interior to establish large scale demonstrations of proper land use and erosion control practices. Such demonstrations, embracing from 25,000 to 150,000 acres, were located in the several problem areas of the country, usually from two to eight in a state. In 1935 this agency was made a permanent bureau of the Department of Agriculture and the name changed to the Soil Conservation Service.

"In the development of these large scale demonstration areas use has been made of all known facts developed by the state experiment stations, the several extension services, other branches of the Department of Agriculture, and the experiences of individual farmers. Land owners of the demonstration areas have cooperated most heartily and contributed a substantial part of the cost. For the most part, the principal contribution of the Soil Conservation Service has been technical assistance in advising and planning for proper operations. Limited quantity of materials and supplies to initiate new phases of the program have been furnished. Also, labor from CCC camps or other relief sources has been furnished where available.

"Recognizing the need for permanent local organizations to carry on such work, the President suggested in 1937 that states pass appropriate legislation for the organization of legally constituted districts where the individual landowners were interested in so organizing for the purpose of controlling erosion on their farms. Such laws already have been passed in 24 states, including a number in the Southeast. (January 1938) Under the provisions of these respective state laws, groups of landowners organize themselves into districts for the purpose of inaugurating a comprehensive large scale program of erosion control. The Soil Conservation Service and other agencies of the Federal and state governments can and are co-operating with districts so organized.

"It has been the experience of the Soil Conservation Service that farmers are very anxious to institute a program of erosion control if given the proper guidance and leadership. The control of water on sloping fields under prevailing conditions in the Southeast requires considerable skill in engineering and field crop technique. One of the great difficulties which farmers have experienced in the past in inaugurating a program of erosion control is that they did not possess sufficient skill in the use of engineering instruments and in many cases did not have the necessary equipment and supplies for inaugurating an adequate program of erosion control.

"The system of agriculture practiced in the Southeast in which clean cultivated crops predominate also accentuates the difficulties of erosion control. A better land use program in which more close growing crops and pastures are found will protect millions of acres now being seriously damaged by erosion, and at the same time provide much needed feed, which in turn will result in a more extensive livestock program.

"The future trend of the soil conservation program undoubtedly will be for the Federal Government to furnish adequate leadership for the proper planning of wise land use and adequate erosion control with the farmer performing the actual operations. Under such leadership we may expect our farmers to become modern pioneers in saving the soil."

WALTER E. WILLIAMS

Walter E. Williams, Carrier, Oklahoma, is a *Master Farmer of Oklahoma.*

From the little booklet in which the records of Master Farmers are kept, we learn that Mr. Williams owns 750 acres of land and that he has a home worth about $8,000, other buildings worth $4,000, and implements worth $3,500. These are just a few of the facts given in the booklet, about Mr. Williams. We find, too, questions and answers like the following: How much do you owe on the purchase price of your farm? The answer given is *nothing*. How much do you owe on improvements? The answer is *nothing*.

Facts like those given in the paragraph above are personal. Under ordinary circumstances, the public is not entitled to such information. But it is given here for the benefit of the boys who read this book—boys who are preparing to enter upon the business of farming for themselves.

Such boys will be greatly interested in the experiences of Mr. Williams:

"I was born (he says) on a farm in Saline County, Missouri. When I was small my parents moved to Ottowa, Kansas, and when I was five to Harper County, Kansas. I lived here until I was twenty-four.

"At twenty-four I got married and moved to Garfield County, Oklahoma and have lived there ever since.

"When I was twenty-one my father rented me a piece of land to make a crop of wheat. The land was not very good, and I did not make a very good crop, but I saved most of the money I got. Before we were married, my wife taught school and saved some money.

"With the money both of us had saved we started out with the determination to succeed. We rented a farm.

"We had two good milk cows and some chickens. We always raised some hogs for meat. We had a good garden and canned plenty of fruits and vegetables. THAT WAS OUR LIVING.

"We raised wheat, oats, corn, and some alfalfa. These were our money crops.

"Since we did not have to spend much money for living, we soon had enough to buy a place of our own.

"We now live on that place. In additon, we operated other rented land. In this way we were able to buy more land from time to time until we got together our present farm of 750 acres.

"I think the essentials of good farming are: (1) diversified farming; (2) suitable equipment; and (3) a determination to get the work done at the right time.

"What success we have had came, I believe, because we love our work, always cooperated, always kept track of what we took in and what we spent, and never went in debt, except for a small amount to finish paying for a piece of land."

F. E. GANDY

F. E. Gandy, Athens, Louisiana, is a farmer whose main sources of income are from dairy farming and livestock. He owns 380 acres of which 210 are in cultivation, 70 in woodland, and 100 in permanent pastures.

Mr. Gandy has three children, two boys and a girl. The girl has graduated from college with a B. S. degree in Home Economics. She is now engaged in teaching. The older boy is in the College of Agriculture at Louisiana State University and the younger one is in high school.

"What advice would you give to boys who are interested in farming?" Mr. Gandy was asked. This was what he replied, and it is evident that he has given the matter serious consideration:

"1. Start with the idea that you will 'Make the Best Better'. You can't have the best to start with, but you can make it better as you go along.

"2. Don't undertake more than you can accomplish.

"3. Follow the live-at-home plan in farming.

"4. Raise all the feed you can, and have a good pasture. It is the foundation of success in farming.

"5. Have the best livestock you can afford.

"6. Go into business with your chin up and keep it up no matter how many ups and downs you may meet."

This is good advice. Mr. Gandy has followed it himself.

When he was 18 years old, his father gave him 3 acres of cotton land. He made two bales and sold it for 20 cents a pound. With a part of the money he bought 40 acres of land for $125 and, after making a crop, sold it for $400. He bought another farm, making a cash payment of $666 and gave notes for the balance. He paid off the notes before they were due.

As the children got older he wanted to be nearer a good school so he bought another farm. In order that the children might help, he decided that the best enterprise to develop "as a sideline" was dairying. This "sideline" has been bringing in a cash income of about $200 a month for several years. He sells his milk through the Cooperative Milk Plant at Monroe, Louisiana.

Mr. Gandy says that it pays a farmer to keep up with livestock prices and to pick up bargains when they are available. He finds this profitable for the reason that he has plenty of feed—pasture and hay. He makes two tons of soybean hay per acre.

He has 100 acres in permanent pasture and can run over every acre of it with a mower. "Nothing helps a pasture," he says, "like mowing it."

Mr. Gandy practices a three-year rotation: *First year,* corn with legumes; *second year,* cotton; *third year,* oats and cowpeas. He uses less fertilizer per acre than his neighbors.

This is a fine farm program. The results speak for themselves. If every farmer in the South were following a general plan of the same type—as it relates to pastures, hay crops, rotations, and a live-at-home program—we would have a higher standard of living, we would not have to depend upon other sections for food products, and there would be less soil erosion and consequently a more profitable agriculture.

GEORGE W. NALL

George W. Nall, Boise City, Oklahoma, now the owner of a farm of 860 acres, was formerly a renter.

Mr. Nall and his wife were reared on farms in Kentucky. After renting for three years they bought and paid for a small farm in Kentucky. They sold it at a good profit and decided to move to the West. At first they acquired a half section and found that they could sell this for enough to buy a section in Cimarron County. They did this eighteen years ago.

"We have found in our experience in farming, both in Kentucky and in Oklahoma, that the most important essential of good farming is not to depend upon one source of income," said Mr. Nall in discussing what it takes to be a good farmer.

"We believe," he said in referring to himself and his wife, "in planning for a year around income. This means such things as livestock, dairy products, and poultry.

"Raise as much of your living as you can, and every time you go to town take enough produce to buy what you need and bring home some cash."

"It is just as essential in farming as in any vocation that the couple work together. Neither can make a success without the other." This is the opinion of Mr. Nall after twenty-eight years of married life, and more years in farming. He is certainly right. A wife, especially on a farm, can determine to a great degree the success of her husband. This principle has been recognized in making the Master Farmer awards, for, as a matter of fact, they are given not to a man—but to a man and his wife.

Mr. and Mrs. Nall live in a small-grain section. Wheat is normally their major source of income, but each year they make about $500 from poultry and $500 from dairy products.

HARRY L. BROWN

Harry L. Brown, Assistant Secretary of Agriculture, holds as high an executive position in the U. S. Department of Agriculture as any man who has ever lived in a Southern State.

He was selected for this honor because of the outstanding work done while he was serving as director of the Agricultural Extension Service in the State of Georgia. After serving in this capacity for a period of more than three years, during which he had charge of the organization of the "Action Programs" of the U. S. Department of Agriculture, he was selected by Secretary Henry A. Wallace as his assistant and given charge of many important phases of the Federal program for agriculture, including that under which it is possible for "landless farmers" to buy farms on the basis of a "character loan" and pay for them over a long term of years.

Mr. Brown was born on a farm in Forsyth County, Georgia. He attended the District Agricultural High School at Clarkesville, Georgia, and later on was graduated from the Georgia State College of Agriculture with the B. S. A. degree.

After graduating from college, Mr. Brown worked as scientific assistant in animal husbandry for one year. He was a state agent in marketing for one year with the Extension Service. For twelve years he was a county agent, serving in Fulton County (Atlanta) Georgia. After this period of service he was called to the college of agriculture to become assistant director of the extension service under J. Phil Campbell.

Mr. Brown is now, and always has been, a farmer. He has a farm in North Georgia on which he makes some of the highest yields of Irish potatoes and other crops recorded in the state.

"Our great problem in the South," said Secretary Brown, on one occasion, "is the proper use of land. While agriculture is not to blame, we have been exploiting our natural resources for a long time. Now we are beginning to learn that either from a present or long-time point of view, this is a mistake. I hope that we can correct conditions, and, if we do, I feel that we will become a more prosperous people."

L. L. MACKEY

L. L. Mackey, Longview, Texas, Route 5, is, according to the letterhead on which he writes, a farmer, a cattleman, and a ginner.

The story of his life, as given in his own words below, should be a help and inspiration to any boy who wants to live a successful and worth while life.

"My father died when I was two years old, leaving my mother with four children. My oldest sister was seven years old. My next sister was five, and my twin sister and I were two.

"My father had bought a 175 acre farm, but had not paid all that was due on it.

"When I was a very small boy, I began to market milk, butter, eggs, and vegetables. By doing this we managed to pay for the farm and keep out of debt.

"At the age of 20 my mother let me have my cotton crop of three bales for my own. I bought a vendor's lein land note with the money.

"With the money brought in by this note and my second cotton crop, I bought a 90-acre farm with no improvements on it. I built a rent house on this land with lumber secured by hauling logs to the sawmill and selling them on the halves. After the house was built, my renter and I cleared enough land to make a nice crop. This same colored renter lives with me today.

"Two years later I bought another tract of land adjoining the first. Another house was built, as was the first, by hauling and selling logs on the halves for lumber.

"With the help of two renters enough land was cleared and fenced for the new renter.

"Most of the farms I have bought have been in a rundown condition. I have built houses, cleared land for crops and pastures, and have built fences.

"When I was thirty-one I married. I bought a woodland tract of 169 acres that fall, and two years later another 55-acre tract for my own home. Again by hauling logs to the mill, I secured enough lumber to build a six-room frame house. The next year I bought a 54-acre tract, and a two-stand cotton gin. I put in new machinery for a three-stand gin.

"I lived on this farm for ten years and then bought the place where I now live. I have bought a second gin. I now have 2,380 acres of land—all paid for. I have the money to furnish my renters from $10,000 to $12,000 a year. I have not borrowed any money from banks since 1925.

"I have a herd of registered Herefords. I have also a grade herd. Cotton is my main money crop, but I grow all the feed I need on my home farm.

"What success I have had has come from hard work and my unwillingness to go in debt. My slogan for successful farming would be:

1. RAISE EVERY CROP POSSIBLE
2. HAVE SOMETHING TO SELL 12 MONTHS IN THE YEAR
3. LIVE WITHIN YOUR INCOME
4. BE THRIFTY
5. LEARN TO CRAWL BEFORE YOU TRY TO WALK

Mr. Mackey has made a vocational success, but he has not neglected his civic and religious duties. He served as president of his local agricultural association, teaches a class in Sunday School; and is an elder in his church. He is active in his Chamber of Commerce and belongs to the Masonic Lodge and the Kiwanis Club.

To the boys of the South, Mr. Mackey says, "I believe there is a better opportunity for farm boys to get ahead today than ever before if they will pay the price by good management and hard work."

CAREERS IN AGRICULTURE

IT IS the duty of every boy to prepare for the responsibilities of manhood. This means, among other things, that he must (1) select some occupation, (2) prepare for it, (3) get established in the work, and (4) plan to make progress in it.

In selecting an occupation, the first question that a farm boy must answer is: *Shall I be a farmer?*

The answer should depend upon the interests of the individual boy. Any job is a good job, if you like it. Do you like to look at farms? Are you interested in plants and animals? Would you like to improve the quality of some farm product? Have you farming plans of your own that you would like to carry out? If so, you will make a good farmer, perhaps a Master Farmer. If not, you should probably select some other occupation. Interest in what you are doing is the greatest factor in success.

Perhaps you are interested in farming, but feel that the prospects for earning money are not so favorable as in other occupations? Let us consider the facts! The average city worker makes more dollars than the average farmer; he must in order to live. Often the item of rent in the budget of a family in a city is larger than the total expenses of a farm family of the same size. It would be helpful, in comparing rural and urban occupations, if we could realize that the vast majority of people work for a living—and a living is about all the average person ever gets. Too many people work to get rich, and consequently reap a harvest of disappointment. Forty per cent of the farm families of America have a gross income between $1,500 and $2,500. Two per cent of the farmers of the nation have an income in excess of $10,000. These figures compare very favorably with the earnings of urban workers. Actually the farm people of the United States have more to show for their work than those who live in cities. The average value of the property owned by the farm families of America is $9,668, contrasted with $8,709 for those living in towns and cities. While the average earnings of the farm people in the South is the lowest of any large class of America's citizens, it is also true that some of the largest farm incomes in the nation are found among the farmers of the Southern States. In other words, there is more in the man than there is in the land.

It is very apparent from reading the biographical sketches of the farmers included in this text that they are men who are earning very satisfactory incomes. It is apparent too that they are earning this money through the operation of a diversified type of farming. There is nothing the South needs so much as an increase in the number of such farmers. Each year 100,000 young men begin farming for themselves in the Southern States. If they will but profit from the experiences of these men who have been successful, they will be assured of an income that will make farming in the South a very satisfying career.

But not all farm boys in the South can become farmers. Many must seek other vocations. Those who are interested in agriculture and who wish to capitalize their farm experience will discover upon investigation that there are thousands of positions to be filled in which farm experience is an asset. The largest number of such jobs are to be found in the business world. Railroads, implement makers, fertilizer manufacturers, creameries, milling companies, commission firms, packing plants, and public utilities are representative of the employer possibilities offered in business. Then there is what may be called the professional field, which properly includes all the work of scientists and educators. In this group will be found county agents, vocational teachers, and all of those employed by colleges of agriculture, experiment stations, and the United States Department of Agriculture. To qualify for positions in the professional group, a college education is required.

Regardless of the occupation in which a young man is interested, it is necessary for him to make the best possible preparation to be assured of success, or even the opportunity to work. Today it requires no more farmers to supply the needs of 120 million people than it did when the population of the country was 75 million. This progress will continue in the future, probably at a faster rate than in the past. This means that only the efficient workers and managers can excel in the vocation of farming. In other fields the competition for jobs is very keen. Those with the best preparation have the greatest possibility for achieving what they and others will regard as a satisfying career.

SUGGESTIONS FOR STUDY

Questions and Problems

1. Discuss the ten suggestions of Dr. Clarence Poe for increasing by $500 the income per farm in the South. Do you think it can be done? How many of these suggestions might be applied to your own home farm?
2. Do you think the story of the steers as reported in the biographical sketch of Dr. I. W. Duggan applies aptly to men? Explain. Can you give an example?
3. George W. Collett states that it is his opinion one of the essential things is to go on a cash basis. What do you

think of this idea? Could it apply to the young man today who wished to start farming for himself? How would the case of a young man of today compare with that of Mr. Collett?

4. Do you agree with D. M. Clements in the thought that there are unlimited opportunities in farming in the South for young men who wish to enter this vocation?
5. What was the contribution that H. H. Bennett made to agriculture? What are the opportunities for young men in the field of work in which Dr. Bennett is engaged? How is this work related to successful farming in the South?
6. What advice does Mark L. Nichols give to farm boys?
7. F. P. Latham expresses the opinion that farming is easier today than when he was a boy. Do you agree? In what ways is farming easier?
8. What do you think of the type and scale of farming conducted by Oscar Johnston? Could this scale of farming be applied in your locality? In all parts of the South? What are its advantages? Disadvantages? Is it possible that this is a glimpse into the future?
9. What is the matter with Southern agriculture? Do you agree with David R. Coker?
10. What very unusual thing has J. S. Mogford done?
11. Explain the cotton investigation work in which H. W. Barre is engaged.
12. What very important discovery was made by Wilmon Newell? Discuss this discovery in relation to Southern agriculture.
13. Among the men whose biographies are given in this text there are two with the name *Harry Brown*. Discuss the work of both men.
14. In what work is Will Clayton engaged? What possibilities for employment does this field offer to young men?
15. What do you think of the suggestion to young men made by Charles M. Meacham? Do you realize that there are men in the country who have made fortunes out of this idea and that few people in the South have ever given it consideration?
16. What do you think of the achievement of Robert Flake Shaw? What do you think of his rotation?

17. What do you think of the 10 rules for farming set up by R. W. Royster? What do you think of preparing a set for your own farming, using those of Mr. Royster as a basis?
18. What are some of the occupations open to men trained in agronomy?
19. William N. Henderson advises getting a good farm or none at all. What are some of the characteristics of a good farm?
20. What do you think of the value of organizations to farmers? Make a list of the possible benefits to be derived from organization. What are the important farm organizations in this country?
21. To what extent is marketing a factor in successful farming? Large yields per acre?
22. Do you know how the South compares with the other parts of the country in the amount of money expended for agricultural research? What do you think of this as a field for which a young man might prepare? What are the qualifications of workers in agricultural research?
23. Do you agree with the message to farm boys given by E. L. Boteler?
24. Many Master Farmers, like Joe M. Chamblee, report that they use less commercial fertilizer per acre than their neighbors. How do you account for this? Do the best farmers in your community use more or less fertilizer than the average?
25. What gross income per year is the largest reported for any Master Farmer whose biography is included in this text? What is the main source of this income?
26. What very unusual practice is carried out on the farm of Elgie Hayes? What effect does this have upon the relationships of those working on this farm? What their general information? Upon their attitude toward their employer?
27. Was it fortunate for B. M. Hager that he was too young to teach at the time he thought of entering this vocation? Compare farming with teaching, giving the advantages and disadvantages of each occupation.
28. What does J. B. Shackelford mean by saying that one must "season in the game of farming"? Do you know of any cases where a farmer tried to grow too fast?

29. Why do you suppose that we have had so few texts written by southern authors? Examine all the books you have in your school. What per cent of them, so far as you can determine, were written and published in the South?
30. What does Thomas Stephen Buie have to say about soil conservation in the Southeast?
31. What are the essentials of good farming according to Walter E. Williams?
32. What pasture practice is followed by F. E. Gandy?
33. How is a "year around" income provided in the farming program of George W. Nall?
34. What does Secretary Brown mean by saying the great problem of the South is the proper use of land?
35. What are the five planks in the farming platform of L. L. Mackey? Discuss how each might be carried out in your locality and list under each some of the ways in which the goal might best be achieved.

Suggested Activities

1. Assign to each member of the class the biographical sketch of one of the farmers included in the text. Have each student study the sketch very carefully. Then as a class assignment discuss the farming program of each, so far as it is revealed, and attempt to find the elements that are common to most of the programs of these farmers. Compare the programs with the items in the Master Farmer score card. What are the conclusions reached relative to the farming programs which are best and safest for the South? Do the same principles apply to all parts of the country?
2. Make a list of all the occupations represented, or held at any time, by the persons whose biographies are included in this text. Give, so far as you are able, the training, experience, and other qualifications required for each.
3. In the same manner as suggested in exercise one above, make a list of all of the characteristics essential for success as revealed in the statements of these men, or in what has been said about them. What are the most important characteristics? Is it possible to list them in order of importance?

4. Which biographical sketch in the list impresses you most favorably? Which is the most interesting? Which represents, in your opinion, the greatest achievement?
5. Make a list of some of the men in your own state who might be added to the roster of leaders in southern agriculture. Secure all the facts about them that may be obtained and write in concise form the story of their careers.

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