How to Make Creamery Butter on the Farm

McLaughlin

Mrs. W. J. McLaughlin

Expert
Butter-
Makers

Directors of the
Butter-Making Service
Department of the
Minnetonna Company

Mr. W. J. McLaughlin

How to Make Creamery Butter on the Farm

by

MR. and MRS.
WM. J. MCLAUGHLIN

This book belongs in your working library

It will prove itself one of the most valuable books you ever had, if studied carefully, referred to often and followed closely in its instructions. This book and the Minnetonna Home Creamery enable you to apply to home buttermaking the scientific principles and processes that are used in the most modern creameries

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To the farmer that it may help him increase his income from the dairy department of his business and—

To the farmer's wife or daughter that it may lessen her labor and increase her efficiency as a buttermaker, this book is respectfully dedicated.

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Preface

IT HAS taken a long time for some branches of human activity to come under the regenerating influence of science. But once she takes hold of a proposition, science works rapidly—and the cruder and more primitive the subject she studies, the more rapidly she works and the more wonderful are the improvements she makes.

It is remarkable indeed, and regrettable, that so vital a human activity as farming, an industry upon which the very existence of the human race depends, should have been so long in coming out of the darkness of primitive ideas and ideals and coming into the light of modern science. It was only within the last half century that a real beginning was made in the science of agriculture—and the real progress in better farming methods has been made in the last quarter century.

Buttermaking, logically a farm activity, began to benefit by the application of scientific principles only within the last twenty years or so. You need only compare the efficiency and rapidity of the buttermaking equipment in the modern creamery to the slow and laborious old fashioned farm churn to realize what science has done in the art of buttermaking. A comparison of the quality of butter produced by the two methods also makes a strong case for the modern way of making butter.

But the farmer has not profited as he should by the wonderful improvements in the method of buttermaking. The rapid development of scientific principles in this industry has been limited to a type of machine too large and too expensive for the individual farm use. The farmer was left with an inefficient barrel churn that gave him but little chance to apply scientific principles and processes to buttermaking even if he was familiar with them.

True, the perfection of these large, efficient buttermaking outfits has made possible the establishment of centralizers and creameries to which farmers can send their cream to be made into butter and share in the proceeds. But the big expenses of running such large butter factories have to be paid out of the proceeds from the sale of the butter, whether the plant is a private enterprise or a co-operative one. We have managed such creameries and we know how much it costs to run one. We know that this cost takes a big chunk out of the income the farmer **should** get from his dairy herd, and **could** get if he could buy a scientific buttermaking machine suitable to his needs and to his pocketbook and could acquire the knowledge of the methods that would enable him to make butter of the highest quality in that machine.

The Minnetonna Company has solved the first problem—they have furnished the machine. We have attempted to supply, in this book, the second requisite—the "know how." We have endeavored to put into plain, practical, easy-to-follow directions, the essential scientific buttermaking knowledge that we have acquired in our quarter-century experience as buttermakers and dairy experts.

If this book helps any of the farmers who receive it to increase their net cash income from their cows by enabling them to make their cream into high-grade butter at home, or shows farmers who are already making butter how to make better and more profitable butter, with less labor, or encourages farmers who have a few or no cows to open up an entirely new source of income by starting a neighborhood creamery, we shall feel amply repaid for the time and labor spent in preparing this volume.

We shall also be glad to have any reader ask us for further explanation of any part that is not perfectly clear, or to ask us for help in solving any buttermaking problem.

THE AUTHORS.

The McLaughlins—Buttermakers

MR. McLAUGHLIN was born and raised on a farm. Early in life he took an interest in dairying. He studied breeding and feeding and their relation to milk and butterfat production. His interest in these subjects soon led to an interest in buttermaking and cheesemaking because it soon becomes evident to the farmer who gives any thought and study to his business that the most profit can be made from his cows by selling their milk as a finished product—butter or cheese—instead of in the raw state —milk or cream.

Mr. McLaughlin has been engaged in the manufacture of butter, cheese and condensed milk for over 24 years. He originated the first exhaust pasteurizer heater, and also the first salt test used in Minnesota.

Mrs. McLaughlin took a keen interest in Mr. McLaughlin's work from the very day of her marriage; in fact, being a country girl, she had been making butter for some time on her father's farm and liked the work. For over twelve years she has been as active as Mr. McLaughlin in the buttermaking business. For many years Mr. and Mrs. McLaughlin were joint managers of the Elgin Co-operative Creamery at Elgin, Minn. They have both attended the Dairy School at the University of Minnesota and are in great demand as speakers at buttermakers' conventions, Farmers' clubs, etc.

It has always been Mrs. McLaughlin's contention that better butter could be made in the home dairy

than in a big creamery. She has proven this time and time again and gives the reason why this is so in the chapter "Why it pays to Make Cream into Butter on the Farm."

Prizes and High Scores Made by

Mr. and Mrs. W. J. McLaughlin.

	SCORE
First—Minnesota Dairyman and Livestock Association, Northfield, Minn., Jan. 21, 1912	95
Second—Minnesota State Fair, Hamline, Minn., Sept., 1912	95
Third—North Iowa Fair, Mason City, Iowa, Sept. 18, 1912	96.50
First—Six months' Scoring Contests, St. Paul, Minn., June 12, 1913	95
Second—Interstate Scoring Contests, Mason City, Iowa, Sept. 18, 1913	95
First—Minnesota Buttermakers' Annual Convention, 2nd District, Wadena, Minn., Dec. 12, 1913	93.33
First—Wisconsin State Fair, Milwaukee, Wis. (Over all classes in complimentary Scores)	95.63
National Creamery Buttermakers' Association, Chicago, Nov. 1, 1911	95
National Buttermakers' Association, Chicago, Oct. 29, 1912	95.16
International Dairy Show, Milwaukee, Wis., Oct. 30, 1911	94.86
International Dairy Show, Milwaukee, Wis., Oct. 30, 1912	96
National, International, Interstate and State Contests for year 1913	94.85
(The highest over any buttermaker in the United States making butter from hand separated cream.)	
Third—Interstate Fair, Oct., 1912	96.50
North Iowa Fair, 1911	94.50
North Iowa Fair, 1911	94.33
Minnesota Butter and Cheesemakers' Association	93
Minnesota Butter and Cheesemakers' Association	93.75
Iowa Fair, Mason City, Iowa, 1912	95
International Dairy Show 1912	93.66
National Dairy Show	94.50
First—Second District at State Fair, 1912	95
Second—Wadena	93.50

CHAPTER I.

Why it Pays to Make Your Cream Into Butter on the Farm

THERE are at least three different sources of extra profit opened up to you when you make your cream into butter at home by the Minnetonna method.

1. The difference between butter-fat in cream prices and high-grade butter prices; the "over-run" alone in butter-making makes this difference at least 25%, as explained in Chapter X.

2. The buttermilk that you are enabled to keep is worth many dollars to you as a feed for hogs, if you do not sell it.

3. The saving in the expense of hauling your milk or cream to the station or creamery. Many farmers have figured that this hauling costs them $1.00 to $2.00 a day.

The "Over-run."

The "over-run" in butter-making is fully explained in Chapter X. Good butter should contain 20% of ingredients other than pure butter-fat, such as moisture, salt, etc. These items are necessary to the flavor and keeping quality of the butter, but they cost you practically nothing. Yet you get butter prices for them. Eighty pounds of butter-fat makes 100 pounds

of butter. Sell your cream and you get paid only for 80 pounds. Make good butter and sell it and get paid for 100 pounds, or 25% more, besides getting more per pound.

The Buttermilk.

The extra money that you can pocket for your buttermilk will amount to a snug little sum in the course of a year. Several of our friends have written us that they can easily sell their buttermilk at 3c to 4c a quart, sometimes more. This fact at least proves the **value** of the buttermilk that you are throwing away when you sell your cream. Even if you do not sell it as buttermilk, you can sell it for even more as hog meat. We need not discuss the merits of buttermilk as a feed for hogs—they are self-evident.

You Save the Cost of Hauling Cream.

Perhaps you don't realize how large an item is the expense of hauling the cream to the creamery or shipping station. You know that your time and labor are worth money—so much per hour. The time that you or your help spend on unnecessary things means just so much lost money. It is not necessary to make nearly so many trips to town when you are manufacturing butter at home and shipping the finished product instead of the raw material. If you will figure up the cost of each trip to town with your wagon, we believe that you'll find, as many other farmers have, that it is somewhere between $1.00 and $2.00 per trip —maybe more if your farm is far out. If you are making and shipping butter you need make only one-half to one-fourth as many trips as you do with milk or cream. It is easy to calculate your savings in hauling

expenses for a year, and we daresay that the figure will open your eyes.

You Pocket Middleman's Profit.

You know that there is really something to this idea about selling direct from the producer to the consumer, cutting out the middleman's rakeoff. In a great many lines it has meant a great deal to both the producer and the consumer—in the farming business perhaps more than any other. Why not carry the idea to the dairy end of your business, make your butter at home and ship direct to the consumer or retail distributer and get a price that includes the cost of manufacturing in the creamery or centralizer, the commission man's profit, the wholesaler's profit, and something of the carrying profit by railroad or express? Add up these various profits and you have a pretty neat sum, often from 5c to 10c on each pound.

You Pocket Creamery Manufacturing Costs.

The manufacturing costs in a big creamery, whether it is a co-operative creamery or a centralizer, is another very important consideration. Take the co-operative creamery for instance. You get more money for your cream in that enterprise than you do from the city centralizers or commission men. But look at what it costs to run the creamery—the salary of a buttermaker, the interest and depreciation on an investment of about $5,000 worth of building and machinery, a high rate of insurance, power and upkeep, etc. Out of your cream check has to come your proportion of the sum total of these expenses.

Get Premium Prices for Butter.

Now there is still another very interesting feature about this home buttermaking business. The minute you start making your cream into good clean butter right on your farm, you at once enjoy a big competing advantage over the big creamery or centralizer. That advantage of yours comes from this fact:

All sorts of cream goes to the creamery or centralizer, some good, some not so good, some not even clean. It all goes into one vat. The poor cream pulls down the quality of the whole batch and the butter turned out is not as good as it might be. Yet every farmer is paid the same price for the butterfat content of his cream. If you have pure, clean, sweet cream, you get no more for it than the fellow whose cream is not so good.

But look here. With that pure, sweet cream of yours you can easily make the highest grade butter at home by the Minnetonna method. For such butter you can get the top market prices and even more. Many Minnetonna Home creamery owners write that they get from 2c to 10c a pound more than regular market prices for their butter.

Good "Dairy Butter" Preferred.

As a matter of fact, many folks prefer "dairy" or home creamery butter, when it is made right and under sanitary conditions. We make this statement only after thorough investigation. You may happen to know some people who shake their heads when you mention dairy butter, but that's because they've had experience with the wrong kind. If you were making Minnetonna Home Creamery butter by our practical

methods, you would only have to let them sample it to change their notions. They'd be pleasantly surprised.

Another thing we discovered in our investigation—one of the reasons why good dairy butter brings higher prices: Quite a number of women have the idea that "dairy" or home creamery butter lasts longer —goes further on the table, especially when it is put up in jars.

Big Market for Quality Butter.

There is always good market for highest quality butter, the kind made by the Minnetonna method. Most of our customers soon find that they can sell more than they can make in their own neighborhood or at the stores in nearby towns. Besides, there are markets in all good sized towns and cities, many of which are easily reached from your place by parcel post or express. You can get in touch with the consumers through the post office, express companies or small ads inserted in city newspapers. We will help you in finding buyers for your butter so you need not worry on that score. There is so little of the real A1 butter to be had that it quickly finds a market at the highest market quotations or better.

Why the Old Time Farm Churn Fails.

A letter from the Potter Casey Co., of Aitkin, Minn., after telling how a farmer increased his net cash income 30% by making his cream into butter by the Minnetonna method reads as follows:

"Yes" some one says, "before the creamery came in we used to make butter and it was always hard to sell. The stores didn't care whether they took it or not and they would never pay what it was worth."

"The same kind of butter still comes to the store. Over-salted, underworked, worked too much, oily—people won't buy it to eat, so we pack it in tubs and send it to the renovating factory."

Making good butter with an ordinary churn is a fine art known to only a few people, and they get the top price for all they can make. The market for good butter is as steady as the market for cream.

With the **Minnetonna Home Creamery** and **Minnetonna Methods,** anyone can make creamery butter, and save that 30% which he is losing now.

If You Have Only a Few Cows,

there are two plans by which you can not only get more money for the little cream you now handle, but also open up an entirely new source of income.

One plan is to buy your neighbors' cream and make it into butter together with your own cream. Many owners of Minnetonnas are adding tidy sums to their income in this way.

Paul Whitebread of Wapwallopen, Pa., writes that he can pay his neighbors higher prices for their cream than the co-operative creameries and still make a good profit on it. **Why?**

There are at least three reasons, the same three reasons that enable you to make more profit on your cream by making it into butter at home, as already given.

You surely would have little trouble buying your neighbors' cream, especially if you offered them a little more than the creamery or cream buyers. You can also show them how they save time, trouble and labor costs in hauling their cream, when they sell to you.

Neighborhood Creamery.

Another way to make the Minnetonna profitable to you, no matter how little cream you have to sell, is to start a neighborhood or community creamery, running it on the same plan that the large co-operative creameries are run. Get your neighbors to join you in sharing the costs, interest and depreciation on a Minnetonna Home Creamery. Suggest that you or whoever operates the machine be paid for their time and labor, the same as a co-operative creamery pays a salary to its buttermaker. Then each member will be paid his share from the sale of the butter according to the amount of cream he has brought in. If you do not clearly understand this plan on which co-operative creameries are managed, we shall be glad to explain it further.

The neighborhood creamery idea seems to be spreading all over the country. It has been mentioned again and again in letters that come to our office. Here, for instance, is an extract from a letter signed by the dairy husbandman in the employ of the U. S. Department of Agriculture, Bureau of Animal Husbandry, at Auburn, Alabama.

"We have five small creameries in Alabama and a number of localities that wish to have a centrally located farmer buy a small engine and churn and churn the cream for the neighborhood. For this purpose I think your outfit would be very well suited."

The expenses of a small neighborhood creamery are much less than those of a large creamery, even in proportion to the amount of cream and butter handled. The profits to the members of such a community creamery are much larger.

CHAPTER II.

The Essential Things in Making Good Butter

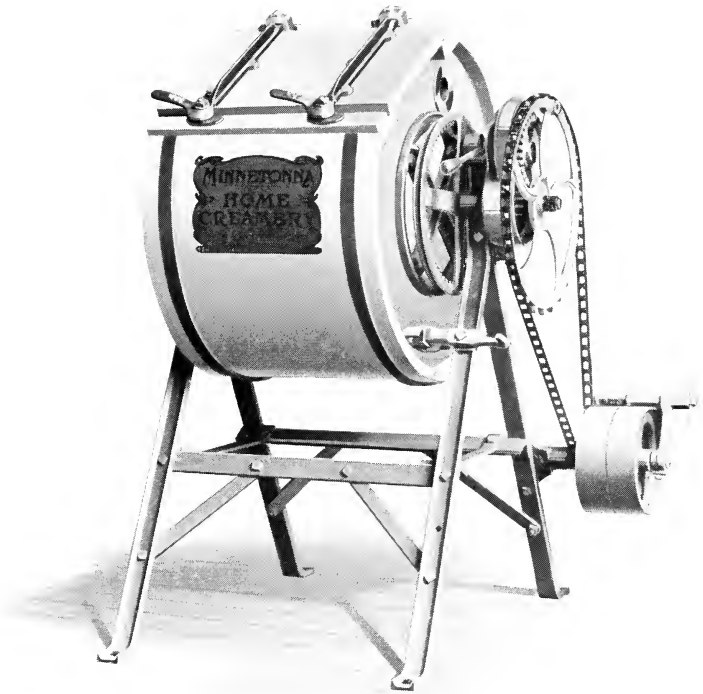
THE making of high-grade butter—the kind of butter that gets premium prices—begins at the cow, the source of the raw material from which the butter is manufactured.

The way a cow is fed and cared for makes a very noticeable and important effect upon the flavor of her milk, as well as upon its quantity and richness in butterfat. The flavor of butter depends upon the flavor of cream from which it is made. Flavor is the most important item in judging butter, and determines more than anything else how much you get for your product.

In Chapter XIV you will find some very interesting and very valuable information about the care and feeding of cows. Don't fail to read that chapter.

The next step in good buttermaking is the handling of the milk and the cream after it is separated. Many things can happen to the milk from the time it leaves the cows until it is made into butter, that greatly affect its flavor, cleanliness or quality. In Chapter III are given some pointers on the selection and care of milk or cream intended for buttermaking.

Separating the cream from the milk and the operation of separators have a relation to scientific butter-



No. 3A Minnetonna Home Creamery. Churning capacity, with barrel half full, 12 gallons. Working capacity, 3 to 25 pounds. Has power attachment for belting to your gasoline engine.

No. 2C Minnetonna Home Creamery, with part of side and one end cut away to show the position of shelf and working roll inside of ALL Minnetonnas. Churning capacity (barrel half full), 22 gallons. Working capacity, 5 to 50 pounds.

The wide range of working capacities in the Minnetonna Home Creamery is made possible by the adjustable shelf feature as explained on page 58.

making that warrants a chapter on these subjects. You may discover in Chapter IV some facts about separating that you do not know or may have overlooked or forgotten.

It's a good thing to know the percentage of butterfat in your milk or cream. Such knowledge will give you a basis for figuring the comparative value of the different feeds and rations you give your cows, showing which produce the richest milk. You will also be able to ascertain, how much, if any, butterfat you are losing in the churning, and why. The Babcock test, the recognized standard test for finding the per cent of butterfat in cream or milk, is fully explained in Chapter V.

Almost as important as the improved processes of churning and working butter are the modern scientific methods of **preparing** the cream for the churning—"ripening" or souring, "starting," getting the right degree of acidity, finding the best temperature at which to churn, etc. These things determine how much or how little butterfat you lose in the churning and to some considerable extent influence the grain and flavor of the butter. The most successful scientific methods of "ripening," testing, "starting," etc., are fully and clearly described in Chapters VI, VII, and VIII.

Butter color has much to do with butter prices. It is dealt with in Chapter IX.

In the churning process of buttermaking there is also another chance to lose a large chunk of your butterfat—and your profit—if you use old time, unscientific, laborious methods. Science has shown how to prevent this loss, as well as how to do away with most

of the drudgery and waste of time connected with butermaking as our mothers and grandmothers did it. The new way in buttermaking is interestingly dealt with in Chapter X.

The last few operations in good buttermaking—washing, working, incorporating moisture and salt, are by no means so unimportant that they deserve anything less than the most careful attention. A "slip-up" here may spoil the otherwise fine batch of butter. Don't skim over Chapter XI. Study it carefully.

Some valuable pointers on putting your butter up in the most marketable forms are also given in Chapter XII.

In concluding this work we could hardly find a more appropriate subject than a principle that is recognized and given careful consideration in all well-managed and successful manufacturing enterprises—the care of the tools or machinery with which we work. Any kind of machinery, no matter how good it is, how correct in working principle, how carefully and strongly built, requires some care if you expect to get the best results from its operation and long reliable service. Chapter XIII is worth reading.

CHAPTER III.

The Handling of the Milk and Cream

How Quality of Butter Is Judged.

TO FULLY appreciate the importance of great care in handling the milk from the time it leaves the cow until it is put in the churn, and to understand why many of the buttermaker's troubles are traceable to things that happen to the milk or cream, it is first necessary to understand how butter is graded, what determines the price you get for it.

With the butter trade—that is, butter buyers, wholesalers and retailers—butter is graded as follows:

"Specials," the very best; "Extras," "Firsts" and "Seconds" in the order named. There is a wide variation in the prices between "Specials" and "Seconds." There is always a good market for "specials" whereas the lower grades are a drug on the market most of the time.

In judging butter, especially in prize competitions, the following division of points is made:

Flavor	45
Body or grain	25
Color	15
Salt	10
Package	5

The flavor is given nearly one-half the total score, indicating it is the most important factor in determin-

ing the market value of the butter. Perfect flavor is difficult to describe, but well known to the majority of butter consumers.

The grain and color of the butter are governed mostly by the churning and working processes, and will be considered in the chapters on those subjects.

The flavor of butter and what affects it will have our attention here. Important as flavor is considered among butter traders and prize contest judges, it is even more important to the consumer, the people who eventually buy and eat the product. In fact, flavor is almost the sole consideration by which most consumers judge butter. If the flavor of your butter is "off" the people won't buy it.

The two things that have more to do with flavor of butter than anything else are the feed and care of cows, and the manner in which the milk and cream are handled before churning.

The Flavor From Certain Feeds,

such as turnips, beets, etc., can be eliminated if the cows are fed right after milking time. This is a fact generally understood by farmers and dairymen. **Rancid flavor from feeding rape** can only be overcome by discontinuing such feed. Rape is so strong and pronounced in flavor that it is impossible to make good butter when it is used as feed for your milk cows.

Silage Flavor.—A very common trouble, especially in the winter months when cows are fed large quantities of silage in poorly ventilated barns. It is caused not by the silage as a feed but by letting the milk or

the cream stand in barns until it takes this taint. It is impossible to feed silage through a cow's system to produce this defect in milk and cream. If the milk and cream is taken from the barn immediately when drawn from the cows there will be no trouble from this source.

The feeding, breeding and care of cows is considered at length in Chapter XII, especially in reference to **quantity** of milk produced and its butterfat content. Cleanliness is the most important thing to remember in the care of cows. It has a direct effect on the flavor of the butter produced from their milk. Sanitation is the first law of good buttermaking. It is absolutely necessary to success in the buttermaking business.

The chief cause of undesirable flavors in butter is the exposure of the milk to strong odors and dirt and the failure to keep cream cool and sweet until it is ripened for buttermaking.

One of the best means of insuring the true butter flavor is proper care of the stable.

The proper and regular cleaning of the cows is extremely important.

On some farms the cream separator never leaves the barn from one year's end to the other. You know the stable was never built which did not have a smell in it. Just remember that milk will absorb odors quicker than anything else. If milk is left standing in the barn or is separated in the barn it is going to taste "cowy." If the milk tastes bad the butter will taste bad also. Do your separating in the milk house.

If this is not convenient some cans can be set outside the barn door to empty the milk into. But keep

them covered. If possible send pail and all to the separator just as soon as you get through milking.

Barn Taint.—This is caused by keeping cows in crowded, unsanitary, poorly ventilated and poorly lighted stables, or by leaving milk and cream in barns, or by leaving hand separators in barn or allowing dust to drop in milk when milking. When milk is cooling in a place where odors exist and the temperature of the milk cools below the temperature of the air, the oxygen of the air enters into the milk and cream, carrying odors that are in the air. This is one of the main causes of barn flavor.

Metallic Flavor is caused by keeping milk or cream in old rusty cans, ripening cream in vats not properly tinned, using poorly tinned starter cans or using anything where the milk comes in contact with metal when sour. Ripening cream to .8% acid also causes metallic flavor.

CHAPTER IV.

Separating the Cream

SEPARATE your milk just as soon after milking as possible. Separating should be done while the milk is warm if you want to get all the butterfat possible. It has been proven that butterfat separates best when it is at a temperature of 90 degrees Fahrenheit. Before separating, the milk should be strained through a reliable wire strainer, so that if any hairs or dirt have gotten into it they will not get into the separator. (We recommend the Ekvall Sanitary Milk Strainer. It is the most efficient strainer we have ever seen. You can buy it from the Minnetonna Co.)

After it is separated, the cream should be put into a long narrow can, stirred so as to aerate it and drive off the animal heat, cooled down to about 50 degrees Fahrenheit and held there until you have cream enough for churning. Do not put cover on the can until the cream is well aerated and cooled and do not hold it over 2½ or 3 days (2 days is better).

Never Mix Warm and Cold Cream.—If you do it will sour or ripen before you want it to do so. By using two cans, you can use one for the morning cream and by evening it will be cooled so you can turn it in with the previous day's cream and have the

empty can to put the warm cream in. There is no need of mixing warm and cold cream as is the general practice.

Smothered Cream is caused by putting a tight cover on can and not allowing the animal heat to pass off. When the milk is drawn from the cow the temperature is 98 degrees and it should be cooled, allowing the animal heat to escape. This smothering of cream produces a rancid smell and is very detrimental to good buttermaking.

Operating the Separator.

The variation of the speed of a cream separator has a great deal to do with the enormous losses of butterfat that have cost dairymen hundreds of thousands of dollars each year. Increasing the speed of a separator two turns increases the velocity or pressure of the bowl 4 times; that is to say, when increasing the speed on handle 2 revolutions, above 45 RPM for example, we increase the skimming velocity 4 times. And should we increase the handle velocity to 60 RPM, the pressure or velocity of the bowl would be 30 times greater at 60 RPM than at 45 RPM. This one thing causes the great variation in cream tests, also the great losses that occur by not turning the hand separator at its proper speed.

Speed Indicator.—Every cream separator should be equipped with one of these devices. They are inexpensive and save their first cost many times in amount of butterfat saved by turning the machine at proper speed, especially when more than one person turns the separator.

Condition of Milk While Separating.—When cows are long in lactation (old milk cows) and are fed on dry feed, the whole milk is much harder to separate, and it is necessary to be careful in the operating of the separator under these conditions.

There is not a cream separator manufactured today that will skim milk at a low temperature and do good, clean skimming with old milk. Great butterfat losses are bound to occur in any separator. All separators do better work when the temperatures are 85 and above.

Foundation for Separator.—A cream separator bowl is the most delicate, highest speed machine made today and it requires great care and should have a good solid foundation and run with steady motion. The foundation should be concrete and the separator should always be kept level. It should be started slow until the full speed is reached—not jerked, and it should also be turned full correct speed as long as any milk is left in the receiving tank to be skimmed.

The Care of Your Separator.

If there is one part of the dairy more than another where cleanliness is an absolute necessity, it is the cream separator. There are some who think that once a day is often enough to wash a separator bowl—others only do it twice or three times a week. That is a big mistake.

A Separator Bowl Must Be Thoroughly Cleaned After Every Skimming.—If it isn't, old particles of butterfat, or particles of impurities full of harmful germs will affect or ruin your next batch of cream or

milk. You can't make first grade butter with tainted, unsanitary butterfat. You can't get pure butterfat if your separator is not freshly cleaned. Besides there is a heavy loss in skimming, as no separator will do as good work when not clean.

Here are a few rules that must be followed to get best cream separator results.

1. Be sure your separator bowl is thoroughly washed after each skimming.
2. Be sure your separator is well oiled.
3. Be sure the speed of your separator is always even, and exactly as specified by the manufacturers.
4. Be sure your separator is in a dry, clean place, nowhere near anything that gives off an odor.
5. Be sure to follow all instructions which accompany your separator.

CHAPTER V.

The Babcock Test

THE Babcock Test, devised by Prof. S. M. Babcock, of the University of Wisconsin, is a method for the accurate and rapid determination of the per cent of butterfat in milk and milk products, such as cream, skim milk, buttermilk, cheese, etc.

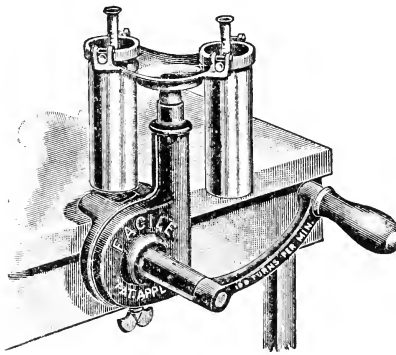
It shows the number of pounds of butterfat in each hundred pounds of milk or cream.

On account of its accuracy it has been adopted in many states as the official method of determining butterfat in milk.

Value of the Babcock Test.—It shows whether or not you are losing butterfat in the operation of the separator. It enables you to determine how much butterfat, if any, you are losing in churning butter.

It enables you to figure the per cent of "over-run." (See Chapter XI for explanation of "over-run"). You should get about 20% "over-run" to make the most profit out of your cream, and make the best grade butter. The Babcock test is necessary to know whether the proper "over-run" is obtained.

It gives you a basis for figuring the comparative value of the different feeds and rations you feed your cows, showing which produce the milk richest in butterfat.



One of the several styles of Babcock Testers sold by the Minnetonna Company. The hand-operated testers are also made for 4 bottles. Electric-operated testers made for 2 to 12 bottles. See Dairy Supply catalog of the Minnetonna Company.

The most valuable use of the Babcock Test is in showing what each cow in your herd is doing in the way of butterfat production. With this knowledge you can weed out the poor cows and breed the best ones to produce even better butterfat producers. The value of a Babcock Test outfit to the dairy farmer cannot be overestimated. To many farmers it has proven itself worth thousands of dollars.

Assistant Secretary of Agriculture Vrooman estimates that the American farmer would be $10,000,000 richer at the end of the year if he took advantage of the knowledge at present on tap in the Department of Agriculture. That estimate is ridiculously low. The owners of the dairy cows alone could make up the $10,000,000 without half trying. Ten minutes a day spent in the study of economical feeds and rations would do the trick. Investment of a few dollars in a Babcock Tester would soon cut out enough of the robbers to give the former cow slave an hour a day for studying the problems of profit-getting and home improvement.

Every Cow Owner Should Have a Babcock Tester.

If you have never used a Babcock Tester or had some one else test your herd, depend upon it you are keeping one or more animals at a loss. A test will show you some surprising facts; facts that you cannot afford to ignore; facts that mean big money to you.

For example, take three cows, each producing 5,500 lbs. of milk per year (an average of 20 lbs. per day for 275 days). Cow No. 1 produces milk containing 3% butterfat, No. 2, 4% butterfat, No. 3, 5% butterfat. Say butterfat is worth 25 cents per pound, see what we get.

Cow No. 1—3% of 5,500 equals 165 lbs. butterfat at 25c $41.25

Cow No. 2—4% of 5,500 equals 220 lbs. butterfat at 25c 55.00

Cow No. 3—5% of 5,500 equals 275 lbs. butterfat at 25c 68.75

Now supposing it costs $40 to feed and care for each cow for one year. On this basis:

Cow No. 1 makes $1.25 net profit.
Cow No. 2 makes $15.00 net profit.
Cow No. 3 makes $28.75 net profit.

Cow No. 3 is equal to 23 cows like No. 1.

Can you afford **not** to own a Babcock Tester?

A tester is inexpensive in first cost. A small supply of an inexpensive chemical is the only expense thereafter. Anyone can make accurate tests.

To Test Milk.

Apparatus: 17.6 c.c. pipette, 17.5 c.c. acid measure, test bottles, dividers, water bath, centrifuge, sulphuric acid (specific gravity 1.83 to 1.84). The milk to be tested and the acid used should be brought to a temperature of about 70 degrees; this can best be done by the use of the hot water bath.

1. Pour sample of milk to be tested from one vessel to another at least five times.

2. Take pipette between thumb and second and third fingers, leaving the index finger free. Draw milk into pipette immediately after stirring, and place the index finger over the top of the pipette; now release the finger very slightly until top of the milk column is even with the mark on the pipette.

3. Hold milk bottle on a slant and place end of pipette in the neck of bottle, leaving an opening for air, so that air bubbles cannot form and throw milk out of neck, and release finger and allow the milk to flow into the bottle, blowing the last drop from the pipette.

4. Fill acid measure to mark (never draw acid into pipette), take milk bottle by the neck between thumb and fingers of the left hand, so that the bottle can be turned; now bring the lip of acid measure to mouth of bottle, and pour acid into the bottle, rotating the bottle so that all of the milk will be washed from the neck into the bottle. Hold the bottle at a slant so that the acid will not fall directly on the milk and form pieces of charred curd.

5. Give bottle a rotary motion in order to cause a gradual mixing of milk and acid; sudden mixing will cause large amounts of heat and gas and will throw

the material out of the bottle. (Keep acid away from face and eyes.)

6. After the bottle has been stirred thoroughly and the curd is dissolved, place the bottle in centrifuge and whirl five minutes.

7. Place bottles in water bath of 180 degrees F. for five minutes and fill with hot water to neck.

8. Whirl for two minutes.

9. Place in water bath for five minutes and fill with hot water to within one-half inch of the top of bottle.

10. Whirl for two minutes.

11. Place in water bath, 130 degrees F., for five minutes.

12. Measure fat column by placing one point of dividers at bottom and the other at the top; then, keeping dividers at that spread, place one point on the zero mark and note where the other point falls on the scale. That number will correspond to the per cent of fat in the milk.

To Test Cream.

In testing cream, the samples of cream for testing should be weighed instead of being measured.

Weigh out 18 grams cream in cream bottle on an accurate scale tested by State Officials having state seal on it. Add sulphuric acid and shake until contents in bottle are coffee brown (the exact amount of acid to use cannot be specified. It must be enough to cause cream to turn to a coffee brown color). Place in tester, run seven minutes, stop, fill to neck with hot water. Place in tester, run two minutes, then

stop. Add water at a temperature of 140 degrees F. until fat rises above zero mark. Place in tester, run two minutes, stop. Then add a few drops of red reader (Emyl alcohol). Then read from bottom of fat line to bottom of red reader line or top of fat line. Place divider on zero mark and read up. This will give you percentage of fat or pounds of fat in 100 pounds of cream.

Cream Test Bottle

Causes of Defects in Tests.

Running tester too slow.
Sour lumpy cream.
Too much acid.
Too strong acid.
Too weak acid.
Reading test too cold.
Reading test too hot.
Not thoroughly mixing sample before testing.
Not taking a proportionate sample.

Speed of Babcock Testers.

Diameter.	R. P. M.
10 inches	1,074
12 inches	980
14 inches	909
16 inches	884
18 inches	800
20 inches	759
22 inches	724
24 inches	650

Temperatures of Cream.

Temperatures of Acid and Temperatures of Cream should be the same or nearly the same, about 70 degrees F.

To Test Lumpy Cream.

Add ¼ stick of Caustic Soda. Put this in sample of sour cream and stir until lumps dissolve.

To find number of pounds butterfat in milk or cream multiply the pounds of milk or cream by percentage as shown by test.

Milk Test Bottle

Example I—Milk.

400 lbs. milk testing 4% butterfat.
$400 \times 4 = 16$ lbs. butterfat.

Example II—Cream.

80 lbs. cream testing 30%.
$80 \times 30 = 24$ lbs. butterfat.
Multiply pounds of cream by test and divide by 100.

Note: It is not necessary to weigh cream samples when testing it for one's own use. It is only when buying cream that it is compulsory to weigh the samples.

CHAPTER VI.

Ripening the Cream

THE butterfat particles in cream are held in solution by the curd. The object of "ripening," which really means souring—is to make the curd so brittle that the butterfat particles will be easily and completely released during the churning process. In that way you waste none of the butterfat, but turn it all into butter. It's very profitable to properly ripen cream before churning it.

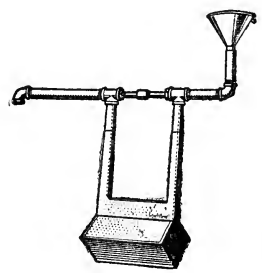
This process is carried on by heating cream to a temperature where the germ life will grow and develop acid—between 60 and 80 degrees. The temperature at which to ripen cream depends on the time of year; temperature of weather, richness of cream. Cream containing a small percentage of butterfat will ripen much faster and at a lower temperature than rich, high-testing cream.

Cream containing 18 to 25% butterfat will ripen at 8 to 10 degrees lower temperature in the same length of time than richer cream and great care should be taken not to over-ripen it.

The heavy-testing cream, from 28 to 35%, ripens slowly as it does not contain the percentage of milk serum (skim milk), therefore can be ripened at a higher temperature, but great care should be taken not to ripen over 8 to 10 hours. Over-ripening causes bitter flavors.

If you churn cream that is soured in the old fashioned way, by letting it stand for four or five days, it is not ripened evenly on churning day, and consequently, you lose a lot of butterfat in the buttermilk.

Cream must be ripened evenly and all to the same degree; then there won't be any loss of butterfat, and you will make the best grade butter.



The Minnetonna patent ripening coil is sold exclusively by the Minnetonna Company and its dealers. See their Dairy Supply catalog.

The Minnetonna Ripening Coil enables you to get this ripening process done just right. First clean and scald out the barrel of the Minnetonna Home Creamery thoroughly. After having cleaned the barrel thoroughly, pour in the cream, first having taken out the shelf—put in the ripening coil, and fill it with hot water, not too hot, but about 90 degrees.

Strain the cream into the barrel. This will break up the body of the cream and remove any dirt which may have found its way in. With the body of the cream broken, the churning will be both complete and easy.

Stir the cream by gently rocking the ripening coil several times so that all the cream will have an even temperature.

Raise the temperature of the cream to about 80 degrees—stir the cream gently with ripening coil. Be

sure that the temperature of all the cream in the barrel is uniform. Use a tested dairy thermometer. Then let the cream cool down to about 75 degrees.

Cover the barrel with a clean cloth, and then with a heavy rug or blanket or something to retain the heat —that is all there is to do. In the morning when you are ready to churn you will find the cream ready, ripened every bit of it—and all to the same degree.

Or you can hold the cream at churning temperature for an indefinite length of time, by adding more hot water as may be necessary.

When the cream has a sour yet pleasant taste and a good body it is ready to churn.

After the cream is ripened, especially in the summer time, it may be too warm, and if so, you can cool it to the right churning temperature by pouring cold water through the ripening coil.

Cooling Cream.—Before churning, the ripened cream should be cooled down to the right temperature. The object of cooling the cream down is also to get it in such a condition that all of the butterfat particles will come out of the cream when it is churned. If cream is churned at too high a temperature, there will be a certain loss of butterfat particles in the buttermilk. The Minnetonna Ripening Coil will quickly cool down the cream to the proper churning temperature by running cold or ice water through it. The correct temperatures of cream for churning are given in Chapter VIII.

When you are through with the ripening coil pour out the water, wipe ripener dry and hang it up in the sun or a warm dry place until you want it again.

CHAPTER VII.

Testing Cream for Acidity

THE acid test tells when the cream is "ripe" or sour enough to churn. This device should be used with the Minnetonna Home Creamery. It is simple. Anyone can quickly learn to use it.

We will explain the Nafis acidity-testing outfit here. We believe it to be the best outfit made for home creamery use because of its simplicity and small cost. You can procure it from the Minnetonna Company. It is listed in their dairy supply catalog.

The idea of the test is simply this: The acid in the cream when mixed with an alkali becomes neutral —that is, it changes into a substance that is known among chemists as a salt. (There are different kinds of salts. Table salt or the salt used for seasoning food is only one of the many kinds of salts.)

The alkali which we use to neutralize the acid in sour cream we call neutralizer.

The amount of neutralizer it takes to neutralize the acid in a given quantity of sour cream gives us a basis for figuring the percentage of acidity in the cream we are testing.

"But can you tell when the acid in sour cream has become neutralized?" you ask.

We put a few drops of a solution called **indicator** into the sample of sour cream we are testing. **Then,** when enough **neutralizer** has been added to the sour cream to neutralize the acid, the cream will turn

pink. If you know how much neutralizer you have added to the cream before it turned pink you can easily figure the percentage of acidity of the cream.

Here's where the necessity for the acidity-testing outfit comes in. You must have the instruments for making accurate measures of both the sour cream to be tested for acidity and the neutralizer used. The value of the test depends absolutely upon the accuracy of the measures taken. Such a small amount of cream is used that if a mistake is made in the test it will be multiplied many times over in giving the results for the whole amount of cream.

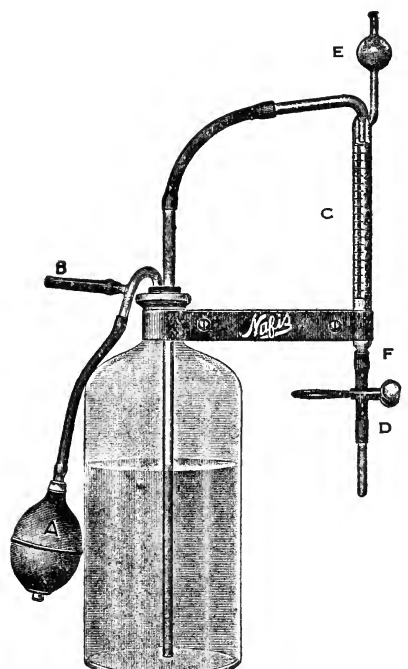
For measuring out the sour cream we use a glass tube called a pipette, which is open at both ends. Dip the lower end of the pipette into the cream, put the upper end in your mouth and suck slowly until the cream is a little past the line in the upper neck of the bottle. (If you suck any of the liquid into your mouth do not use that liquid as some of the acid from your mouth may have mixed with the cream and spoiled it for testing.) Remove the end from your mouth and quickly place your finger or thumb tightly over opening (at top). You can then lift the pipette out of the cream and the cream in the pipette will not run out unless you remove your finger. If the cream in the pipette is still above the measuring line, lift your thumb slightly and allow the surplus to run out.

Now let the cream in the pipette run out into a clean glass. Then suck some clean water into the pipette, shake it around to be sure that none of the cream is left in the pipette, and add the rinsing to the cream in the glass.

For this test use a pipette holding 9 c.c. (c.c. means

cubic centimeters, the standard of measurement used in chemistry).

Add a couple of drops of indicator to the cream in the glass. We are now ready to add the neutralizer, but will first explain the apparatus for measuring the neutralizer—the Nafis Outfit illustrated here.



The outfit comes "Knocked down" so it is first necessary to put it together as shown in the illustration, being careful to have all joints tight.

The neutralizer is shipped in powder form to be mixed with water. This saves breakage on bottles and express charges on the water.

The large bottle contains the neutralizer.

The glass tube (C) with figures 0 to 10 c.c. (cubic centimeters) is called a **burette.** This is used to measure the amount of neutralizer that is added to the cream being tested for acidity.

The pinchcock (D) when pressed between the fingers, allows the neutralizer to run out of the burette as slow or as fast as desired.

To fill the burette: Hold the rubber vent tube

(B) shut and press down the rubber bulb (A). The air pressure then forces neutralizer from the bottle into the burette ("C"). When enough of the liquid has been forced into the burette to flow into the bulb (E) at the top of the tube, release your pressure on the vent tube (B) and the rubber bulb (A). The air pressure will then force the surplus neutralizer back into the bottle so that the burette will remain filled only to the zero point.

It is well to draw out a little of the liquid from the burette to be sure that the tip (F) is filled. You must then, however, force more neutralizer into the burette, so that it is again filled to the zero point. (The neutralizer drawn off may be put back into the bottle.)

Making the test. We are now ready to add the neutralizer to the cream which we have measured out into the glass. Do this slowly, drop by drop, by pressing on the pinchcock (D) very gently. Stir the cream constantly. At first the pink color caused by adding a few drops of the neutralizer will disappear quickly, but as the acid becomes neutralized the color will disappear more slowly. As soon as a permanent pink color is obtained, the acidity is neutralized.

Reading the Test.

The burette holds 10 c.c. of the neutralizer. When enough neutralizer has been drawn off to turn the cream pink the figure opposite the column of neutralizer still remaining in the burette indicates the number of c.c. of neutralizer it took to neutralize the cream.

Each c.c. of neutralizer used shows that there is .1 per cent (one-tenth of one per cent) of acidity in

the cream. **Examples.** If 2.1 c.c. of neutralizer are used the acidity is .21 per cent ($^{21}/_{100}$ of 1%) if 6.4 c.c. are used the acidity is .64 per cent ($^{64}/_{100}$ of 1%), etc. If all the neutralizer in the burette were used before the cream turned pink, it would show that the cream contained 1% of acid (much too sour for making good butter).

When the acidity of the cream is .5 per cent (one-half of one per cent) it is ready to churn. From .5 to .7 per cent (one-half to seven-tenths per cent) is safe for churning, but .8 per cent is the danger mark. Cream should never be that sour to make good butter.

CHAPTER VIII.

Starters

CREAM held at 50 degrees Fahrenheit or thereabouts will not ripen or sour at once. In fact, it will keep a long time at that temperature. Before you ripen it, you must warm it to about 65 or 70 degrees Fahrenheit. It has been customary on most farms to let the cream sour or ripen of its own accord, but there are several reasons why this should not be done.

First again, comes flavor. If we were sure the right kind of bacteria were in the cream and enough of them to eat up any objectionable kinds which may have found their way in, there would be no necessity for using "starters."

But as we have no way of knowing this, the safest way is to put in the right kind of starter in sufficient quantities, so you will know just what the results will be beforehand.

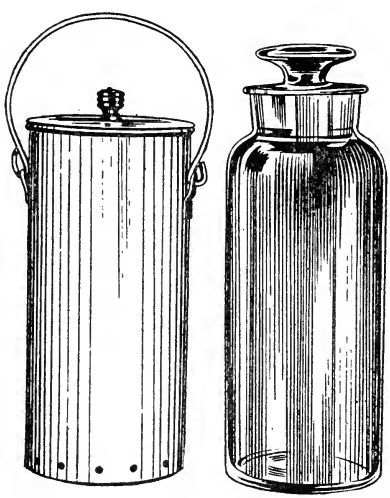
Then too, if the cream is allowed to ripen of its own accord, you will have to churn when the cream is ready, which may not be a convenient time. If the cream is kept sweet until the starter is put in, it can be so timed that it is ready when you want it, be that morning, noon or night.

Another reason for using the starter, and an important reason, is that you will get better butter of a more

uniform grade out of a given quantity of cream by using a good starter, than you will by allowing the cream to ripen of its own accord.

We advise the use of a commercial starter. There are several good ones on the market. Starter tablets can be bought from the Minnetonna Company.

That you may be prepared for such an emergency as finding yourself out of starter tablets and unable to get a new supply quickly, we include at the end of this chapter directions for a **home-made** starter.



The Minnetonna Tea Kettle Starter Outfit. The can fits into any family size tea kettle and is used like a double boiler in heating the cream to the proper temperature. The glass jar is for keeping the starter in until used. See the Minnetonna Dairy Supply catalog.

How to Use a Commercial Starter.

Take two quarts of milk and heat to 180 or 190° F., cool to 80, add one tablet; set at a temperature of 80 in winter; 69 to 70 in summer. It will take 12 to 15 hours to coagulate (sour). Set in glass jars or glass stopper bottle. This is the most sanitary way to grow

a starter. Absolute cleanliness must be used in making starters. All utensils should be washed clean and scalded when being used. Never put thermometer in mouth when taking temperatures. It will transfer the germs into the starter.

When starter is ripe stir it thoroughly so as to break up the curd; then cool to 60° if used at once and to 50 if held any length of time.

When the cream to be churned is heated to proper temperatures for ripening, add the starter, stirring the cream so the starter will be well stirred into it. Then let the cream stand until ripe.

Cream containing from 18 to 20% of butterfat should have 2 quarts of "starter" to each 10 gallons of cream or less. Two quarts of starter will not do any harm in five gallons of cream. Cream containing from 28 to 35% of butterfat should have 3 quarts of "starter" to 10 gallons of cream.

Cream should never contain over 35% butterfat to get good results in churning.

When cows are milked a long time (strippers) the cream is very difficult to ripen as it contains a large percentage of milk sugar, and will ripen slowly, especially when fed on dry feed in winter time. The percentage of "starter" can be increased under these conditions and higher temperatures used. Great care must be taken as such cream will develop undesirable flavors if held too long or ripened too long before churning, causing bitter flavor in the butter.

A Few Things to Remember.

Remember that the lactic acid germ is a tiny, delicate plant.

That heat may very easily destroy its life.

That cold does it no injury whatever.

That high acid weakens and finally kills it.

That a temperature between 65-75° F. is most favorable for the production of a good quality of acid.

Always use a thermometer when setting a starter.

Never pasteurize without knowing the time and temperature applied.

Never use old, acid or unclean milk.

Never use anything but glassware or good tinware for handling your starter.

Have a well tinned starter can. Copper is poison to the good flavor of lactic acid.

Try to be a good judge of conditions as they arise.

Do not think that the starter will take care of itself.

Do not think that any kind of sweet milk is good for making a first-class starter.

Do not shake up the starter until it is to be used.

Home-Made Starter.

Take 2 quarts of milk; select the milk from the newest milk cow that gives the most milk. Cool and stir this milk so as to drive off all animal heat; then heat to 85 degrees and place in a Mason fruit jar; set it where the temperature will stay at 85. It coagulates (sours) in 10 to 12 hours. This starter should be stirred until all the lumps break up and it appears like rich cream. Then cool to 50 and it can be transferred into the cream to be ripened.

Should there be an unpleasant odor or taste to the starter, it should not, of course, be used. No matter how careful you may be this sometimes happens. It is advisable to have two or three jars of starter going

at the same time so that you will not have to wait 24 hours for another one.

When ripening your cream in a Minnetonna Home Creamery, put the cream in the barrel first, then pour in the starter. This gives the starter a better chance to become thoroughly mixed with the cream.

When the cream has soured to the point where it is just about the same taste as the starter, it is just where you want it and should be cooled down to churning temperature.

CHAPTER IX.

Butter Color

When and How to Use Color.

COLOR should be added to cream before it is churned. The amount of color will depend upon the market, kinds of cows milked, time of year and kind of feed used. The cream from Jersey or Guernsey herds usually need little, if any color. Holstein and other breeds produce white butter and color must be used to get an even color. This will have to be governed to meet conditions by the one who churns.

For mixed herds, in winter, add one teaspoonful of color to each 5 gallons of cream testing from 18 to 25% butterfat; and one and one-half teaspoonfuls for cream testing from 25 to 35% butterfat. No color need be used when cows are on full grass, unless during a very dry season.

Should you forget to add the color to the cream before churning, you may include it with the salt just before working the butter. First add the color to the dry salt, mixing it thoroughly,—then add the mixture to the butter and proceed with the working. Be careful not to spill any of the color or colored salt mixture on the shelf or rollers in the barrel. Color should be mixed with salt only when it is dry, never with wet salt.

Do not allow butter color to freeze, as this causes specks in butter.

Sometimes we get butter color from the stores that has been on hand for years, and has lost its strength or has been adulterated and is of no value. When buying color get it as fresh as possible and from reliable companies. Old color imparts a rancid oily flavor to butter.

The color should be the shade of yellow which is produced when the cows are in the pasture in the early part of summer. The color should be uniform, that is, not mottled or streaked. Uneven color is usually caused by the salt not being thoroughly distributed, and in this way indicates too little working. If the color is decidedly too high or too low it would be counted a defect even though it be uniform.

CHAPTER X.

Churning

CHURNING is the process of turning the butter granules in cream into butter by some form of agitation — stirring, shaking, lifting and dropping, etc. It was discovered by the Egyptians several centuries ago, while carrying goats' milk in skin sacks on camels' backs. The shaking of the sacks for many hours on long journeys caused the milk to churn into butter.

Science has adopted certain principles in churning cream that have made it easier, quicker and more exhaustive or "cleaner." By exhaustive or "clean" churning is meant that all of the butterfat globules in the cream are turned into butter. By the more primitive methods of churning a considerable per cent of the butterfat remained in the buttermilk after the churning and therefore was lost as far as its most valuable and profitable use was concerned. A machine having shelves and roll will churn faster and cleaner than the old-fashioned box or barrel churn because the cream is more thoroughly agitated. These scientific principles and many others are embodied in the Minnetonna Home Creamery. Therein lies its efficiency.

Temperature at Which to Churn.

This depends on several conditions, but cream should never be above 62 degrees or below 52 degrees

for home creamery buttermaking. (See table on temperatures). When cream is put into churn it will be noticed that the temperature will rise during the churning process, as much as 4 degrees. This is caused by the agitation friction. This occurs especially in warm weather.

The following table shows the different temperatures at which cream can be churned at different seasons with different percentages of fat in cream:

Test	Spring	Summer	Autumn	Winter
30	52-56	52-56	58-60	58-60
28	54-58	52-56	58-60	58-60
26	54-58	54-58	58-60	60-60
24	56-60	54-58	58-60	60-61
22	58-60	56-58	58-60	60-62
20	58-61	56-60	60-60	62-62
18	60-62	57-60	60-62	62-62

In very cold weather or when using cream from cows long in lactation period or fed on dry feed, you can safely churn at 62 degrees F.; and in warm weather or where the cows are fresh and fed on green feed, you may go down to 52 degrees F.; but these are conditions the person on the job must look into for himself.

The best way to discover the proper temperature would be to take the temperature at different times and then stick to the one which obtained the best results.

It takes a little longer to churn at a low temperature than it does at a high one, but so much better butter can be made where you churn at a low one that we strongly advise it. If it is churned at about 60 degrees the butter should break in from 15 to 25 minutes, or if at 52 degrees in from 25 to 40 minutes.

If churned at too high a temperature—higher than 58 degrees in summer or 62 degrees in winter—the butter is likely to have a greasy appearance. If churned at too low a temperature—less than 52 degrees in summer or 58 degrees in winter—the butter will be hard and often incomplete and will not hold much moisture, in that way reducing the overrun.

Directions for Operating the Minnetonna Home Creamery.

It is best not to fill the barrel over half full—and many find that the best results are obtained when the barrel is less than one-third full.

The reason for this is that the more the cream is agitated, the quicker the butter is made and the better the butter that results. And when the barrel is too full the agitation is not as thorough as necessary to produce the best results.

Furthermore, the barrel should be operated at the speed given in the special directions for the type of Minnetonna Home Creamery you possess. (See special directions in the back of this book.)

If the barrel is operated slower than directed, the butter will not come as quickly as desired.

If it is turned too rapidly the cream will cling to the sides and part of the butter will be lost.

There are several methods of telling when the churning is complete, but the best and simplest way is to note the size of the flaky granules, which should be shaggy and the size of kernels of corn.

Notice carefully the little glass peep-hole in the side of the barrel. During the churning this little round glass is always milk-wet. The very first time the glass

clears entirely the butter has come and the churning process is over. You are then ready to draw off the buttermilk—wash, salt and work the butter as per instructions.

Over-churning.—When we agitate cream we break up the casein or curd part of the cream and cause the butterfat globules contained in the cream to unite and form granules. These little granules contain several thousand fat globules. They will multiply very fast in size after formed in the churn, and great care and precaution should be taken not to over-churn them and form them in a solid mass. This is very detrimental to good buttermaking. Over-churning affects the flavor of butter, the body or texture and the color, as it is impossible to remove the buttermilk from over-churned butter.

Slow churning is caused by having too much cream in the churn or having cream at too low a temperature or not sufficiently ripened. When cream is not ripe the casein or curd is tough and it will not break so the fat globules can unite. Such cream can be churned for several hours before the butter will form. It will not churn until the agitation and friction warms the cream so that the fat globules can unite. When the butter finally does come, it will be soft, slushy and greasy—poor butter. This often occurs from old milk cows fed on dry feed. To avoid this trouble, ripen more and raise the temperature on ripening and churning.

CHAPTER XI.

Washing, Working, Salting, Packing

Drawing off Buttermilk.

WHEN the churning is done, open the faucet at the bottom of the barrel to draw off the buttermilk. This should be done as soon as the churning is complete. It is important to leave the faucet open as long as the buttermilk runs out. The faucet connects with a strainer tube made of perforated metal, which prevents the loss of any butterfat particles. Next, close the faucet and pour some clean, cold water into the barrel. After 8 to 10 turns of the barrel on slow speed, draw off this water and the butter is then thoroughly cleansed of buttermilk and ready to work. Buttermilk, if left in the butter, has a tendency to cause it to sour and spoil. Under the old method of making butter it was very difficult, and at times impossible, to get out all of the buttermilk.

Washing.

The butter should be washed with water from 2 to 10 degrees colder than the buttermilk and twice as much water used as buttermilk in small machines. Great care should be taken as to the temperature of the wash water. When buttermilk has a temperature of 62 or above, the wash water can be 50 F. When buttermilk is below 60, the water can be 2 to 4 degrees lower than the buttermilk.

If the wash water, when drawn off, is not clear but is quite milky, the butter should be washed again. Use water a few degrees lower than the butter and about half as much as the first wash. Washing the butter improves its flavor and keeping qualities. Be sure to have pure water, for impure water might have more undesirable effects than the buttermilk.

Salting Butter.

First mix the salt in enough water so that the dirt will rise to the top. Then pour off the water until the dirt is removed, thus washing the salt. In winter the water used for this purpose should be just warm enough so that the chill is off—about 68 to 70 degrees. In summer it should be straight from the pump, as cold as possible.

Next, take the ladle, make a trough in the roll of butter that lies on the shelf in the barrel, add salt, distributing it evenly from one end of the butter mass to the other.

Home-made creamery butter can be salted higher than butter for New York market. Use two ounces of salt to one pound of butter to be made.

To determine ultimate amount of butter to be made from given batch of cream, add one-fifth to weight of butterfat.

For example: 50 lbs. cream testing 30% requires 36 oz. salt.

50 lbs. cream testing 30% equals 15 lbs. butterfat.
⅕ of 15 equals 3 lbs. 3 lbs. added to 15 equals 18 lbs. butter.
2 oz. salt to lb. butter 2x18 equals 36 oz. salt.

Over Salting.

When too much salt has been used, the percentage can be decreased by adding cold water, working a few

revolutions and draining off. This should not be done until the working process is nearly finished. Great care should be taken not to add too much water or wash too much so as to reduce the salt too much.

Caution.

Never use coarse barrel salt for butter. It will not dissolve, but leave the butter gritty and mottled. Never use table salt. It is too fine and will wash out. Use only butter salt made for this purpose. The best is none too good, as salting is a particular part of butter-making.

There are several brands of salt on the market made especially for butter that do not cost any more than the salt that you buy at the grocery store. We advise using one of these, as they are far better for the purpose and just as good for other purposes.

The salt should be the same temperature as the wash water and can be made so by mixing with water, which will also dissolve it to a certain extent and cause it to mix better with butter. Never use dry salt, as it takes too long to properly incorporate it into the butter, with the result that your butter is overworked and becomes greasy.

Working Butter.

Butter should be worked until, when broken, it shows a grain like a broken piece of steel — a long grain. Butter should have a firm, waxy body, not brittle or short-grained. Butter can be worked from 20 to 35 revolutions without hurting grain or texture, especially if body is cold and firm. Great care must

be taken to see that the salt is thoroughly worked in, so it is not gritty.

You can tell by looking at the butter when it has been worked sufficiently. When the butter has been thoroughly worked you will find it all in a solid, compact mass or roll on the shelf, and it can be lifted out of the barrel in one piece, by hand, or you can lift the shelf out and the butter with it.

The objects of working butter are: First, to distribute the salt; second, to bring the butter into compact form; and lastly, to incorporate the moisture to the desired proportion of 16%.

Value of Salt and Moisture in Butter.

Butter containing a good percentage of moisture and salt will keep longer. Fifteen to 16 per cent moisture and 2 to 3 per cent salt are better than dry, lightly salted butter, as the water and salt form a brine pickle that preserves and keeps butter fresh and sweet.

When we incorporate 15 to 16 per cent moisture and 3 per cent of salt we can make considerably more money than if we have light moisture and salt. Every pound of water and salt we add to butterfat increases the value of our butterfat. Here is where a rightly constructed buttermaking machine like the Minnetonna Home Creamery makes more money for the dairyman.

The Overrun.

Butterfat and butter are not the same thing. All butter contains butterfat, but there are other things in butter besides butterfat.

The butterfat of cream, as determined by the Babcock butterfat test (used by all creamery men and cream buyers) is pure butter oil. Butter on the other hand, is a mixture of butter oil, water, curd, salt and ash. The average composition of butter is approximately as follows:

Butterfat	80.25 per cent
Water	15.00 per cent
Curd	.75 per cent
Salt	3.50 per cent
Ash, acid, etc.....	.50 per cent

Thus 80 pounds of butterfat makes about 100 pounds of butter, after the proper amount of moisture and salt have been worked in. The curd, ash, etc., are already in the cream,—the small amount that is usually found in the butter when chemically analyzed is the amount that is not lost in the churning process.

Now let's see what this "over-run" means in the way of profit. The difference between 80 pounds and 100 pounds is 20 pounds. Twenty pounds is one-fourth of 80, or 25%. This means 25% more for your cream in the form of butter, just on account of the "over-run" alone, to say nothing of the possibility of getting higher prices for your butter than the creamery gets for theirs.

Packing Butter.

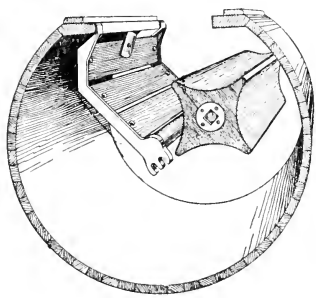
If jars or tubs are used they should be filled with cold water and allowed to swell up and cool off before they are used, so that when the butter is packed in them, it will not melt around the edges.

The most marketable form in which to put up butter is in one pound prints. There are two types of

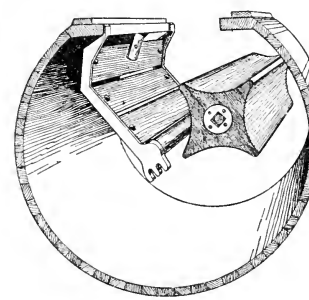
butter-printing machine, one operated by hand and the other has a lever which hastens the work and for a large dairy would be preferable. Both types have loose bottoms, that is, the bottoms can be removed and the print of butter will come out.

When the butter is printed it should be wrapped in parchment paper, which is air- and moisture-proof and preserves the butter to a great extent.

The Minnetonna Company can supply printers, parchment paper cartons and shipping boxes. Read their dairy supply catalog.



Limited Capacity.



Full Capacity.

These cross section views show how the butter is worked in the Minnetonna Home Creamery—the large working roll revolves and forces the butter down between itself and the idle roll in the lower end of the shelf. By simply slipping the shelf into either one or the other of the two sets of pegs, you have the proper adjustment for working a small or a large quantity of butter.

CHAPTER XII.

Buttermaking Troubles and their Causes

What Causes Short Grain Butter.

FREEZING cream.
Not working enough.
Churning too warm.
Churning too cold.
Over-working butter.
Freezing butter after made.

What Causes Streaked or Mottled Butter.

Uneven working.
Putting cold salt into butter that is warm.
Not putting salt in evenly.
Not working enough.
Putting in dry salt that does not dissolve.

What Makes Butter Salvy.

Overchurning butter.
Overworking butter.
Churning cream at too high temperature.

What Causes Bitter Butter.

Old stale cream.
Ripening cream too slow.
Holding cream at ripening temperature too long.

Where Cattle Run Outside.

Feeding large quantities of oat straw.
Cows during long period of lactation (old milk cows).
Feeding rutabagas before milking.
Eating corn stalks.

What Causes Flat Flavor.

Not ripening cream enough.
Churning sweet cream.
Not using salt enough.

What Causes Gritty Butter.

Using too much salt.
Using salt dry and cold.
Using coarse-grained salt. (Never use any kind of salt other than regular butter salt).
Using too cold water to wash butter.
Not having salt dissolved in butter.
Not working butter enough.

What Causes Low "Over-Run."

Churning too warm—heavy loss of butterfat in buttermilk.
Churning too cold—having hard small granules.
Not incorporating moisture in butter.

THE DEFECTS IN MILK AND CREAM WHICH CAUSE TROUBLE.

From Flavors.

Absorbed from air. Poor ventilation.
Stables unclean.

Milkhouse unsanitary.
Kitchen flavors from cooking.
Keeping in ice chest with vegetables.

From Chemical Action.

Sour.
Bitter.
Gassy.
Rapey.
Thick coagulated.

From Cow.

Unhealthy.
Character of feed.

Resulting Butter.

Rancid.
Sour.
Bitter.

CHAPTER XIII

The Care and Operation of The Minnetonna Home Creamery

WARNING

Be Sure to Soak the Barrel of Your Home Creamery With Hot Water Before Making Butter the First Time

YOUR Home Creamery may have been in the warehouse or stock room for some time.

Unless you soak the barrel thoroughly with hot water, it may leak both at the cover and perhaps in the heads.

First: Fill the barrel with hot water, put the cover on, turn up door buttons (Casting No. 209). You can also tighten cover at door strap loops No. 218, by turning down set screw.

Be sure to loosen straps or bands at hoop lug No. 215 a trifle. The hot water makes the barrel swell and if straps are not loosened a trifle, the heads may bulge.

And remember to do this also: When you are soaking the barrel turn the barrel over with the cover down so the cork will swell. When the cork is thoroughly soaked it becomes very pliable and will not require a great deal of strain on the door buttons in order to tighten the joint.

Give the barrel a good thorough soaking. Keep in the hot water until there is not the slightest sign of a leak at cover or in heads.

Let the Barrel Cool Off Itself. Do Not Use Cold Water to Cool the Barrel.

As soon as the barrel is completely cooled off, tighten the barrel straps. If the cover is too tight, loosen it easily at strap loops No. 218.

Follow these instructions and the barrel will not leak. If you churn twice each week it will probably not be necessary to ever soak barrel again, but should barrel leak at any time, due perhaps to the fact that you may not have used it for a long time, all you need to do is to **soak it again** according to these instructions.

Be sure that roll screw No. 283 is turned into place.

If you have any trouble write and tell us about it and we will tell you what to do.

SPECIAL DIRECTIONS FOR OPERATING MINNETONNA HOME CREAMERY.

Sizes 3A and 2C.

Before starting to churn, see that the front and rear bearings are properly oiled; also oil No. 254 gear on eccentric shaft.

When the machine is operated by hand, the speed for churning with heavy cream should be not more than 30 revolutions per minute; but with light cream as fast as 40 revolutions per minute.

To get the working speed, throw the eccentric lever to the left and turn the crank handle, at the same

speed as when churning, and the barrel will revolve at the proper speed for working.

To put the worker roll into motion, throw the stop button on the leg over far enough to come in contact with the extension on the internal gear, which will hold the internal gear stationary and cause the pinion to revolve on the inside of the larger gear, thus turning the worker. When the machine is operated by power, the speed for churning is regulated by the speed of the pulley, which should run about 200 revolutions per minute.

For working the butter the eccentric lever is thrown to the left and the stop button turned to come in contact with the extension on the internal gear as described above.

When the machine is furnished for power and power is not used, remove the drive chain from the large sprocket, before using for hand power.

Do not change the speed from slow to high when the machine is running, as there is a possibility of breaking the gear clutch.

Do not keep tightening the door button nuts unless they work loose, for they do not pull the buttons any closer to the strap.

The capacity of all sizes of the Minnetonna Home Creamery is figured on 30 per cent cream with the barrel half full.

Be sure to wash the barrel, shelf and worker roll with scalding water when through churning. Dry the barrel with the door removed and the door opening turned down.

After churning for a short time, the vent should be opened to allow the gas, which forms, to escape.

The spiral spring must be on main shaft outside of sprocket wheel No. 255. If inside the gears will not mesh on high speed.

To take roll out of barrel loosen thumbscrew or roll end key. The shelf lifts out of barrel by simply moving wooden latch.

SPECIAL INSTRUCTIONS FOR MINNETONNA HOME CREAMERY. ALL NO. 1 STYLES.

Be sure to oil all the bearing boxes and sprockets well before starting to work the machine. Also see that the pulley grease cup is filled with hard oil, so that you will have no trouble with cut bearings.

The lever on the upper shaft is used only to throw the roll into motion when working the butter.

The clutch lever on the lower shaft when thrown to the left places the gearing in high speed or churning speed. When thrown to the right it places the gearing in slow speed or working speed.

The pulley lever when thrown to the left expands the friction in the pulley and starts the churn in motion.

The friction pulley is the most practicable churn pulley in use, and is the most simple to operate and adjust. Each friction is adjusted before leaving the factory, but as the wearing blocks wear away, it will be necessary to force these blocks closer to the pulley rim by screwing up the set screws in the friction arms under the blocks.

The pulley should run at 150 R. P. M. The barrel will then revolve 30 times a minute with the clutch thrown in churning speed, which is the proper speed to give satisfactory results. The clutch thrown to

working speed will revolve the barrel 7 R. P. M. Throw the roll clutch in and the worker roll revolves 12 times to every revolution of the barrel.

If you have any trouble, or if there is anything you do not understand, write us.

A churn should be scalded with boiling water just as soon as the butter is removed. Use 2 to 4 pails if you have a small size Minnetonna, and enough to make about one-third full if you have a large size. Run 1 to 5 minutes if large size and 1 to 2 minutes if small size. Always put roll in gear while running and be sure to run on high speed. After this has been done drain off boiling water. It may be necessary in some cases to rinse twice with boiling water.

To Clean Old Barrel in Bad Condition.

Use a quart of sulphuric acid. Mix one-third full of water at a temperature of 130 degrees, close door tight, run for 5 minutes, draw off water; run churn one-quarter full boiling water, add from 1 to 5 pounds of sal-soda or Wyandotte washing powder; run 30 revolutions on high speed; then rinse a few times with boiling water. Then run with cold salt water, using 5 to 10 pounds of salt in cold water.

To Sweeten a Sour Barrel.

Use one-half quart of slacked lime mixed with water, temperature of 85 degrees, run churn and leave in several hours. Draw off and rinse with boiling water twice; then run or soak with cold salt water.

CHAPTER XIV.

How to Make Cottage Cheese

Buttermilk Cottage Cheese.

SET buttermilk in a can at temperature from 85 to 90 degrees; let it stand until curd settles to the bottom of the can, pour off one-half of whey. Then place can in boiling water, raise temperature to between 130 and 140 degrees; hold at this temperature for 15 minutes without stirring. Pour into a clean sugar sack and drain off whey, wash with water at a temperature of 90 to 100 degrees by pouring water over cheese in sack. Drain water off by twisting sack with a stick. It is necessary to wash well and drain dry so as to remove all whey from the curd. Salt one-quarter ounce butter-salt to pound of cheese. Add sweet cream when ready to serve. This makes good cottage cheese and from 6 to 8 pounds can be made from 100 pounds of buttermilk.

Skimmed Milk Cottage Cheese.

Set skimmed milk in a can at temperature between 75 and 90 degrees. Let it set at this temperature until it becomes thick and sour (coagulated). Then place the can into boiling water. Raise temperature of the sour milk to 110 degrees, stirring gently not to break curd up too fine. Cook at this temperature from 15

to 20 minutes. When curd begins to get firmer pour into a clean sugar sack and let the whey drain off. Then wash the curd by pouring a small amount of water into sack at a temperature of 85 to 90 degrees. This will remove rancid flavor. Salt at the rate of one-half teaspoonful of salt to pound of cheese; then keep in a cool place until ready to serve. When serving, add a little sweet cream and work with a long spoon. This gives the cheese a fine texture. Never add cream until ready to serve as the acids in the cheese will cause curd to become sour, especially in hot weather after cream has been added.

CHAPTER XV.

Managing the Dairy Herd to Produce the Largest and Richest Milk Yields

Importance of Proper Care and Feeding.

It is not so much a matter of cows as it is a matter of care.

Recent investigations have proven that even common cows are capable of producing much larger yields than those secured by the average farmer.

One of our large state universities has in its dairy herd a number of common cows.

It has been proven that these common cows—and by common cows it is meant cows having no dairy heredity—can be induced to greatly increase their yearly yield. The average yield from these common cows, over records taken each year for twenty-three years, is 5,000 pounds of milk and 222 pounds of butter.

If we figure the butter at the rate of thirty cents per pound, it means that the product of each cow has a value of $66.60 for butter **alone.** Since the average yield of the common cow is $46.40 according to average statistics, this certainly proves that care and proper feeding will induce the average cow to yield $20.20 more per year.

The foregoing must not be misunderstood. It is not in any way a disparagement of the practice of

purchasing blooded cattle, or of the practice of grading up the herd. It is simply a statement of a fact. And that fact is that proper care and feeding is most essential if one is to derive the most profit from the milk-making machine known as a cow.

Proper breeding is, of course, essential, but proper handling and proper feeding are also most essential if one is to pocket the most profit from his dairy herd.

Weeding Out "Boarders."

It does not cost any more to keep good cows than poor cows and the returns from the good cows at the end of the year greatly exceed the returns from ordinary cows during the same period.

The first time this matter is brought right home to the dairy farmer and figured out for him, comparisons made, the Babcock test used and the better cows selected from the ordinary ones in the herd, he is usually dumfounded and amazed, and when you still figure and add up the number of dollars that have been lost and wasted year after year, due to the fact that he has been wasting good feed and good pasture land on ordinary, non-producing, no-profit cows, he is speechless.

Grade cows are not a necessity. If you are just starting in the dairy business, chances are you can't afford to spend a lot of money for high-priced cows. The best plan is to grade up, weed out the poor cows, the heavy feeders that are poor milkers, add a good tested cow to your herd whenever you can economically, and you will come out all right. Keep cow records. Be sure you are getting a run for your money.

How to Grade Up Herds.

The most satisfactory method of grading up a herd is that of using a pure-bred sire with the cows now in your herd.

This sire should be selected very carefully.

Best results are found to be obtained from the sons of heavy-milking dams. One of the best tests for such a sire is the fact that he is already credited with the production of heavy-milking offspring.

The finest bred bull, if young, is always more or less of a gamble. He may produce splendid milking offspring, but again he may not. Pedigree does not alone assure that. Judge him by his products. However, a properly pedigreed animal is usually to be relied upon in this respect.

One good rule to follow is not to dispose of a satisfactory bull until you have found a superior bull to take his place. Judge that superiority solely by the fact that the new bull has produced offspring of greater milk-producing capacity.

The only way on earth that you will ever be able to grade up your herd is to use a pure-bred sire. Experts do not recommend grade sires. Their help in grading up the herd is not certain, nor is it rapid. Grade sires quite frequently transmit to their offspring some of the undesirable qualities inherited from their low-grade ancestors. Sometimes this not only retards the progress of the grade of your herd, but actually sets it back.

Any farmer using a pure-bred sire can reasonably expect that each succeeding generation of grade heifers will produce more heavily than their dams.

Don't guess on this point. Keep a record of each

cow's product. Have as your ambition a yearly average milk yield of more than 4,000 pounds per cow.

Most dairymen who have taken this as their aim have surpassed this point.

And it pays.

What Grading Has Done in Other Instances.

We quote the following from a table compiled to show how experience has proved that a pure-bred sire will grade up a mixed or common herd of cows into practically pure-bred dairy animals:

Calves of first generation contain 50 % pure blood.
Calves of second generation contain 75 % pure blood.
Calves of third generation contain 87.5% pure blood.
Calves of fourth generation contain 93.75% pure blood.
Calves of fifth generation contain 96.87% pure blood.
Calves of sixth generation contain 98.43% pure blood.

Therefore it will be seen that the sixth generation is practically 99 per cent pure.

It might be stated here that when conditions have been favorable, animals of the fourth generation are hard to distinguish from absolutely pure-bred cattle. This shows that a pure bred sire will impress the traits of his breed upon his offspring within four generations, as a rule.

It is only from pure-bred sires that you can expect results like this.

If you will write to Cornell University, Ithaca, New York, the authorities there will be very glad to send you a bulletin giving the history, care and feeding of a special herd on which this method of grading up the herd was used.

Results at Cornell have been similar to those experienced by shrewd dairymen throughout the United States. They have proven that a good dairy cow should produce at least 5,000 pounds of milk and over 200 pounds of butterfat every year. It is easy to understand what this means to the dairymen when it is realized that the average in the United States is less than 3,000 pounds of milk per cow.

Make use of the Babcock test. It is a simple and cheap and an infallible way of learning the precise value of your cows. It shows you which cow shows a profit and which one does not. It helps you to get rid of the cows that are not profit producers.

Hints on Handling Dairy Cows.

The average dairy cow is as nervous as the proverbial cat. The more highly bred the cow, the more nervous it is as a rule. Rough handling will always show itself in the decrease in milk yield. It pays to treat your dairy cows gently. If you run or hurry them or allow the dogs to annoy them, or the hired hands to stone, beat or kick them, **you** will pay for it in decrease in milk yield. Keeping your cows clean means putting dividends into your own pocket.

Also protect your cows from cold winds and cold storms.

Too many dairymen do not realize that cows must be treated individually. No two cows can be treated or fed exactly the same. Do not forget for one minute that you lose in profit for every excitement, worry, exposure, abuse or neglect your cows suffer.

Perhaps we might better first define the meaning of nutritive ration, inasmuch as that term will be used frequently in these instructions on proper feeding.

This term is used to express the respective amounts of protein—the muscle, the blood and milk-making parts of feed—and what are known as carbohydrates and fats, which are the heat and fat-producing elements of feed.

Protein is the name given to the group of food elements in the feed that contain nitrogen. The protein in the feed makes lean flesh, blood, tendons, hair, horn, wool, and casein and albumen of milk. The necessity for the feed to be high in protein value is that this protein actually maintains existence—makes the cattle grow—and is the primal cause for the increase in milk yield.

The food element known as carbohydrates goes to make up either fat, or heat or energy. Coarse fodders, such as marsh hay, prairie hay, timothy, millet, sorghum, fodder corn, stover and straw as well as clover or alfalfa hay need the addition of some concentrate with a high protein content such as small farm grains.

The fats include the wax and green coloring matter of plants. The fat element of the ration is either stored up in the body or burned to furnish heat and energy to the animal. The importance of making sure that the feed contains the proper proportion of fat elements can be readily seen when it is shown you that as a heat producer, a pound of fat is worth as much as 2.2 pounds of carbohydrates.

A little study on the part of the dairyman and farmer will soon enable him to provide that ration which will preserve the proper nutritive ratio.

Experts have proven that the most economical and the best ratio for dairy crop is from 6.5 to 7.5 pounds digestible carbohydrates and fats to one pound of

protein. There will be a shrinkage either in milk or body weight if the ratio of protein to carbohydrates and fats is greater than that prescribed above. Moreover, feeds high in protein are expensive.

To make this even more clear, nutritive ratio is something obtained by dividing the sum of the digestible carbohydrates and fats by the digestible proteins.

To bring this point closer home, we will point out the fact that there are two pounds of carbohydrates to one pound of protein in separator skimmed milk. That is, there is twice as much of carbohydrates and fats as there is of protein. Therefore, the nutritive ratio is expressed this way—skimmed milk 1:2.

In order that you may know exactly the nutritive ratios of each one of the fodders usually fed to your cows, we are printing herewith a table that is official:

	Nutritive Ratio
Corn Fodder	1: 14.9
Mixed Grass and Clover	1: 7.4
Wheat Bran	1: 3.7
Skimmed Milk	1: 2
Corn Silage	1: 14.3
Gluten Meal	1: 2.5
Corn or Cornmeal	1: 9.7
Mangles	1: 5.1
Red Clover Hay	1: 3.1
Alfalfa (green)	1: 3.1
Alfalfa (hay)	1: 3.8

So that you will not be confused we will state here that the figures given above vary slightly from those published by other experimental and agricultural universities. However, it agrees substantially with all those published by the best authorities.

A point to be brought out here is, that you will notice that some foods are almost perfectly balanced insofar as nutritive ratio is maintained.

It might be well to explain this point. For example, take clover hay and mangles. The ratio of these is a trifle wider than 1 : 5. It might be best to say here that neither one **alone** is a perfect feed. The reason for this is that their bulk is not in proper proportion to their protein and nutrients. The cows fed upon clover hay would have swallowed more than enough dry matter without obtaining a sufficient quantity of nutrient. And again, in eating thirty pounds of mangles, the cow would get only 2.7 pounds of dry matter and at the same time less than a half pound of protein.

The point to be emphasized here, is that nutritive ratio must not be confused with a **completed ration.**

The purpose of these instructions in regard to rations is that we desire to help all to obtain the ideal ration at the lowest cost—to help you see to it that the cows get a sufficient quantity of food, containing the correct amount of digestible nutrients, together with the milk forming elements in their proper proportion to the heat forming elements.

Balanced Rations for Milch Cows.

The trouble with the usual formula for balanced rations is that it is not practical for most farmers, as they may not have the desired elements on hand. The following rations are made up of different materials, so as to conform with the feed that you may happen to have on your farm. Any one of these rations is equally good. The number of pounds stated

in each ration is for a day's feed of twenty-four hours and is applicable to the average cow weighing from 900 to 1,200 pounds and giving from 3.6 to 4% milk.

		Pounds
1.	Corn silage	35
	Hay	8
	Wheat bran	4
	Ground oats	3
	Oil meal	2
		52
2.	Corn silage	50
	Corn stalks	10
	Corn meal	2
	Wheat bran	4
	Malt sprouts	3
	Oil meal	1
		70
3.	Corn silage	20
	Corn stalks	10
	Hay	4
	Wheat bran	4
	Gluten meal	3
	Corn cob meal	3
		44
4.	Corn silage	40
	Clover, timothy hay	10
	Wheat shorts	3
	Gluten meal	3
	Ground oats	3
		59
5.	Silage	40
	Clover	10
	Oat feed	4
	Corn meal	3
	Gluten meal	3
		60
6.	Silage	45
	Oat straw	5
	Brewers' grains	4
	Corn stalks	5
	Wheat shorts	4
		63
7.	Corn silage	35
	Hay	10
	Corn meal	3
	Wheat bran	4
	Ground oats	3
		55
8.	Corn silage	40
	Corn stover	8
	Corn meal	2
	Wheat bran	4
	Oil meal	2
		56
9.	Corn silage	20
	Clover, timothy hay	15
	Corn meal	3
	Ground oats	3
	Oil meal	2
	Cotton seed meal	1
		44
10.	Clover silage	25
	Corn stover	10
	Hay	5
	Wheat shorts	2
	Oats feed	4
	Corn meal	2
	Linseed meal	1
		49
11.	Clover silage	30
	Dry fodder	10
	Oat straw	4
	Wheat bran	4
	Malt sprouts	2
	Oil meal	2
		52
12.	Clover silage	40
	Hay	10
	Roots	20
	Corn meal	4
	Ground oats	4
	Linseed meal	1
		69

Formula for Stock Foods.

These are the same formulas used in the manufacture of advertised stock foods for which the farmer pays a big price:

No. 1.	Lbs.
Faenigreek	2
Allspice	2
Gentian	4
Salt	5
Saltpeter	5
Epsom salts	10
Linseed meal	100

Feed two to three tablespoonfuls to feeding.

No. 2.	Lbs.
Gentian	8
Ginger	8
Faenigreek	8
Powdered sulphur	8
Potassium nitrate	2
Rosin	2
Cayenne pepper	4
Linseed meal	44
Powdered charcoal	20
Common salt	10
Wheat bran	100

Compound, mix, feed one-half cupful to feeding.

Feeding should be done right after milking time, in which case feed flavors largely pass off through channels or secretions other than the milk and are not so noticeable. However, most dairymen and farmers understand this, and there is very little milk spoiled from this cause.

The feeding of dairy cows is a very important matter. The composition of feeds is an interesting subject. Most feeds can and should be grown on the farm.

The idea of feeding dairy cows simply to dispose of crops is ruinous. The successful idea nowadays is to **farm to feed** dairy cows.

The Value of Silos in Solving the Ration Problem.

Various experts have agreed that corn silage is probably the best and cheapest source of succulence. There should be a silo on every dairy farm which should be used for the purpose of furnishing this valuable necessary milk-making food during the winter and the dry months of the summer. Corn, oats and barley are splendid for supplying carbohydrates and dry matter to the dairy herd. All these can be raised almost anywhere. So can clover, alfalfa, sweet clover, vetches, cow peas, soy beans and Canada field peas. Each of these crops are rich in protein and ash. If you will feed hay, made from any of these leguminous crops, together with all the corn silage that the cow will eat you will find that it will form a balanced ration that will be succulent and also that the carbohydrates and fats in the corn silage will be balanced by the protein and dry matter in the hay. This will form a splendid ration for cows giving, say, from fifteen to twenty pounds of milk per day.

If you are living in the corn belt, you will find that ground corn and cornmeal is a splendid and a cheap concentrated food. This should, in your case, form the basis of the ration. Such a ration supplies everything necessary except the protein, ash and the necessary variety. It would be well, however, to add such additional rations as ground oats, bran, oil meal, dried distillers' grains, gluten feed or some other food rich in gluten.

Another very well balanced ration, when fed in conjunction with an abundance of corn silage, together with any of the leguminous hays, is a mixture of two parts of ground corn, one part ground oats and one

part of either one of the commercial by-product protein foods.

The above rations should be supplied to each cow at the rate of one pound each day to every pound of butterfat that that cow yields each week.

This is a very inexpensive ration. Furthermore it gives the cow exactly what she needs to make the most milk, and the greatest percentage of butterfat.

Right in this connection we might say that there is one special time that is best of all for starting the bettering of the feeding methods of the dairy herd. This time is about four to six weeks before the cow is due to freshen. At that time it is best to turn the cow dry and then feed her abundantly. It must be borne in mind at this time that the greatest profits are returned for the feed used in preparing the cow for the work that is to come. It is best that the cow be as high as possible in flesh at the time she freshens. Otherwise too great a percentage of her food will be consumed in maintaining her, building up her flesh, strengthening her stamina—and not making milk, as it should.

It is at this time that the cow that has been well fed with corn silage and roughage that is high in protein together with a carefully balanced grain ration yields the biggest profit to the dairyman. It is then that he begins to pocket the dividends that he has earned by his careful handling of the cow in her dry period.

Aside from the fact that corn silage proves one of the best rations for milk cows, it is also one of the cheapest.

Wherever farmers have tried out this method of

feeding the dairy herd, the economy has been at once evident.

The writer has before him at the present time one specific instance of this character. This is the boiled-down experience of a farmer in a middle western state who has tried out the silage ration system very thoroughly and has found it wonderfully profitable. This man built a concrete silo sixty feet in diameter and forty feet in height. This silo was filled four times from ten acres of drill corn and cow peas. Some comparison of the value of this ten acres of silo corn will be of interest. The 200 tons of silage thus obtained was equivalent to 70 tons of timothy hay, which, at $8 a ton, would be worth $560. This would make his silage worth $56 an acre. At one and one-half tons to the acre—a large crop for the state in which this test was made—it would have required forty-five acres to grow the hay thus secured by the silage method. To figure it in another way, this ten acres of silage was the nutrient equivalent of 1,420 bushels of corn. These at sixty cents a bushel would be equal to the value of $850, or $85 an acre. It would have required thirty-five acres of ground to produce the same amount at forty bushels to the acre.

Then again, this silage crop equaled in value fifty-eight tons of bran. As values are now, this would be equal to $1,400, or $140 for each acre.

And to figure it another way, these ten acres of silage are equal to forty-five tons of cottonseed meal. Cottonseed meal at $30 per ton would equal $1,450, or a valuation of $145 an acre for the silage.

The value of silage to the dairy farmer can hardly be overestimated. Silage stores well. It will keep

with less waste than corn or oats in the crib or hay in the stack, if it is properly housed. It also keeps longer. Furthermore, it is harvested when corn has reached the most development. It is harvested when nature can put no more into it. It is put away in its own juice, when it is so soft that even the cob can be thoroughly masticated and thus digested.

It is a notable fact that the cows eat silo food **eagerly.**

Furthermore, silage corresponds more closely to the nature of the cow itself. It is a bulk feed. The cows' stomachs are made for grass. And what is the corn plant but a great big grass? When it is cut up fine for her in the form of silage, it makes the cow's winter ration more like her summer grass.

Whereas concentrated, condensed feeds contract the stomach and bring about a radical readjustment in the internal cow, silage feed meets the requirements of nature itself. Moreover, concentrated feed can be fed with great advantage when mixed with the bulkier silage. Remember, there is absolutely no waste in feeding silage.

Again, there is no waste in harvesting silage, because the stalks, the blades, the grain, the cobs, the tassels, are **all** utilized. It forms the best solution of the feeding problem during the droughts and the short pasture periods of summer.

The farmer who has a few acres of corn in his silo is safeguarded against drought.

Right in this connection the writer might state that from the ten acres of silo corn, above referred to, the dairyman fed, from the first of November until the grass came, thirty cows and fifteen head of fall calves. And from the first of March, twenty head of year-

lings, and after all that, when grass came, this farmer still had four feet of silage left.

If you will write to the University of Illinois Agricultural College, at Urbana, and ask for Bulletin No. 101, you will receive free of charge a valuable and instructive bulletin on "Crops for the Silo and Cost of Silo Filling." They will also be very glad to send you a very comprehensive bulletin covering the main facts to be considered in building a silo. This is known as Bulletin No. 102.

Care of the Cows.

There was a time, not so many years ago either, when the farmer or dairyman who cleaned his cows was considered over-cleanly, to say the least. Even now there are a great many people who never clean their cows either before or after milking, or any other time.

But the up-to-date farmers and dairymen, the ones who are making the most money out of their herds, take just as good care of their cows as they do of their horses.

Saw off the handle of an old broom part way down and brush thoroughly with that if you don't have time to use a currycomb and brush. You can do a fairly good job with the short broom if it is followed up with a rag rubbing to pick up the loose dust. In any event, don't fail to use a damp cloth to wipe off the back of the cow, including the udder. If this is not done, some of the dirt from the cow is bound to get into the milk pail and that is what you want to avoid.

Just remember if dirt gets into the milk it is bound to leave its flavor there to a greater or lesser extent,

depending on how much gets in. If the milk is flavored, the butter will be also.

Dirt and barn odors which get into the milk at milking time are one of the chief causes of poor butter; therefore do all you can to avoid them.

Care of the Stable.

In order to make the **best** butter you must start with the stable itself. This should be kept as clean as possible at all times, and particular care taken to clean it and bed down the stalls half an hour or more before milking time. If possible the bedding should be sprinkled with water to lay the dust. It will not be necessary to make it wet; just a slight sprinkling will be sufficient.

When cows are kept in crowded and unclean stables with but little fresh air, sanitary milk cannot be expected.

When kept under unsanitary conditions for any length of time the animals become unhealthy, and even where they themselves are not diseased, the milk as soon as drawn absorbs the unclean atmosphere of the stable, which readily spoils it for either domestic or commercial purposes.

The liquid and solid excrements of the stable are teeming with various fermentive bodies. The air is filled with dust particles which contain ferment and fermentable substances, and as soon as the milk is drawn it is contaminated.

In order to keep the stable in a wholesome condition, a liberal amount of bedding and absorbents should be used. In localities where straw cannot be obtained, sawdust, shavings, peat and other materials

are employed. In addition, a small amount of land plaster or gypsum will be found valuable for deodorizing the stable.

Gypsum can be used at the rate of about half a pound per day for each animal, and is sprinkled in the stalls and trenches.

Lime in any other form than the sulphate is not suitable for use in stables. Instead of absorbing the odors, quick lime and slacked lime decompose the refuse materials, producing more odors. Lime sulphate or land plaster can usually be procured at about $5 a ton, and is, in addition to the deodorizing properties, a valuable fertilizer. When added to the manure, it increases its value by preventing unnecessary fermentation and loss of ammonia.

A cow is nothing but a very peculiar factory into which is taken the raw stuffs and from which she turns a highly finished product. Everything she needs to make the most output is an important cog in the wheel and if omitted she fails to do perfect work. Don't forget this. She must have every comfort. She must not be exposed.

The average cow quarters on the general farm are too small and poorly lighted to be comfortable for cows that are expected to make a profit. The idea that anything will do to shelter cows during bad weather is wrong. Neither will anything in the way of night stabling do during the brisk nights of late fall and early spring. While it is advantageous to keep cows up during inclement weather and feed in the stanchion or stall, it is not a good plan to pamper them in weather when sunshine and air will do them good.

Health above all things should be perfect in a dairy cow.

Ventilation of Dairy Barns.

In ventilating dairy barns a great many things must be taken into consideration; location of barn, the general surroundings, height of barn, the number of cows, etc. The sizes of intakes and outlets depend on various conditions. No ventilation will work automatically and it requires good judgment along with proper equipment to make ventilation proper and effective. The temperature of the dairy barn should be 60° to 65°, therefore when the weather is very cold it takes but little air circulation to maintain good ventilation and still retain the proper heat. There are people who have made a study of ventilation for years but still come far from the demands of the perfectly ventilated dairy barn. All barns should be equipped with some kind of ventilation. The placing of canvas over the top of windows and a heavy strip of canvas on the bottom of the same window, will help to ventilate as the foul air will pass off through the canvas at the top and the fresh air will pass through the bottom. The canvas will break the wind which causes the draught. When too much air is let in and taken out of the dairy barn in cold weather it causes the heat from the cow to congeal and the walls become damp and drops of water form on the sides and ceiling. When installing galvanized pipes in barns for intakes and outlets, great care should be taken so these can be closed off or partly closed when conditions require it, and also installed where they will not come in contact with cold, as the damp air passing through will freeze and cause trouble.

It is useless to try and ventilate a poorly built, cold barn. It is impossible to ventilate to any satisfaction without a certain degree of heat. There are companies who make a specialty of ventilation. They publish books that are useful and instructive to anyone who may desire this information. The King system is recognized as being the best and most efficient.

Proper Treatment for Cow Consumption or Tuberculosis.

The seriousness of this plague can be best understood when it is explained that it causes the loss of $15,000,000 yearly to dairymen and that today ten per cent of dairy stock is infected. It might be well to here state that the chief source of the spread of the disease is the buying and selling of cattle already infected.

However, it is not our purpose here to dilate upon the spread of this disease, but rather to suggest means that have been found effective in protecting the cattle not already infected.

Dr. A. S. Alexander, professor of veterinary science, University of Wisconsin, advises all dairymen to use only healthy sires and dams in stock breeding. He advises each dairyman to allow each cow or bull not less than 600 to 800 feet of air space and not less than four square feet of window glass lighting space in the stable. This stable must be perfectly ventilated. The stable must be cleaned daily and manure hauled away each day. By this you prevent germs, obnoxious gases and flies. The drinking water provided must be pure and uncontaminated. Care in food and regularity in feeding must be exercised. Milking must be done in regular hours and must be absolutely sanitary.

The first step in prevention is to quarantine all newly bought animals until they are proven to be absolutely sound and free from any symptoms of tuberculosis. The tuberculin test will ascertain this fact. We advise you to write to your state agricultural college and get its advice on this subject.

In addition to testing the newly bought cattle it is wise to test the entire herd once or twice each year, and if any animal is found infected that animal should be isolated. One wise precaution is never to use the neighbor's cows. Experts advise the free use of disinfectants. Use them often in the gutters and on the stall floors. It is also wise to whitewash the stable at least twice a year.

In the case of feeding calves or hogs, it is best to sterilize all milk before feeding, unless you absolutely know that it comes from cattle that are free from this disease. Milk can be easily sterilized by simply heating it to 190 degrees Fahrenheit. It is never safe to feed skimmed milk from a creamery. Feed your own skimmed milk before it ever leaves the farm.

Here are some of the symptoms by which you can detect tuberculosis:

Tuberculosis germs affect the lymph glands and cause the appearance of small or large tubercles, which contain pus, gray substance or cheesy or gritty material.

One of the first symptoms is a cough. Noisy breathing and cough quite frequently denote tuberculosis that is affecting and enlarging the glands of the throat. Tuberculosis may affect the bones, joints, muscles or skin. One of the effects of tuberculosis is pressure

upon the gullet, which will give rise to chronic bloating.

The most common seat of this disease is the udder. Animals affected with tuberculosis gradually pine away, that is, if they are suffering from what is known as acute or open tuberculosis. They may live indefinitely if afflicted with sub-acute or closed tuberculosis.

If you have any doubts about your own cattle, it will be best to write to your state agricultural college. They will be able to help you to relieve the cause and to cure and prevent the spread of this disease. They will also be able to post you on the proper methods of stable ventilation. In this connection we might suggest that you write to the University of Wisconsin Agricultural Experiment Station and ask for Bulletin No. 23 on "Bovine Tuberculosis."

CHAPTER XVI.

A Plan that will Add $13 to $24 to Your Profits from Each Cow Each Year

THE milk that your cows yield should put two different and distinct profits into your pocket. One is the profit that you will obtain from the butter made in your Minnetonna Home Creamery. The other is derived from feeding the skim milk to the calves, and the buttermilk to the pigs.

You lose money if you let your calves have the whole milk. For by doing so you cheat yourself out of the butterfat. That butterfat does nothing other than make the calves warmer and fatter. It does not make them grow.

You can use cornmeal, oil meal or flaxseed meal and either one of the three will furnish the calves with heat and fat just as well as the butterfat, and either will cost you but little more than one cent per pound.

Why should you feed the calves whole milk containing thirty-cent butterfat when your neighbors are raising just as good calves on skim milk and one-cent meal?

Skim milk possesses all the food elements necessary to make bone, blood, muscle, nerves, hair, skin, teeth, hoofs and horns. All that skim milk lacks is fat, and a calf raised on skim milk plus meal gets the necessary heat and fat-making elements from the meal.

This is not theory.

The experiment station of one of our largest state agricultural universities found, after exhaustive experiments, that calves that were fed on skim milk plus meal, actually showed an increase in weight on the nominal cost of two and one-half cents per pound. At the same time experiments were made upon calves fed upon whole milk and it was discovered that the cost per pound of gain was seven cents!

The average calf weighs eighty pounds at birth. As a rule it is vealed at an age of six weeks. The average weight at that time is 175 pounds. This shows a gain of ninety-five pounds.

If calves are fed on skim milk plus meal that ninety-five pounds gain is made at a cost of only two and one-quarter cents per pound or a total of less than $2.14 per calf.

Raise the calf on whole milk and this ninety-five pounds gain will cost you at least seven cents per pound; that is a total of $6.65 per calf.

Why not pocket this difference of $4.51?

By the foregoing we do not want you to get the impression that we do not advocate the policy of the calf receiving whole or part whole milk for the first few days.

This does not reduce the profit the dairyman receives from that cow, because the milk for the first two or three or four days from a fresh cow is not suitable for human use, anyway, and must be fed to calves or hogs in any event. At this period the calves thrive nicely on as little as **ninety** pounds of whole milk.

Feed the calves the skimmed milk while it is still warm from the cow. In this way the best results will

be realized. This is one reason why skimmed milk brought back from the creamery is not satisfactory. It is then cold and naturally sour. It is also apt to be mixed with rinse water and also contaminated with germs of various diseases from the milk of other herds. Here we have **another** argument why you should make your butter at home.

It might be well in this connection to quote from an authority on this subject of giving milk to calves. Our authority in this instance is the Wisconsin Agricultural Experiment Station, located at Madison. In its Bulletin No. 192, which you may obtain free by writing to the Experiment Station, it is claimed: "When a calf is weaned from its mother, let it go eighteen to twenty-four hours without milk in order to have it hungry for its first meal from the pail. The feeder should realize that instinct compels the calf to look up for its feed and he must change this by teaching the calf to look down. Some calves are taught to drink from the pails at the first trial with little or no sucking of the finger. Others will require much more persistent effort, and considerable patience and common sense are required. The calf will respond to kindness, although stubborn at first, and the feeder who will put himself in sympathy with calf nature will find that the stubbornness of the calf may soon be overcome. In regard to the amount of milk fed, the normal calf should be given about four pounds—two quarts—of whole milk three times each day, sweet and at blood temperature."

The following record has been successfully used as a guide:

"For the first 100 pounds of live weight ten pounds of skimmed milk each day.

"For the second 100 pounds of live weight, five pounds of skimmed milk per day.

"For the third 100 pounds of live weight two and one-half pounds of skimmed milk per day.

"You should use your own discretion as to how long to feed whole milk, but do not continue it longer than necessary. Change the calf to skimmed milk very gradually. A wise plan is to first substitute one pint of skimmed milk for one pint of whole milk and gradually decrease the whole milk and increase the skimmed milk until the calf is getting all skimmed milk. Be sure that the skimmed milk is always sweet and always clean and always at body heat."

We again quote from Bulletin No. 192:

"A calf weighing eighty pounds would be fed according to this plan eight and one-half pounds—one gallon—of skimmed milk per day; a calf weighing 300 pounds will be getting a little over seventeen pounds—two gallons—per day. If skimmed milk is available it can be fed profitably to the dairy calf six to eight months or even a year."

When you change the calves to skimmed milk they must be given some substitute for butterfat. Ground flaxseed made into a jelly and fed with the milk is soothing and makes an excellent substitute for the butterfat until the calf is three or four weeks old. At that time it should be able to eat ordinary farm grains. Corn and oats then given in sufficient quantities will prove an excellent substitute for butterfat. Again we have found that calves will quite frequently learn to eat the grain more readily if a little bran is intro-

duced into the ration. You can easily teach the calf to eat grain by rubbing a little of it on his nose when it is through drinking milk. It will quickly learn to eat from the feed box if this method is employed. When the calf is fed skimmed milk there is little danger of its eating too much grain. In this connection it must be remembered young calves show greater gain where grain is consumed than the older calves. This is an additional reason for giving them all they can eat. It is a mistake to limit the grain ration, because this means a loss in gain and a loss in profit. The calf from four to six weeks old is possessed of a good set of grinder teeth and is able to obtain excellent results with a grain ration at that time.

We know a number of breeders who have obtained splendid results by feeding calves on whole oats. When fed shelled corn or corn cobs, calves seem to do better and are less subject to scours.

It is best to grind grain that is small and hard. A mixture of two or three grains rather than just one grain is best whenever it is possible. Do not mix the grain with the milk. This is because the calf should properly masticate the food. The calf should chew it well and not gulp it down, for the starchy matter of the feed is acted upon by the saliva. Many who have taken this precaution tell us that it prevents scours.

When calves are two or three weeks of age they will eat roughage. At that time they will consume about the same quantity of roughage that they will of grain.

A warning to be given here is that against sud-

den changes in feeding. Such changes are sometimes dangerous.

Give the calves all the good, clean water they can consume, but do not mix it with the milk when feeding the calves.

Be sure to feed calves the same time each day with the same quantity and the same quality of milk. This helps to maintain a healthy condition. Be warned against overfeeding on milk, also the feeding of milk that is either cold or sour or the feeding of milk sweet one meal and then sour the next. Feeding of this sort is frequently the cause of scours.

Calves should be provided with a dry pen. The pen should be warm and well ventilated in winter and also cool in summer. The calf is very sensitive to its environment and the dairyman who pays attention to the calves' environment will find it an extremely profitable precaution.

At the first sign of scours, cut down the supply of milk. You should also dose the calf with a couple of teaspoonfuls of castor oil in scalded milk. If the scours persist it might be well to try the use of sterilized dried blood or blood meal. Mild cases of scours are usually cured in one or two days by simply reducing the regular feed of milk and giving each calf a teaspoonful of dried blood at each meal. If the scours prove chronic you should give each calf a tablespoonful of dried blood at each meal. Always mix the dried blood or meal with the milk at the time of feeding.

How to Estimate Weight of Cattle.

To estimate the weight of live cattle or carcasses undressed. First measure in inches the girth behind

the shoulders. Next the length from the front part or front of the shoulder blade along the back to the bone at the tail in a vertical line with the buttocks. Multiply the girth in inches by the length in inches and divide this product by 144. This will give the number of superficial feet.

If the girth of the animal is from 3 to 5 feet multiply the number of superficial feet by 16; the result will be the animal's weight. If the girth is from 5 to 7 feet, multiply by 23; if from 7 to 9 feet, multiply by 31. If less than 3 feet, as in case of calves, multiply by 11. Of course individual animals will vary slightly but this will give approximate results. Or for a short method, multiply the square of the animal's girth by 17.5 which will give the weight of the animal within a few pounds.