GUIDE TO DAIRYING IN SOUTH AFRICA

BY
R. BROUGHAM COOK.

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WITH ILLUSTRATIONS

T. MASKEW MILLER

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FOREWORD

A WISE man once said, "Of the making of many books there is no end;" but no excuse is offered for bringing out this work, for there is apparently much need of an up-to-date South African Dairy book. The aim of this work is to place before the small dairy farmers in general information which is quite modern and thoroughly practical, in as lucid and comprehensive a manner as the limits of a work of this nature will allow.

It is intended to show how and where, why and when, the farmer may benefit by paying attention to the points set out in this book. No theories are expounded, but facts are dealt with, and all the subject-matter is the outcome of the results produced by practical men, and proved and applied by persons of experience in South Africa.

Dairying is not an easy thing, as the writer well knows from personal work on the farm, in the dairy school, and in the creamery; yet each in his appointed occupation in the dairy industry, whether he be the breeder, the farmer, or the creamery operator, must work with energy and persistence if the best results are to be obtained.

The greater part of this book is based on actual work on the farm and in the factory, but the chapter on "Ailments of Dairy Cows at Calving

Time" is also based on lectures delivered to the students at Elsenburg (the Government College of Agriculture) by a capable veterinary surgeon. The book throughout is pre-eminently South African work, and deals with those points raised in the growing South African industry.

There is also included a chapter by the well-known dairy expert, Mr. E. O. Challis, dealing with the vexed question from the farmers' point of view as to why cream tests vary; and the writer is much indebted to Mr. Challis for the use of his excellent pamphlet. The writer's thanks are also due to those gentlemen who have so kindly supplied him with photos.

The prices and figures mentioned in Chapter III. (and in fact any figures) will be criticised as too high or too low, but they are the average of the estimated values supplied the writer by many hundreds of dairy farmers distributed over the Union. In any case it is not to be expected that hard and fast figures can be laid down on cost of production, as this will vary with the local conditions, the class of farming adopted, the individuality of the cow, and also, to a great extent, on "the man behind the gun."

To make this work as popular as its size would permit, and as useful as possible to those engaged in the dairying industry of South Africa, has been the sole aim of the writer.

R. BROUGHAM COOK.

S. AFRICA, 1922.

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GUIDE TO DAIRYING IN SOUTH AFRICA

CHAPTER I

DEVELOPMENT OF DAIRYING IN SOUTH AFRICA

"And joy to him, who o'er his task
Remembers toil is Nature's plan;
Who, working, thinks—and never sinks
His independence as a man."

MACKAY.

THE remarkable increase in the agricultural production of South Africa since the Boer War is not at once apparent to the man who is not engaged in agricultural work; yet a brief survey of the many lucrative business propositions in the implement and fertiliser lines forces one to the conclusion that production must be increasing at a great rate.

The four provinces of the Union were at one time described as "a land of samples" because the bulk was never forthcoming; but this slur is rapidly being removed agriculturally and industrially to the material benefit of the country. The fruit export trade of the Cape is also rapidly expanding, and the quality of the produce placed on the London markets

exceeds anything exported by other countries, whilst the quantity is increasing year by year. The methods being employed are such that the Cape is now in the proud position of having them copied by other countries of repute which have been held up to us for example. Such is the considered view of men who handle the goods on the other side, and they are in the position of knowing the truth. Our wools are coming forward in greater quantities, while the quality of the bulk is ten times better than it was ten years ago. Then again, the quantity of maize produced is rapidly assuming large proportions, while the quality exported rivals the best La Plata maize, and compares more than favourably with that produced in the United States. The Natal resident is acquainted with the lucrative sugar industry which has been built up, while the quantity produced will in a few years more than meet the requirements of the Union.

These are but a few instances, and not the least among the agricultural industries is the remarkable and rapid rise of the butter industry. This has, in a large measure, been due to private enterprise and to the awakening of those farmers who realise that their salvation lies in their own hands. The fact that there are, approximately, seventy-three creameries in the Union to-day, compared with scarcely ten existing fifteen years ago, may come as a surprise to many ; while the quantity of butter

produced—viz. about fifteen million pounds during the months when dairying is possible—makes one expect to see the Union exporting butter in quantity within the next five years. The quality, too, is such that our best brands are much superior to anything yet imported into this country, and we shall yet see it on the London markets second only in quality and price to the best Danish article.

On reading the "Black List" of imports into South Africa it may be a matter of surprise to notice how much butter is brought into the country from outside sources, but that surprise is quite uncalled for when we realise that these imports of Australian butter, chiefly through the port of Cape Town, are brought here mostly for speculative purposes. Speaking with reference to pre-war prices, butter could be landed in Cape Town at 1*s.* 2½*d.* per lb. approximately, while the same butter sells at anything from 1*s.* 7*d.* to 1*s.* 10*d.*, so that the consumer receives not only an inferior article, but is gulled into satisfaction by the magic of the word "Imported," which is only a false value. "Protection" is needed for the dairy industry, and import duties placed on all imported butter and tinned milk would materially encourage the farmer to produce; for if so much profit could not be made on imported articles the merchant would exploit more of colonial produce, to the benefit of the farmer. True, it is said that the public gets what it demands, but this

demand is largely controlled by the merchant, who forces the demand by magnifying the value of those things on which he can make the most profit. The development of our country is therefore retarded largely by the fact that there are so many dealers who are willing to *sell* anything and everything to the farmer, but who are so loth to *buy* outright for cash his goods. The farmer can get anything sold off his farm on paying a "commission," but for a direct market he is rather handicapped.

CHAPTER II

CO-OPERATION AND THE DAIRY FARMER

In the dairy world the Creamery Company has to a large extent stepped into the breach, and the farmer has a direct market for as much butter fat as he can produce. One cannot urge the farmer to produce when there is no market immediately available for his results. The world's markets are indeed open to all; but this is only true in a sense, since the individual farmer cannot hope to place his dairy produce in them without the aid of a co-operative dairy company. More butter factories are therefore required, so that having the market almost at his door the farmer may be induced to produce more.

There are many who contend that the dairy industry is in a bad way, and who argue they are being robbed if they only receive 1*s.* per lb. for butter fat whereas in the bygone days, before the advent of the creamery, all they could get was from 6*d.* to 1*s.* per lb. for butter on the local markets—true, some exceeded this figure, but they were in the minority. This type of farmer does not consider that Australian butter, in pre-war days, sold at

1*s.* 1½*d.* per lb. on the London markets, and that from this sale-price had to be deducted the cost of freight from Melbourne to London plus the cost of turning the raw material into a finished product. Yet farmers in Australia contend that dairying pays, as witnessed by the huge export trade in butter.

In South Africa the dairy industry must still grow in importance and become one of the leading agricultural industries in the country. Milk and its products have followed the European wherever he has penetrated, and as fat and oils are a necessary item of food for man it seems hardly possible to produce too much. As long ago as 1902 the United States of America—to take one country as an instance—produced approximately 480,000,000 lbs. of butter for that year, irrespective of the vast amount of cheese and other milk products turned out. The author's authority for this statement is Chas. Y. Knight, of Chicago, secretary of the National Dairy Union, and editor and manager of the *Chicago Dairy Produce*, a weekly paper devoted to the interests of butter and butter-making. That was as long ago as 1902; what must be their production to-day? Yet it is all consumed in the States, and only a small export trade exists in butter. Denmark, one of the leading dairy countries of the world, was once on the verge of bankruptcy, but the dairy industry has changed this to prosperity and placed the economic development of the

country on a sound basis. Australia, Canada, and New Zealand have had wonderful results because farmers made a study of the dairy industry. Land has been taken up, homesteads built, emigrants attracted, and families set on the road to health and prosperity.

In South Africa we are fast coming into line, and it must be so, for we have the climate, the land, and cheap labour. In this connection we may quote the Hon. Mr. Burton in his Budget speech of March 30th, 1917, in the Union Parliament. "There was," he said, "satisfactory evidence to show that we were progressing in the direction of supporting ourselves. In 1913 we imported 2,890,000 lbs. of butter, while in 1916 we only imported 267,000 lbs." There are now, as we said, nearly seventy-three butter factories at work through the seven or eight months of the year when dairying is possible.

The amount of butter produced in the Union for the year 1915–16 was between 6000 and 7000 tons as far as can be gathered from available sources, but unfortunately there are no reliable figures on this point.

The rise of the dairy industry cannot be attributed so much to Government assistance as to private enterprise—after all, the best means by which such an industry may be fostered, and in this connection the names of the Hon. Joseph Baynes,

of Richmond and Thos. Russell, Esq., of Mooi River, Natal, will long be remembered as pioneers. The former started what was practically the first butter factory in Natal. This was closely followed by other factories in that province, organised by a number of far-seeing farmers who co-operated, and began to study their own and others' interests in the dairy line. Small concerns by degrees were also started in each of the other colonies now comprising the Union. Besides all this, better class of stock was introduced by leading farmers, while experts were engaged by the Government to instruct the farmers in modern methods. Unfortunately, while they have done excellent work, the benefit derived from their energies has been somewhat restricted owing to the fewness of such officers contrasted with the large areas over which they have had to work.

The various agricultural societies have also to be taken into account, for while the creamery companies have been improving the products of milk, these societies by instituting prizes for dairy cattle at the various shows have been the means of raising the class of dairy stock in the Union through keen competition, which is the life-blood of any industry.

At the outbreak of the Great War in 1914, the import of Australian butters into South Africa almost ceased because of an Australian law pro-

hibiting the export of butter. And while in 1914 the Union production was only 10,682,000 lbs., in 1915 it had risen to about 13,470,000 lbs., an increase of 2,750,000 over that of 1914, while in 1916 we began a small export trade for the first time. This increase and export were not all owing to the war, but were largely due to the fostering care of those who have given their time and energy for developing the butter industry. When the war broke out they began to reap the results of their untiring and ceaseless energy. During the 1916–17 season the export of butter had risen to 1800 odd tons, but for the next two years there was a serious decline. The 1919–20 season saw a great scarcity of butter in South Africa, owing to the after effects of the influenza epidemic and by reason of a drought and caterpillar plague during the grazing season. No butter was available for local trade in the usual manner, consequently there was none for export. Prices touched a fabulous value which the consumer could not afford to pay.

With that remarkable power of recovery which our country possesses things soon became normal, and for season 1920–21 there were about 600 tons available for export. The season 1921–22 has commenced under good conditions, and given a continuation of normal conditions there will be about 75 % of the whole Union production available for export.

Having now reached the competitive stage against other countries in the European markets (as well as in his own), the farmer is urged to study co-operative effort and its advantages with regard to collective wholesale buying and selling, to become his own middleman, in fact.

In view of outside competition prices must drop to a level with that of other countries. It is, therefore, up to us to co-operate in order to keep down the cost of production and to earnestly strive after increasing the output per cow to make up for lowered prices which we have to take or leave in the world's markets.

CHAPTER III

COMPARATIVE FINANCIAL RETURNS FROM DAIRYING

DAIRYING may be described as a safe industry and a safe investment, for the increase of population with its insistent demand keeps well ahead of production.

There is no other branch of farming which brings such a regular return as Dairying. The quick monthly settlements for milk or cream provide payment of wages, living expenses, and other outgoings on a farm, whereas many months have to elapse before this can be done in other branches. This alone should create confidence in dairy farming as a safe industry.

An income may be derived in three ways:—

(I) By sale of milk retail.

(II) By sale of milk wholesale.

(III) By sale of cream and milk fed porkers.

Other sources of income are Buttermaking and Cheesemaking, but as these two lend themselves to Factory Dairying and have to-day grown to such an extent that they are almost industries by themselves employing a great deal of capital, it would

be unwise for the beginner to compete at a disadvantage. This makes it unnecessary to notice here the nature of the returns from butter and cheesemaking.

Sale of Milk Retail.

There is no way of disposing of milk so profitable as by selling it whole or intact, always providing the farm is convenient to a town or village where a "milk round" can be worked up.

Under this system the cost of production is usually higher than any other, because the land, being near a town or village, has a higher upset value, is generally of small area, has very little grazing, and has to be worked on an intensive system. It is only right, therefore, that the income derived from this form of marketing should be the greatest possible.

The milk is usually sold by the "bottle," of which six make up a gallon. In summer the price readily obtainable is 3*d.* per bottle, while anything from 4*d.* to 6*d.* is obtainable in winter. In South Africa the value of the cow (breeding not considered) is reckoned at the rate of £1 for every bottle of milk yielded in twenty-four hours when at the height of her lactation period. This is to say, that a cow yielding 18 bottles (3 gallons) would be worth £18. But most sellers would want from £25 to £30 for such an animal.

A cow of this description, yielding the conser-

vative quantity of 600 gallons in one year, would therefore bring in a financial return almost from 1½ to 2½ times her value in cash.

From this, of course, has to be deducted the cost of production, depreciation in value of cow, interest on capital, cost of delivery, bad debts, upkeep of bottles, etc., but in any case the reader is assured of a substantial profit.

Sale of Milk Wholesale.

This may be subdivided into three heads :—

(1) *By Contract.*—It is sometimes possible for a producer to get a yearly contract to supply some such institution as an hospital or an hotel with a good deal of milk at a fixed price per gallon all the year round. Or he may have two or three such contracts. The price usually obtainable in this case is 1*s.* to 1*s.* 6*d.* per gallon. This will be found to yield a most satisfactory profit. It has much to recommend it, as there are usually no bad debts, while the cost of delivery is usually considerably lower and there is no upkeep of bottles to consider.

(2) *By Disposal to a Pasteurizing Centre,* which buys the milk outright, making a profit or loss on the retailing. In this case the supplier is assured of a regular and certain monthly settlement with no fear of bad debts. The price usually obtainable is from 9*d.* to 1*s.* per gallon, depending on the time of year and the amount of supplies available.

This method of disposal is suited only to those

farms which are close at hand or where the railway is convenient to such a centre, as the milk must be delivered in a fresh condition. From this we see that a cow is capable of paying for herself in one season. The cost of production has to be considered, of course, but this is usually not so high as in the other cases ; further, the cost of delivery is reduced to a mere bagatelle, as it is the custom for consignee to pay railage.

(3) *By Disposal to a Cheese Factory.*—The price usually obtainable is 6*d.* per gallon. This at first glance appears to be low, but with the majority the cost of producing is also very low, as most of it is produced on grass veld having a nominal rental value of 2*s.* 6*d.* per head of stock the land can carry. There is also the cost of haulage to the factory to be considered, but this need not be excessive. This method of disposal also yields a very substantial dividend on capital investment, in many cases up to 50 %.

Sale of Cream.

This form of marketing is the most common in South Africa, where great distances between farms and towns and the great number of farms outlying from the railway render the sale of whole milk practically an impossibility. Cream being less perishable than milk allows of it being kept longer. It may be delivered to the factory two or three times per week. It is paid for on its fat content.

A fair estimate of the yield of butter fat derived from a cow of the aforementioned description would be in the neighbourhood of 180 lbs., which would fetch an average price of 10*d.* per lb. There would also be 550 gallons of skim (separator) milk which, converted into pork products, is worth 1*d.* per gallon. From this we gather that the income from a cow of the above class would be in the neighbourhood of £9 15*s.* From this has to be deducted the cost of production, which, being manufactured on grass and maize ensilage (referred to elsewhere), is only a nominal cost.

In cream selling, as in no other branch of milk selling, the quality of the milk is an enormous factor in determining the nett profit. In the above example the milk has been estimated as yielding 3 % of milk fat. It will be seen, therefore, that if the milk yielded 4 % the returns would be relatively greater, while 5 % milk would give still greater returns without in any way increasing the cost of production; in many cases the extra 1 % of milk fat would pay for the cost of production.

Cost of Production.

The chief factor in cost of production of milk is cost of food. This must be considered from the point of view of cost per gallon and not cost per cow. The profitable character of milk production is not dependent entirely on the milk yield per cow, but on the cost at which the yield is obtained.

From personal investigations by the writer, embracing a number of farms in different parts of the Union, the cost of producing a gallon of milk was found to range between ½*d.* and 6*d.* per gallon. A good many of these producers did not give their cows any extra food over grass on the contention that it did not pay; others again believed in high feeding as being a paying proposition both as regards quantity and quality, but this is not altogether borne out by facts in either case. Where milk records are being worked for, high feeding may pay; but in such case the feeding has a double object, and the conditions are not those of the ordinary milk producer. The ordinary dairy cow is not capable of being worked like a penny in the slot machine on the principle that the more pennyworths of food you put in the more gallons of milk you take out.

The law of diminishing returns holds good in production of milk as in all other forms of production, and a high yield may be obtained at a cost which leaves no balance on the credit side, whilst it might be possible to obtain a lower yield at a lower expenditure and at a profit.

The great aim in cost of production as regards feeding must be to find out what we may call the "economical maximum" per cow, and to keep her at that.

CHAPTER IV

HOW TO BUILD A HERD OF DAIRY COWS

THE Dairy Industry is based on the cow, and she is the first step towards true dairy progress. For, although in recent years we have had wonderful progress in the dairy world, through improved facilities and methods in our creameries, the cow is the source upon which the raw material depends. It is therefore necessary to see that our cows are good, for on reckoning his profit and loss the farmer has to deal with them first and always. This is of far greater importance in these days of keen competition than ever before, because farms are increasing in value and are being so subdivided that a great number of cows cannot be maintained on one farm. Rents are also rising, and good veld is scarce. The farmer is beginning to realise that, through the advent of the creamery and the huge demand for dairy produce, his cows are becoming machines for converting cheap foods raised on the farm, and perhaps other foods, into ready cash. The greater is the necessity, therefore, to see that his cows are of good breed.

There are some two million cows in South

Africa, and if each of these cows were milked and gave the small yield of 100 lbs. butter fat per year, think of the money which would be put into circulation! We have, then, a gold-mine in the Union far more lasting than the Rand. These two million cows are grazing on pasture which should be converted into produce for the country, but in the present state of affairs the result is not commensurate. The root of the trouble does not lie with the farmer so much as with the cows themselves. They are usually of the wrong kind and need to be carefully selected.

The dairy farmer must begin with those on his own farm. It is impossible to judge a cow from one milking whether she will return a profit or a loss on the year's working, and to try and do so is folly. For unless the whole milking period is taken into account the farmer may decide to sell her and so be getting rid of a good animal before he knows what she is really capable of yielding. There are many good cows which are sold off each year by farmers who think that they are worthless. This seems a questionable statement to make, but it is true nevertheless; for so many farmers have no idea of the actual value of their cows. The remedy for this is to keep an exact record of the milk given daily by each cow, and also to test the milk from each cow for butter fat by means of the Babcock Tester described elsewhere. Unless the

daily yield from each cow is carefully noted it is impossible to make a profitable selection of a good cow. If he keeps a milk and butter-fat record the farmer finds out which are profitable and which are not. In many instances half the herd has been found (when the milk yield has been recorded for one year and the Babcock butter-fat test taken) to be unprofitable. This means a direct loss in feed, money, time, and energy.

The average output of milk and butter fat per cow in South Africa is amazingly poor and not what it might be. This is because so many scrub cows are kept. These scrub cows are impossible to detect unless a system of weighing the milk, keeping a record for a year, and using the Babcock Tester be carried out. It is not altogether possible to estimate the real value of a cow by merely looking at the udder. Even the very best of experts are often deceived, for it is well known that the milk produced by some of our best-looking cows is very poor in butter fat.

Daily milk records also help to discover any variation in the yield, and cause the owner to look to the animal as the source of the shrinkage. Either the animal may be sick or the "boys" not milking properly. Milk records will make one observant of those details which make all the difference between profit and loss. From a money-making point of view it is well worth while, then, to keep records.

One raises better dairy stock, and one can also get better prices for the progeny of cows with a record of merit. Also the cows themselves are worth more if records are kept of what each has done in a year. Keeping records, then, and the use of the Babcock Tester are the first essentials towards progress in building up a profitable dairy herd.

MILK AND CREAM SCALE.

This circular spring balance weighs sixty lbs. by two ounces and is very useful for weighing milk at the barn.

Do you weigh and test your milk? If not, commence now! With a milk sheet properly ruled, and with the names or numbers of the cows, together with the days of the month placed on it and a spring milk balance for weighing —all placed in a convenient position where the milking is done— the farmer can record the amount in pounds which each cow gives at every milking with the spending of only a few seconds at each time. The milk should be weighed twice daily, mornings and evenings, and it will be found that there is always less milk in the evening. The butter-fat test by Babcock method described on another page should be taken once per week, or at least once per month, both morning's and

evening's milk being used in equal quantities to get at the average test; for the evening's milk is generally slightly richer in fat than that of the morning. At the end of each month these record sheets may be pinned together and kept for future reference, but it is far better to enter them into a book kept specially for the purpose, so that if one wishes to refer to any particular cow to see if it is profitable or not one has only to refer to the month he requires to find the yield in butter fat of that cow. Then, when the farmer knows the cost of the feed his cows consume and the amount of the cheque he receives from the creamery for butter fat, he can easily decide which cows are showing a loss, and *weed them out.*

In weeding out the unprofitable cows the farmer is faced with a difficult problem, for in nearly every case half of his original animals will be found only useful for beef or trek purposes. What, then, is he to do to get better ones? He cannot have the yearly record of any before he decides to buy, because those who have cows to sell have not kept a record of each animal for a year, or should they have done so, they are too business-like to offer their best ones. It is no good to ask the seller, "Is she a good cow?" for he will naturally assure you that they are all good. It is little use to see the cow milked, or take a sample away and test it —one cannot learn from one milking what that cow

is going to turn out for a year. The only thing for the keen farmer to do is to trust to his own judgment, being guided entirely by the form or shape of the cow and many other details such as these.

The following illustration shows how a milk record sheet should be ruled and kept—showing morning's and evening's milk :—

MILK RECORD SHEET.

June.	1st.		2nd.		3rd.		4th.	
	M.	E.	M.	E.	M.	E.		
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
Gertie	20	15	20	15	20	14		
Gladys	17	12	17	12	17	12		
Gwen	—	—	—	—	—	—		
Total	37	27	37	27	37	26		

	29th.	30th.		31st.		Total in lbs.	Fat %.	Total fat in lbs.
		M.	E.	M.	E.			
		lbs.	lbs.	lbs.	lbs.			
		19	12	19	12	1050	4	42
		14	9	14	9	870	5	34·8
		—	—	—	—	—	—	—
		33	21	33	21	1920		76·8

RECORD PAD

Week ending, _____ 19 ___

Name or No. of Cow	Sunday		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Total	Average per Day
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.		

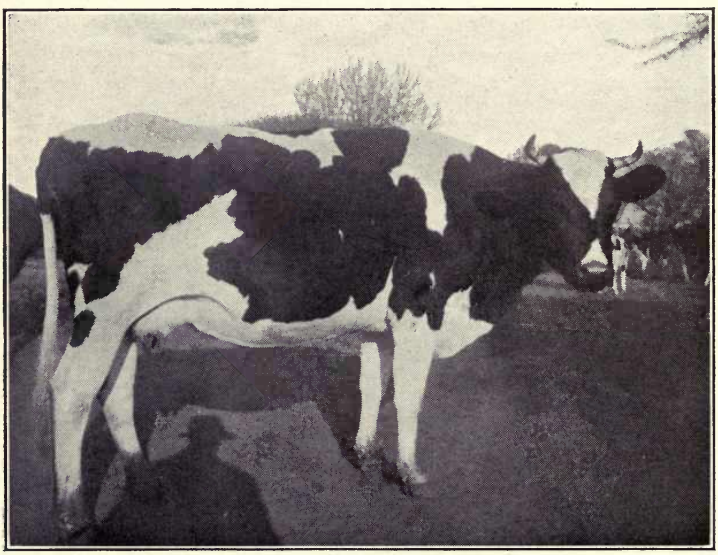


FIG. 1.—GRADE COW, OR CREAMERY PATRON'S COW.
A good type for foundation of a dairy herd.

There is decidedly a "type" which belongs exclusively to a dairy cow—a type indicating ability at the pail, which a cautious and observant farmer or student is able to recognise at once. In nearly each breed there are cows which have the true dairy type, and there are good performers in nearly all breeds. *But* they are found more regularly, so that it becomes a rule rather than an exception, among the recognised dairy breeds—the Friesland, the Jersey, and the Ayrshire. There are sometimes to be found good performers also amongst the beef breeds, but they are the exception, and while good themselves they are not likely to transmit dairy qualities to their progeny. It is therefore best to seek, when buying, cows amongst the dairy breeds mentioned or amongst "Grade" breeds, viz. those which have a mixture of dairy stock blood in them, and which have been raised from common stock and used through many generations for dairy purposes. The "Cape" cow is one of the most notable examples of a "grade" dairy breed in the world.

The cautious farmer, therefore, when he buys a cow from a man who does not keep a daily entry of the milk-yield from each, will carefully look at the animal and decide from her shape and outward points whether she is, in his own opinion, of the right type to be a good producer. It must not be thought that there is a different type for each of the

different dairy breeds. Not all the biggest yielders of all breeds, or even in the same breed, are shaped exactly alike, but all good cows of all dairy breeds have certain well-defined points, similar to each other, which stamp them as distinct dairy animals.

Now, it must not be thought that a man can, though he be the best judge of dairy stock, select a good animal every time, because unerring certainty can only be obtained from a yearly record and fat test of which few signs are given outwardly; but the very best guide which is at every one's disposal is to decide by the dairy form.

There are three types given: the Dairy type, Beef type, and the "Scrub" cow, leggy and lacking in abdominal capacity which is so necessary for a good milker. The figure marked (I) gives the outline of a profitable cow, and helps to illustrate as far as possible the points to look at when making a choice.

When judging a dairy cow, approach her quietly from the side. This is a necessary precaution, for, being a stranger to the animal, any sudden movement around her will startle her, and it will not stand while you wish to feel its milk veins situated along and underneath the belly.

The first thing to look at is the head. She should have a broad forehead with large, full, mild, and intelligent-looking eyes, showing indications of a strong brain with nervous force. A cow with

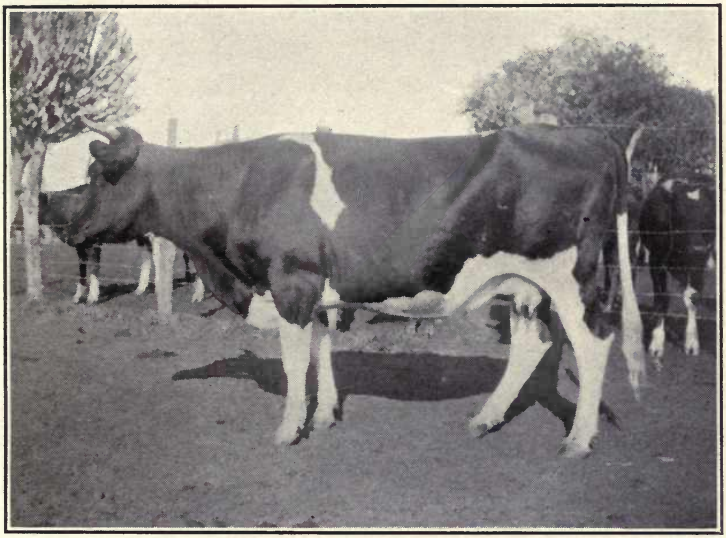


FIG. 2.—A FINE FRIESLAND: "A SOUTH AFRICAN DAIRY QUEEN."
Note the fine head of the dairy type.

I. RIGHT DAIRY TYPE.

FIG. 3.—II. BEEF TYPE OF COW.

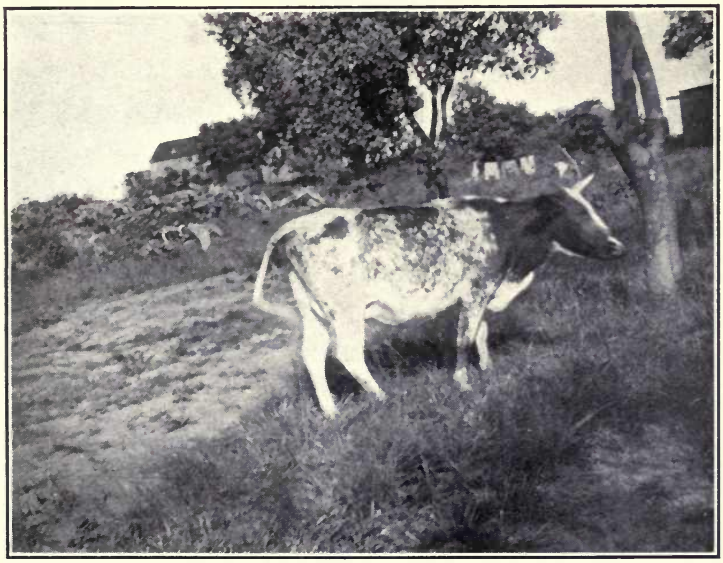


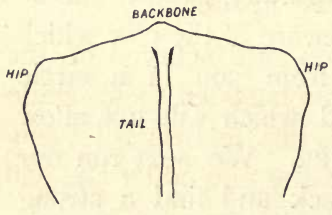
FIG. 4.—III. SCRUB COW.

Light in girth, restless disposition.

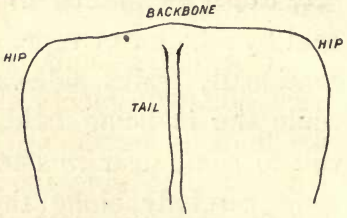
a wild eye is not usually a continuous milker. The jaws should be clean cut, strong, and muscular, the teeth in good order, and she should possess a nice broad mouth which denotes feeding capacity. The nostrils should be wide and full, showing constitution and lung capacity.

Having examined the head we next run our hand along the back and feel the backbone—moving gently but with firmness, as any sudden movement may cause the animal to jump away, even if she be held by a halter or rope. Beware of the cow which continually walks sideways from you in a circle while she is being held, and which will not allow you to come near to FEEL HER. We next run our hand carefully along the back and find a strong rugged backbone, which shows that it encloses a strong and large spinal cord. This is important, because milking capacity is the result of nervous force, and this nerve force starts from the brain and runs along the spinal cord. Between each section of the backbone nerves branch off from the spinal cord, and the larger these nerves are the more open are these sections and the ribs further apart. This gives the dairy cow the appearance of being very loose and relaxed, which may be gathered quickly by glancing at the general appearance of the animal when first approaching her. Next stand back a little from the animal and note the depth of the body, which should be round and deep with ribs

well sprung, showing a deep barrel in which to hold and digest the food which her strong jaws will consume. The chest should be broad, with girth large round the heart and plenty of lung space to make use of the fresh air which her wide nostrils will take up and so manufacture the life-blood from which the milk is derived. She should have a broad, strong loin, with hips wide apart and the backbone rising quite high between them.



Dairy Type.



Beef Type.

This is a strong point and shows where the dairy type differs from the beef type when viewed from behind.

These figures are somewhat exaggerated, but standing beside the animal and holding a stick horizontally at right angles to the backbone it will be found that in the dairy type the hip bones will be a few inches below the level of the backbone, while in a beef type the backbone and hips are on a level—the amount of flesh on the two animals making no difference.

This indicates plenty of room for the organs of maternity; for, as Professor C. L. Beach, of Connecticut Experiment Station, says:—

"Dairying is based on the maternity of the cow. It is the mother function which arouses the milk organs into activity for the feeding of the young. Many generations of selection and breeding by man have prolonged the period of activity of these organs of the dairy cow, but the beginning is always a function of reproduction which must occur with considerable regularity in profitable cows. In order that this may occur with the least tax upon the vigour and activity of the animal, she should have broad hips and a high pelvic arch."

The thighs should be thin and incurved on the back side, with plenty of room between them, while the flank is arched up high just in front of them. All this is to give room to the fine udder she will put on when she freshens.

Having now seen the animal from nearly all points, approach her again carefully from the milking side. Place the right hand gently on her shoulders, smoothing her flanks with the palm of your left hand, and continue until the hand is underneath the belly and in contact with the milk veins; standing well clear of her back legs all the time, so that you may bend over to enable you to *see underneath*, when it should be noted how the milk veins behave where they enter the udder. These should be branching out like the delta of a river and extending all over the udder, forming a network of prominent and knotty-looking veins. A cow with such a network of veins is usually a good milker.

Then run the hand gently along the milk veins which extend from the udder towards the chest. These should be well developed and when the cow is fresh they are large and full, showing that they carry the blood well between the heart and the udder. Well-developed milk veins generally denote a cow which will give a large milk yield when she is properly fed. Finally run the left hand over the udder to make sure if it is sound in every quarter and that it gives milk freely and easily from all four quarters.

In selecting cows by looks, more mistakes are made over the udder than on any other point, for a great number of farmers judge the animal's usefulness entirely by the udder. They think, quite mistakenly, that if the udder is large and good she is a good cow no matter what her shape is. A good udder, of course, usually accompanies a good form, but not always, and when it does not the animal is generally a total failure as a dairy cow. On the other hand, a cow may have a very fine and large udder indeed and yield a good flow for a short time, but if it is not accompanied by the dairy form she has not the means of filling the bag long enough to make her profitable. Look at the style and form of the animal first, and beware of being deceived by a large fleshy udder; for more farmers are deceived by that than anything else, for they invariably judge by the udder and ignore other important points.

"Don'ts" when buying a Cow.

1. Don't be deceived by a fleshy udder.

2. Don't forget to look at her style and form.

3. Don't buy if she has a defective quarter in the udder.

4. Don't buy if she has a habit of leaking milk.

5. Don't buy a cow which sucks others.

6. Don't buy a cow if she sucks herself.

7. Don't buy a cow with a ring in her nose, or if the nose is pierced; that has been done for some fault or other.

8. Don't buy a cow with the hair worn off her neck unless you are sure it is not caused by some contrivance to keep her from jumping fences.

9. Don't forget to look for peculiarities.

10. Don't forget to look for disease.

11. Don't believe all the owner says about her yield.

12. Don't forget he may want to get rid of the animal.

13. Don't forget to see the cow milked dry before you buy, for unless the udder shrinks considerably after milking it is a flesh udder and not a continuous milker.

14. Don't forget a good cow eats less than two bad ones.

15. Don't be afraid of paying a good price when you choose a good cow—she will repay you.

16. Don't forget that when you have bought cows by the standard already given you must test them with milk scales and Babcock test; for, however good a judge you may be, the butter-fat point will delude you.

The Dairy Sire.

Having discussed the chief points of a good dairy cow, the reader may perhaps think that the selection of the cows purely for dairy purposes is the beginning and end of having a profitable herd. But although the selection of good cows is so vastly important, the task of maintaining the herd, either as pure-breds or for practical dairy work only, must after all depend chiefly on the sire. In any given herd, whilst the greater number of heifers raised are from different mothers and therefore inherit different traits, they are all by the same sire, hence each one will inherit his good or bad points. If the male used is not suitable he may spoil all the good points which the good cows would impart to their progeny; so that to maintain the herd in an advancing state of profit it is imperative that the bull should be the best one that can be bought. The selection and study of the sire is a most important matter. When you see a man owning a superior herd of cattle or an even flock of sheep they all tell the same tale—they are all the records of the strength and character of good sires. Without a

good pure-bred male, all efforts to keep a profitable herd will fail. Great breeders of all times and of all classes of stock have made the selection of the sire not only their most important study but also a life-long study.

Many farmers are content to use any bull as long as he has ability to get the cow in calf. This may be suitable where heredity is simply a matter of shape and substance, such as for slaughter stock. But when we deal with more highly organised animals of delicate temperament Nature's laws work with much less certainty, for dairy cattle are usually highly artificial creations, and therefore successful sires—that is, those having the ability to transmit their nervous temperament so necessary to their heifers—are comparatively rare, and he should therefore be pure bred, as being more reliable in stamping his progeny with the characteristics bred in him.

In discussing the qualities of the dairy bull many things must be taken into consideration. It is not enough that he should belong to any known pure breed, or that he have a good form and substance as a bull, but there are other qualities to be considered which may not appear to be in the animal himself but which we must seek for in his pedigree. By pedigree we do not mean mere prize-winning of ancestors at exhibitions and in competition with other animals of their kind. His dam

may hold the championship for best Fries, Ayrshire, or Shorthorn, at one of our principal shows, or his sire may hold a red ticket from some other society and several of his ancestors may be champions on the Continent; *but*, while all this is very desirable, it does not necessarily make him a good sire for dairy heifers. His pedigree must show the performance at the pail of his female ancestors, for this is far more important than mere prize winning.

The first point, therefore, in choosing our pure-bred bull, is that he should be from a good dairy cow, not merely judged by shape, but one who has a good record for the year together with a good fat record, for this is a quality which may be transmitted to the heifers through the bull. It has been shown both from experiments and experience that a good female of any class of stock usually transmits her good qualities to her male offspring, so that while it is not necessarily conclusive evidence of inherited excellence, the bull used should never be without a strong family tree of performing dams.

IF IT IS AT ALL POSSIBLE, WE SHOULD ALSO STUDY THE SISTERS OF THE BULL WE WISH TO USE. This means sisters by the same sire. If they are good dairy workers, it is almost a certainty that the bull himself will also have inherited dairy qualities and be a sire of successful daughters. To illustrate the foregoing we cannot do better than give the case of the following bull, Rioter's Exile of St. Lambert,

No. 48228, American Jersey Cattle Club, belonging to D. S. Williams, Esq., of Nashville, Tennessee. This bull is bred from a cow which produced 24 lbs. 2 ozs. of butter in 7 days from 318 lbs. of milk. This bull has 94 sisters, *i.e.* sisters by the same sire, which hold good positions and are well placed in the ADVANCED Register of Merit, which is a record, of tested sisters, higher than any other bull living. Before this bull "Rioter's Exile" was five years old he had produced 11 tested heifers as follows:—

American Jersey Cattle Herd-book.

No. 152314	testing	23	lbs.	6	ozs.	butter in 7 days.
„ 152126	„	23	„	3	„	„ „
„ 143807	„	23	„	4	„	„ „
„ 151536	„	23	„	1	„	„ „
„ 142248	„	23	„	1	„	„ „
„ 153242	„	22	„	6	„	„ „
„ 152315	„	22	„	3	„	„ „
„ 152391	„	22	„	3	„	„ „
„ 153276	„	22	„	2	„	„ „
„ 145753	„	18	„	2	„	„ „
„ 152392	„	15	„	2	„	„ „

No other bull has ever given such results at such an age, and it is small wonder that Rioter's Exile of St. Lambert should get such excellent progeny when we look at the excellent record of his dam and the positions of merit held by his 94 sisters.

Of course it is not given to each one of us to possess such a bull or perhaps ever to secure one, but we need not be barred from using some such ideal to breed to and greatly improve our herds. It lies with the breeder to set his own standard of production.

For the man of limited means the quickest road

to success is to buy a young bull calf of some pure breed which he may fancy, but it should be bought from a man of repute—one who keeps milk records and who can give you the particulars of the animal's dam and her performance at the pail or churn. If the farmer raises his own bull calf he learns to know his master and is more easily handled than a full-grown animal brought to a strange place. And what is of more importance is that, having limited cash to spend, a farmer will have more chance of securing the desired "blood" at a price suited to his purse while the animal is a calf, and then by exercising care and patience possess an animal far beyond what he could afford had he bought the same animal when it was full grown.

When selecting a bull for your dairy herd, where you cannot have the record of his dam placed before you or where you cannot see the dam herself, be sure that he is pure bred, and if he is fully matured and has been used at stud, try to see the type of heifers he produces.

In closing this discussion about the good dairy sire we cannot do better than quote Professor Curtiss, Director of the Iowa Experimental Station, U.S.A. He says :—

"First, among the characteristics sought in a good sire, I would look to the head. I presume many will take exception to this and place constitution first, but the head reveals constitution almost as

accurately as do depth and width of thorax and fullness of heart girth. I regard the head as the most expressive character of the dairy cow, as well as the chief significance in the dairy bull. The more we study the best types of domestic animals and the more we study the work and the products of the great breeders, the more we are forced to recognise the head as of chief significance in revealing the inherent quality and practical value of animal excellence. The head is, in a sense, a mirror reflecting all that goes to make up the animal. The successful sire must have a bull's head. It must be strong, masculine, full of character and vigour. It must be broad between the eyes, clean cut, and well defined. The eyes must stand out full and prominent.

"The head is sometimes classed among the points of fancy, but it is more than this. It indicates vitality, strength, breed type, and nerve force; all of which are essential to a successful sire. A sire must descend from a strong line of good ancestors, but he must have more than this, he must present unmistakable evidence in his make-up of having inherited from these ancestors in a marked degree the qualities and characteristics that are sought for reproduction. Depth and spring of ribs, indicating feeding capacity, necessarily rank among the characteristics of prime importance in the sire as well as the dam."

CHAPTER V

BREEDS OF DAIRY COWS

THE question generally arises amongst farmers who wish to take up dairying as to which is the best breed for their purpose, but it may be definitely stated that there is no "best" breed, otherwise there would soon be no other breeds but the one called "best," since everybody would invest in that one kind, and no others obviously would be bred. The best dairy cow is that one which will give the greatest profit, and to which of the so-called "dairy breeds" this cow will belong depends entirely upon the district in which the farm is located, the character of the veld, the kind of farming adopted, the care bestowed on the herd, and whether the product is to be sold in the form of milk or cream, butter, or cheese.

The farmer who wishes to make his returns from the sale of milk only may find it more profitable to keep a different breed from one who wishes to make his returns from sale of cream or butter; while if he wishes to produce beef and also a moderate amount of milk or butter fat, he may find

a still different breed best for his purpose. There are enough breeds to suit all purposes, but in the following we give a brief review of the qualities of the *leading breeds of dairy cattle.*

Many pig breeders claim that there is "more in the feed than in the breed," but this is not true of cattle. The best breed for milk or butter is never the best for beef.

The Friesland.

There are several varieties of this type, but they have so many points in common that they are regarded, outside of Holland their native home, as one breed. In America they are known as Holsteins, in England as Dutch cattle, while in South Africa they are known all over as Frieslands. They are a dairy breed, but when not giving milk they can be readily fattened. They are large cattle which have been reared and improved on land of a moist and marshy character where there is abundance of green succulent food. The breed is well established in America and also in South Africa, where probably as milk producers they have a reputation superior to the shorthorn—especially in the southern portion of Cape Province. They have a long and narrow head, with broad mouth and horns always pointing forwards; these are invariably short. The neck is long and frequently shows a depression in the ridge, otherwise known as

U necked. The chest and back are broad, the line of back straight to the tail; the body is long, the limbs flat and long. The hind legs of the cow are often inclined to be knockneed; the bones should be fine, skin delicate and flexible.

The cows are large, weighing from 1000 to 1400 lbs., and are irregularly marked with black and white. Those with most black on them are more eagerly sought after in South Africa, but this is merely a question of personal taste, as the colour of the animal does not have any effect on its milking qualities. They are very gentle cows and easy to handle. They fatten quickly at any age, and so are easily turned into beef when finished with in the dairy. The calves are large and strong. The cows yield enormous quantities of milk, sometimes averaging per month an amount equal to their own weight for ten or twelve successive months. Although the milk yield is far beyond that of most of the other breeds, its quality is usually poor, and in some cases far below the standard required by law, viz. 3 %, the butter-fat test in many cases being as low as 1·8 %. The milk is usually lighter in colour than that of the Jersey, Guernsey, or Devon, even when fairly rich in fat, and consumers who have been accustomed to milk of a richer appearance sometimes object to it on account of absence of colour, which gives an impression of poorer quality.

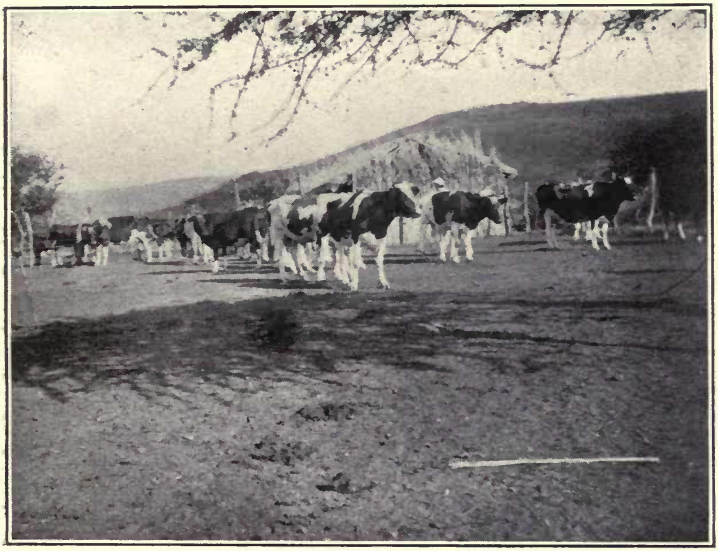


FIG. 5.—A FINE GROUP OF FRIESLANDS.
Owned by K. N. Young, Esq., N'Kwaleni, Zululand.

While the breed as a whole is rather poor in the fat percentage of their milk, it is only right to say that many individual cows, however, produce an excellent quality milk, whilst there are records of cows in this breed which have yielded as much as 25 lbs. of butter in a week, but such cows fetch a fabulous price and are not within the reach of the ordinary dairy farmer. They cross well with the ordinary stock of the country, but they need rich pasture, rich food, and good care to make them succeed well, and they are likely to prove disappointing when they are not given the best of feed and attention. Although the quality of the milk is, on the whole, poor, they may by careful selection be raised to a fairly high standard in yield of fat, and there are one or two herds on the list of the Mooi River Cow Testing Association (Natal) where the average butter-fat test of the herd is 4 %, but this has taken years to arrive at.

The Jersey.

The Jersey cow, originally called the "Alderney," is a Channel Island breed, and may lay some good claim to being called the "Dairy Queen." It is a remarkable animal on account of its small size and apparently delicate appearance contrasted with its great yield of cream of a deep yellow colour and exceedingly rich in butter fat.

The animals are small and useless for beef; they are entirely a dairy breed and compare more than favourably with any other breed for dairy purposes. They vary in colour, khaki, fawn, and silver-grey being allowed, while many of the bulls are nearly black. They have sleek short hair, deer-like heads, and slender frames, but they have the big "barrel" and true wedge shape so desirable in a dairy cow. They show a strong yellow tint all over, on horns, inside of ears, and on hindquarters and at the roots of hair.

Although natives of the Channel Islands they are also common in the South of England; the Jersey as bred in England and America is, however, somewhat larger and coarser in frame. The cows weigh below 1000 lbs., are usually rather angular in outline, nervous, good feeders, and produce liberal yields of very rich milk. For over four hundred years they have been bred exclusively for the production of butter fat. They are the most common breed in the United States where dollars count. They are bred extensively in Canada, and have made good reputations in Australia and New Zealand. They are not very well known in South Africa, where they are somewhat despised on account of their small size. They are found principally at the Cape and in the Western Province, and many of the native cattle in that region show a very strong mixture of Jersey

blood, which together with the Friesland has done so much towards making the popularity of the famous "Cape" cow. They produce the richest milk of any of the dairy breeds, their milk never going below the legal standard, viz. 3 %, and very seldom below 4·75 %. A very large number of cows tested at the various experimental stations in America as reported on by Professor Woll averaged 5·5 %, while in many cases individuals test as high as 6·5 %. They are such continuous milkers that it is very often difficult to dry them off between calves, and many a herd can show an average yield of over 5000 lbs. of milk per cow per year.

Individual records show much higher yields, running as high as 10,000 to 12,000 lbs., and there are two authenticated records of cows, *i.e.* Jersey cows, which have produced over 16,000 lbs. of milk within twelve months. That the milk of the Jersey cows is rich in butter fat is shown by the fact that many herds produce an average annual yield of 300 lbs. of butter fat per cow. Herds averaging 400 lbs. per cow are not uncommon, while individual animals have even produced more than double that amount in the same time. The Jersey is an animal which will one day be more largely known in South Africa and benefit the farmer greatly by giving him more butter fat per head of cows milked. Like the Friesland they need good food and good care to make them succeed well, but they are also likely to

prove disappointing when they are not given the best of feed and attention.

The Ayrshire,

as its name implies, comes from Scotland. These cows are regarded generally in the British Isles as a real dairy breed. They can thrive on inferior pasture, doing well also on rich soils, although they sometimes lose their milk power and lay on fat. They are a hardy breed, and are very popular in the dairy sections of Canada and Australia. The cows are not very big and seldom weigh more than 1000 lbs., but are good deep milkers, 5000 lbs. of milk per year being a common yield. The milk is somewhat above the average in quality, but not so rich as that of the Jersey. Professor Woll gives the average fat content of the milk at 3·75. The cows are not as gentle as the Jersey or Friesland, but are more active, better "rustlers," will live on poorer feed and will find grazing on rougher pastures. They cross well with other breeds. The hind quarters of these cows are broad and deep, forequarters narrow and light, giving the body a wedge-like shape which is regarded as a sure indication of good milking powers. The udder is large, extending well forward under the belly and backwards carried well up behind.

The Ayrshire has usually very small teats, but this is rapidly being remedied by selection. The milk veins are prominent and well developed, and the horns are wide apart and curved upwards. The colour of the breed is brown, red, white, black, or these mixed in patches, but never roan. The most common colour is red with white patches or white with red patches. The colours should be distinct, as a mingling of them is regarded as a defect; the colouring, however, does not affect an animal's milking qualities. The milk of the Ayrshire is particularly adapted for cheesemaking on account of the butter fat occurring in very small globules, which is an advantage to the cheesemaker. Ayrshires are being more extensively bred in South Africa than formerly, and there are some noted and popular herds scattered over the Union.

The Shorthorn.

This includes the Durham breeds, and is the most widely distributed of all breeds of cattle. It is an all-round breed suiting a wide range of localities, and crosses well with nearly every local breed; for this reason it is greatly in demand for grading purposes. There are two distinct strains among Shorthorns—one bred for dairy purpose and the other for beef. The *milking shorthorns* are good deep milkers, and are probably the heaviest

milkers after the Friesland. Individual cows of this breed have been known to produce 10,000 to 12,000 lbs. of milk in a season, and entire herds have averaged from 6500 to 7500 lbs. per cow per year. The milk is of good quality, the cream being a little pale in colour. According to Professor Woll, who reported on the various tests held at experimental stations all over the United States, the average fat percentage is 3·97 lbs. The *beef shorthorns* are as a rule very poor milkers, and in choosing this breed for dairy purposes care must be taken not to buy the beef strain. These animals are mostly coloured red or white or red and white, or these two colours blended forming a roan. They are never found black. The ribs are full; the horns small and neat and never black tipped—they should have a slight downward curve, never up, and should be of a fleshy or creamy colour. The eyes are large and prominent. The back is straight and very wide between the pelvic bones.

The Devon.

The Devon cattle are becoming very popular in many parts of South Africa, especially where the production of milk and butter is not the sole object for which the animals are kept. They resemble the true Africander cattle in colour, being a self-coloured dark red with white on udder and white tip to tail.

FIG. 6.—DUAL PURPOSE SHORTHORN.

More beef than milk.

They are extremely useful for draught purposes, having been largely used for this purpose in their native home. The cows are of good size, averaging not less than 1000 lbs. in weight. They are good at veld ranging, quick and active, but quite docile and very easily handled. There are two strains, one bred more for beef and the other for milk, but they are only fair as milkers, not being very continuous in their flow. The milk is, however, very rich in fat and deeply coloured. At the various tests held in America on this breed the milk averaged 4·6 per cent. of butter fat, as reported on by Professor Woll, while a single test of 72 animals reported by the New York Experimental Station showed an average of 4·15 per cent. butter fat. Some strains of Devons contain heavy milkers, yields of 5000 lbs. per year being not uncommon as a herd average.

Breeds compared.

It has been said that comparisons are odious, and it is not the purpose to discuss under this heading the superior merits of any one particular breed over another. We can only make general observations, for all breeds have their admirers, who point with pride to the large milk records of their favourites. Care must be taken not to judge or select a particular breed from the merits of one

or two performers, for every dairy breed in existence has one, two, or more phenomenal records on which it would be a great mistake and extremely disappointing to select a breed and expect them to average a yield anything as high as that particular record.

Each breed has its especial good qualities as well as its peculiar weaknesses, and no one breed is best suited to all districts, or all branches of dairywork. In Bulletin No. 151 issued by the United States Agricultural Department, and written by Professor Tracey, we find the following directions:—

"Though many attempts have been made to develop a breed of cattle profitable for beef and milk, success in that direction has never been reached, and it seems more than probable that such a breed will never be secured. It is the natural tendency of every cow to use her surplus food either in growth and the laying on of fat, or in the production of milk. Either of these tendencies may be greatly strengthened by intelligent breeding and selection, but no breed has ever been developed which excels in both beef and butter-making qualities, and improvement in one direction has usually been accompanied by a corresponding loss in the other. It is true that there are some breeds which make animals of fair size and which are also fair dairy animals, but they are only fair as either. The best beef animal and the best milking

animal have never been found in the same individual or even in the same breed. A profitable beef cow is one thing, while a profitable dairy cow is something quite different. The farmer who expects to make his main source of income from dairying should select the breed which will give him the greatest amount of milk or butter from the smallest number of animals at the least cost."

To summarise the matter of breeds, it may be said that the *Friesland* produces an immense yield of milk which is not rich in fat, and they are easily fattened into good beef, but require the best of care and abundance of rich succulent feed.

The *Jerseys* produce a large yield of rich milk, are good rustlers, and far more hardy than their looks promise; but they are of little value for beef or yoke purposes.

The *Ayrshires* are good milk producers, will thrive on a poorer pasture than most others, and are easily fattened when wanted for slaughter, although the carcase is small.

The *Devons* produce a moderate amount of rich milk, and are easily made into good beef.

The "milking *Shorthorns*" produce a good yield of milk which is of good quality, and can be turned into excellent beef at any time, but they are not good hustlers and need good veld to do well.

At the "World's Fair" held at St. Louis (U.S.A.), a test was conducted for 120 days for milk and

butter-fat yield. The number of cows entered were: five Swiss cows, twenty-five Jerseys, fifteen Holsteins or Fries, and twenty-nine Shorthorns; *i.e.* seventy-four cows all told. Thirty-three of these produced enough fat in their milk to make an average of two pounds or more of butter for each of the 120 days, and of these thirty-three cows twenty-one were Jerseys, ten Friesland, one Shorthorn, and one Swiss. As a result of the trial the Friesland were easily first as milk producers, Jerseys came second, and Shorthorns last; while as butter producers the Jerseys were first, the Friesland second, and the Swiss third.

RESULT OF DAIRY TEST CONDUCTED AT THE "WORLD'S FAIR," ST. LOUIS, U.S.A.

TABLE I.

Breed.	Tested for 120 days.		Average fat % of milk.	Cost of food for	
	No. entered.	Milk per cow per day.		1 lb. fat.	100 lb. MILK.
		lbs.		pence.	pence.
Friesland . .	15	50·2	3·4	$6\frac{3}{4}$	$26\frac{3}{4}$
Jersey. . . .	25	37·5	5·1	$5\frac{1}{4}$	29
Shorthorn . .	29	29·8	3·7	—	—
Swiss	5	39	3·8	$7\frac{1}{4}$	—

Table II. shows the positions of merit, and also the butter yield of the leading fifteen cows out of the seventy-four entered in the above test conducted for 120 days.

TABLE II.

Order of merit.	Breed.	Butter yield for 120 days.
1	Friesland. . .	330·3 lbs.
2	Jersey. . . .	330 „
3	Jersey. . . .	312 „
4	Jersey. . . .	310·5 „
5	Jersey. . . .	300·5 „
6	Jersey. . . .	299 „
7	Friesland. . .	298 „
8	Jersey. . . .	295 „
9	Jersey. . . .	297 „
10	Jersey. . . .	290 „
11	Jersey. . . .	290 „
12	Friesland. . .	287 „
13	Jersey. . . .	286 „
14	Jersey. . . .	283 „
15	Friesland. . .	280 „

THE "CAPE" COW.

She's long in her face, she's fine in her horn ;
She'll quickly give milk with care and corn ;
She's clear in her jaws and strong in her mouth ;
She's black in colour and bred in the South ;
She's wide in her hips and calm in her eyes ;
She's fine in her shoulders and thin in her thighs ;
She's light in her neck and long in her tail ;
She's wide in her chest, she's good at the pail ;
She's fine in her bone and silky of skin ;
In the race for Profit she is bound to win.

CHAPTER VI

HANDLING A DAIRY HERD FOR PROFIT

HOWEVER excellent the breed of our dairy cows may be, and however good milkers they may have been in some one else's care, all this may be lost by indifferent handling. There are many cows which never milk well because they have never had the chance, through this fault of indifferent handling.

We do not wish to advance the oft-repeated maxim "Treat a dairy cow with kindness," for the man who is investing in dairy cows will naturally handle them as a business proposition, and that is the kind of handling to which they will respond. If you tie a blue ribbon round a cow's neck, pet it, and make a fuss of it, she will give you no more milk than if kept in a clean stall and tied by a halter, rope, or stanchion and well fed. "Kindness" means shelter from wind and good food, which our pasture lands do not, unfortunately, always supply.

The old style of cow standing knee-deep in manurial mud inside a bush or stone kraal subjected to all the four winds of heaven, the blazing sun, the beating rain, or the biting frost, means indifferent

and cruel handling. The man who keeps his stock in such a manner does not deserve to get any increase from them; but the keen farmer knows instinctively that he is dealing with a highly organised creature, and therefore he would never subject his patient animals to lack of feed, exposure, and neglect. The success of a dairy cow depends on four things—(1) Feed, (2) Comfort, (3) Selection, and (4) Breeding.

Presuming the animal is of the correct dairy type, "Breeding" is the least important of these, for, however carefully bred and however excellent the sire or dam, the whole length of pedigree is useless without Feed backed up by Comfort. The dairy farmer's motto will be "hard work for the owner, and comfort for the cows," and then the owner will also find comfort for himself. A cow with an empty belly—as they are often empty during a South African winter—never made any man's bank account grow, for it is not written that a man shall prosper at the expense of his beast.

It is not altogether necessary that a cow should be pure bred to get profit from her, for a poor specimen of any pure breed is worthless. But as long as she is a *good* cow the breeding does not really matter. It is, however, very nice to have pure breeds, and certainly more good cows are found among the purely bred than amongst mongrels or scrubs; but unless the farmer is well off he

cannot afford to buy highly priced pure-bred cows which have established phenomenal milk records.

Get the best cows possible at the best price you can afford to pay. Handle them intelligently, and whenever an opportunity presents itself get rid of any cow testing below a standard which you have fixed for your mark. Seize always the chance to invest in one of better quality, remembering that one good cow gives more satisfaction than two bad ones.

In handling a herd for profit the time in which we should allow our cows to calve depends on what branch of dairying we are following. Should the farmer be near a town or city and the supply of whole milk be his aim, he must obviously not have all his cows calve at once. If he has twelve cows, for example, he may have one of them calve every month ; or, if six cows only are kept, one cow should calve every two months. By this means there is a continual and even supply of milk, so necessary when customers have been found and who depend on a constant daily milk delivery.

This method of having a cow come fresh every month is easily worked by allowing certain periods of "heat" to pass, and as the cow "bulls" every three weeks, by keeping the bull away from the herd and bringing each cow to him separately. The date of calving can therefore be controlled to a very considerable extent. Care, however, must be

exercised that too long a period is not allowed to pass before having the cow served, because some cows have been known to put off breeding when several periods of "heat" have been omitted.

If the farmer is supplying butter fat to one of the South African creameries, the best time to have the cows calve is at the beginning of winter, say April; this would be an entirely new departure from the prevailing custom, but it is nevertheless a good plan. Butter-fat returns give higher cash values in winter than in summer all through South Africa. Therefore the farmer with from twenty to thirty good cows must make his aim for these top winter prices offered by the creamery companies.

A cow can be made to give more milk at a smaller cost when she calves in late autumn or early winter than when she calves in the spring or early summer—October, November; for if the cows are handled so as to calve in April or May they are put on to their winter feeding and will continue to give a good yield of milk and butter fat while prices are high, viz. from April to August. When the spring rains fall between August and October or early November, the veld is beginning to recover and the spring grazing stimulates the declining milk yield to a bigger flow towards the end of the milking period. The cow then becomes dry in summer, January February, when creamery prices for butter fat are low, when the weather is too hot to stable the cows,

and when milk and butter fat are more difficult to handle on account of the heat.

By getting the cows served about August or September and letting them calve in April or May they rest during the hottest months when prices are lowest, and so it makes them most productive when prices are highest. Not only, therefore, is the difference felt in the creamery cheque, but the young stock are weaned at the beginning of spring, the most suitable period for weaning. They will have been fed on skim milk in their calfhood during the winter, along with hay and light grain feed, and when they are weaned they go straight to a growing pasture and thus have no "set back."

At present, in the majority of cases the South African cow calves in the early spring, the calf is weaned at the end of summer and has to manage for itself on a declining and frost-bitten pasture, the result being a "set-back," and the animals take three to four years to grow out properly. The calf should be kept coming on steadily from the day of its birth until it has reached full size; for young dairy stock which is hindered at any stage of its life is spoilt stock.

Heifer calves intended for the dairy should frequently be handled in order to develop in them a quiet temperament, and when they are "in calf" occasional handling of the udder will make them familiar with the operation, so that a cow will take

to milking without her calf quite readily, and thus there will be no trouble of breaking her in. The heifer should be put to the bull when eighteen months of age, so that she may be rising two and a half years when she drops her first calf. This refers, of course, to vigorous, well-grown young dairy stock. If the farmer leaves this later, one year's milk is lost, one calf less in her lifetime, and there is therefore an extra year to feed her. Not only that, if young cows be left for another year they are liable to put on flesh instead of making milk, and this tendency then exists right through their lives. *It is therefore advisable to breed early, provided the stock is well grown.* In handling a dairy cow remember, above all things she is a business proposition—a means of swelling your bank account, and you will then not go far wrong. But remember, also, if you try to enrich yourself at the expense of your cow you are only courting disaster. The dairy cow looks upon good food and shelter as her right, and when she gets her "rights" she makes it her duty to repay you bountifully.

Keep the bull in the sight of the cows as much as possible, and at night have him near them, but do not let him wander about among them at will. Stable the bull in all weathers and seasons of the year and feed him. Groom him also and treat him as you would a valuable horse. Unless the dairy farmer is prepared to do all this, dairying is not his

line in life, and therefore he cannot expect it to pay him Always give the bull gentle treatment, but there must be no question as to which of you is master; for should he once be allowed his own way he will learn his own obstinate lesson. Put a ring in his nose and lead him by this by means of a bull strap or pole. Only put him out in such camps or lands where the fencing is strong. If he never learns his full strength he may be handled with ease, but no bull should ever be trusted—it is mere folly to do so.

CHAPTER VII

HOW TO RAISE A DAIRY CALF ON SKIM MILK

THE raising of a first-class calf begins by giving attention to the dam before the birth of the young. The best calves are usually obtained from those cows which are dry for at least six weeks or a month before calving; but if it is found impossible to dry the cow—as is common in very highly bred continuous milkers—she should be milked right through until she freshens again. This is very seldom necessary, however, as "drying-off" the cow should be commenced at least two months before she is due to calve. Dry cows on good veld with plenty of shade and water could ask for no better quarters. They need very little attention except that they must not be annoyed by other animals. They should be kept in good condition but not too fat. Ensilage, mangolds, turnips, or swedes are very beneficial for cows at this time. Keep the bowels loose and the animal in good condition and in a healthy state. This has an important bearing on the health and condition of the calf before and after birth, for should the cow be sick

her blood and milk are liable to be affected, and so do more harm than good to the young animal.

If it be very cold weather she should be sheltered, not necessarily in an expensive or elaborate building, but free from draught and well bedded. When the calf is born she should have light loosening feed and water from which the chill has been removed, for very cold water is likely to cause a shrinkage or contraction of the womb, which leads to trouble in getting rid of the "after-birth." Keep the bowels loose, and if any sign of constipation appears give her one pound of Epsom salts dissolved in hot water.

Since the supplying of butter fat to the creameries has become such an important part of dairy farming and the utmost profit has to be made from the cow, it becomes a very important point with cream suppliers to know how to raise a first-class calf by hand and by the use of skim milk. Any cow which is worth being called a dairy cow produces more milk than it is possible for the calf to drink, and the sooner the cow and calf are separated the better for both. When the milking is done by hand the cow soon forgets her offspring and regards the milking as the natural means of relief to her udder. She will "let down" her milk just as easily to the milker as to the calf, and the farmer can be sure the udder is drained with each milking.

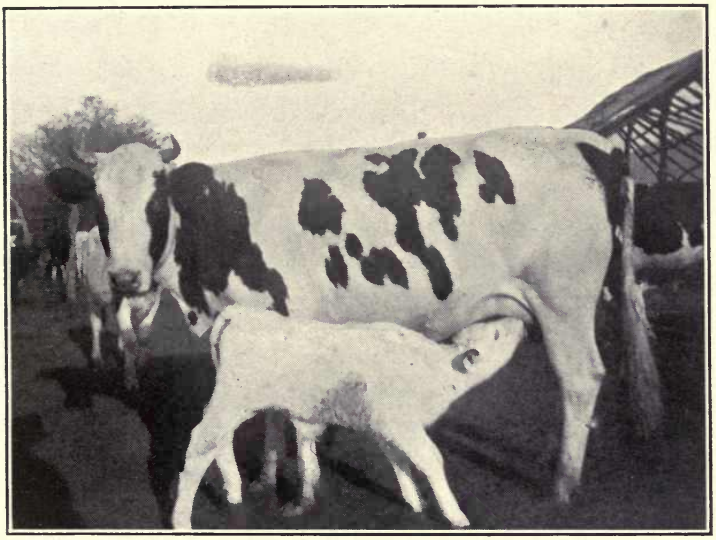


FIG. 7.—THE WRONG WAY TO DEVELOP A GOOD MILKER.

When the cow has licked her newly born calf it should rise to its feet and take its first meal, or should be assisted if it is too weak and unable to find the udder, after which it should be taken away from her, providing her udder is in good condition. It is easier to teach the calf to drink from a bucket when it has not learned too much about sucking. Experience has shown that when the calf is taken from the mother directly after the first meal or within four or five days, it will make good progress on hand feeding; but when it has been left with the dam for three weeks or so, that, on being hand-fed, it has a slight "set-back" for the first eight or nine days after being removed from the mother. This should be avoided. If the udder of the cow is "caked" or hard, however, it is best to leave the calf with her for two or three days, as the rubbing and nosing of the calf softens and reduces any inflammation of the udder.

When hand feeding the calf it is absolutely necessary to imitate nature to get the best results. The mother's milk is always warm, at blood temperature, so that the calf should always be given the mother milk, colostroum, or beistings as it is called, while it is fresh and warm.

This is important, for it acts as a gentle purgative and clears the meconium out of the intestines. The anus of the calf should always be examined, as frequently it is found closed. In nature, the calf

gets its milk often and in small quantities and always at blood temperature. We should, therefore, always be sure that the milk is warm or as near blood heat as possible. Give the young animal the beistings or mother's milk for the first two weeks, care being taken not to give too much, for the young calf is a greedy animal and there is a great temptation to give it more than is good for it, so causing scouring, which is undoubtedly caused by overfeeding. The milk should be measured or weighed for each feed. Do not feed more than 10 lbs. each day of the beistings, divided into three meals as follows: mornings, 4 lbs.; midday, 2 lbs.; evening, 4 lbs.; never forgetting that it must be warm and fresh. This may be gradually increased to 12 lbs. per day. After two weeks the calf may be fed twice daily, giving half this quantity at each meal, *i.e.* 6 lbs. morning and 6 lbs. evening.

After the calf is two weeks old a little fresh, sweet and warm skim milk may be added to the fresh milk, and the amount of skim milk may be gradually increased until the calf is a month old, when skim milk, sweet and warm, may be given alone. The stomach of the calf being very sensitive and delicate, this change in feed should be made gradually. Do not change from whole milk to skim milk faster than 1 lb. skim milk per day. That is to say, the calf is getting 12 lbs. whole milk per day when he is two weeks old. On the day of

changing the feed give 11 lbs. whole milk and 1 lb. skim milk, *warm and sweet.* The second day give 10 lbs. whole milk and 2 lbs. skim (separator) milk. The third day 9 lbs. whole milk and 3 lbs. separator milk, *warm and sweet;* and continue this until the young animal is only taking *sweet separator milk.*

The writer makes no excuse for repeating the words "sweet and warm," for that is the whole secret of successful calf raising by hand and by use of skim milk. By "sweet" skim milk sugar sweetness is not meant, but sweet or fresh as opposed to sour or acid, for it is impossible to raise a calf successfully if it has fresh one day and sour the next. The warm milk need not be kept up after the calf begins to take other food, but the skim milk must always be fresh. Calves from three to five weeks old will require 10 to 12 lbs. daily. When from seven to eight weeks old they will need 14 to 16 lbs. daily, and when three or four months old 18 to 20 lbs. daily, fed morning and evening.

It is not necessary to buy high-priced patent calf meals to take the place of the fat removed from the milk. These patent foods are unnecessary and do not give any better results than two grains grown on your own farm, viz. mealie meal and Kaffir corn meal, for it has been found in the most exhaustive experiments in Europe and America that carbohydrates are able to do the work of fats if the latter are not present in a food. The fats present in a

food form animal heat and fat, but the carbohydrates of a food also produce heat and fat, and are thus able to perform the work of the fats, so that in removing the "milk fat" from the milk and giving skim milk to the calf with the addition of a food rich in carbohydrates (*i.e.* starch) the young calf will not miss the "milk fat."

The two grains on every farm in South Africa rich in carbohydrates (or starch) are mealies and Kaffir corn, and it has been found *by experience* that the starch and fat in mealie meal and Kaffir corn easily take the place of fat removed from the milk in separating.

Calves will begin to eat meal when they are about two weeks old, and a little Kaffir corn meal should be placed in their mouths *after* they have had their drink of milk, and in a short time they will eat the meal readily from their box or feeding trough. *The meal should never be mixed in the milk*, because the starch in the Kaffir corn has to be changed into sugar before the young animal can digest it. This change has to take place through the action of the saliva in the calf's mouth, and if the meal is gulped down with the milk, the starch cannot be digested by the gastric juices in the stomach because it is acid instead of alkaline or neutral, and this change must take place through the action of an alkali or neutral as seen in the calf's mouth. Therefore always feed the meal dry.

FIG. 8.—A NICE GROUP OF HAND-RAISED CALVES.
Bred by A. E. Dix, Winterton, Natal.

FIG. 9.—FED ON SEPARATOR MILK AND KAFFIR CORN MEAL.
Bred and reared by A. E. Dix, Esq., Winterton, Natal.

Kaffir corn has proved to be a real good calf food fed in the form of a dry meal, and calves of four weeks old will readily eat from half to three-quarters of a pound per diem, and when two months old about two pounds per day. This Kaffir corn meal, to which a little mealie meal may be added, makes a very perfect substitute, when fed dry, for the cream removed from the milk. It is, therefore, unnecessary to believe that we have to buy a "cream substitute," for we have the right grains on our own farms, *but* they must be fed separately from the milk and not mixed with it.

About the same time that they are beginning to eat grain or meal the calves will also begin nibbling hay. They will readily eat 1 lb. daily per head, and should only be given good clean, well-made grass hay. Lucerne hay is a little too loosening for them, but it may be gradually introduced into their ration when they are older and weaned.

Weaning should take place when the calf is about five to six months of age, and it should be gradually accustomed to green food before being turned on to a green heavy pasture. The calf should have access to fresh water daily. Each calf should have its own feed trough, and be tied near this but far enough apart from his neighbours to prevent them sucking each other's ears. If each calf has its own feed trough to which it is tied during meal time he learns to eat more quickly than

when running loose in a pen, but there is no necessity to keep them tied up during the day. They may be turned into a camp away from the cows.

The calf should be kept constantly growing from the time it is born until it has reached full size, and this should be done by giving it plenty of hay and roughage—all he can eat, with only a small amount of mealie or Kaffir corn. When calves are allowed plenty of hay and a good pasture the digestive organs become well developed. This means a stomach capable of holding and digesting a large amount of food, which is necessary to every animal which is to become profitable.

When they are five to six months old they may be weaned gradually from the skim milk by reducing the amount given each day until they are getting none at all—a week being about the time necessary. If plenty of grass veld is available, with shelter and water, young weaned stock could have no better quarters or feed.

To summarise we cannot do better than give the following extract from *The Jersey Bulletin and Dairy World*:—

"About 70 per cent. of the 1,242,700 dairy calves reared in Wisconsin each year must be raised on skim milk," writes Professor D. H. Otis, of the Agricultural Experimental Station, Madison, U.S.A. "By good care and proper feeding several dollars

may be added to the value of any calf during the first year. The total increase by this means would amount to millions of dollars to the dairy farmers of the State. Young calves need whole milk for the first few days," adds Professor Otis. "Skim milk is a cheap feed for calves, but should be carefully fed in limited quantities and only while it is warm and sweet. Skim milk may form the principal diet of the calf for six months or even longer. The best skim milk is that which is fresh from the separator and still warm. Experiments show that it is only one-fourth as expensive to raise calves on skim milk as on whole milk. Two lbs. of grain with the proper amount of skim milk equal in feed value 1 lb. of butter fat. The grain for calves should be fed first while the calf is quite small. High-priced concentrates are unnecessary and give no better results than corn meal, oats, bran, barley, etc., when fed correctly. The roughage or hay should first be fed when the calf begins to eat grain. Corn silage is an excellent calf feed when fed in moderate amounts. Good pasture is essential after four or six months. The management of the calf during the first year has much to do with its later usefulness. Plenty of water and salt should be given in clean vessels. Sudden changes of diet should be avoided and regularity in feeding should be practised."

CHAPTER VIII

AILMENTS OF DAIRY COWS AT CALVING TIME

The following are notes taken from lectures delivered at Elsenberg Agricultural College.

Abortion.

THIS condition does not frequently occur with cows, and it may be divided into two classes, accidental and contagious. Sometimes the term "premature birth" is used with abortion, but, strictly speaking, in premature birth the fœtus is living, and it occurs during the latter part of pregnancy; whereas in abortion the fœtus is not living, and it occurs during the earliest parts of pregnancy.

Causes.—It may be either due to injuries, rough treatment, over-excitement from any cause, result of an illness, exposure to either excessive heat or cold, poisonous plants, long journeys or use of a purgative.

Symptoms.—There is little or no suggestion of it. There may be a slight swelling of teats and vulva, a slight discharge from vulva, the animal is restive, afterwards in apparent pain—hurried breathing and expulsion of fœtus happen.

Treatment.—The only preventive treatment is to avoid the causes above mentioned, for once the animal commences to abort it is impossible to check it. Every case should be looked upon as a possible case of contagious form. Sometimes the

animal suffers for a long time. It may be that the membranes are retained, and these must be removed if necessary and the animal put on to a course of good nursing. She should be disinfected with a reliable and weak antiseptic such as Jeyes' or Condy's fluid. A purgative may be needed (1 lb. Epsom salts for a cow), and give a laxative diet such as bran mash, green barley, etc. The cow should be kept warm. Keep her away from other cows, and when she is better destroy or burn all the bedding, etc., as precautions must be taken against the contagious form. There is a peculiar sympathy in disease amongst cows, and a good illustration of this is in the case of abortion, for it is a familiar experience that if a case of accidental abortion has occurred one or more of the cows will abort through sympathy. Captain Hayes, M.R.C.V.S., in his book for horse-owners, says, "Nervous sympathy cannot be doubted, and a mare having aborted should certainly be separated from in-foal mares."

Contagious Abortion.

This is an extremely infectious disease seen principally in the cow. In dairy herds it is sometimes responsible for the loss of forty to fifty per cent. calves for two or three years running.

Cause.—It is due to an organism the pathologic agent of which is not known, and as long as the agent is not known contagious abortion must be

classed as a specific disease. The virulent agent exists in the discharge of the genital canals and in the fœtal fluid, and through the means of these fluids healthy animals become infected. It is proved that infection may occur by the cows swallowing the organisms in their food, or it may be spread by the bull serving first a diseased cow and then straight to a healthy one. It is usually introduced into the herd through a new purchase or through allowing your bull to serve your neighbours' cows. This infectious abortion may occur in the very best-kept stables, which proves that filth is only a secondary cause.

Treatment.—Newly purchased dairy stock should always be kept somewhat apart from the rest of the herd until sure that they are healthy. Destroy by fire, or burying very deeply, the fœtus, membranes, and bedding, etc., of all aborted animals. Disinfect as far as possible the stables in which the animal has been standing. Whitewash the walls and give plenty of light in the stalls. Cover the whole floor with a thin coat of air-slaked lime each day, also spray the entire stable with a solution of creolin twice or three times per week. Do not allow the same boy or man to attend to the sick and healthy animals alike. Wash out the wombs of all affected cows with 1 to 1000 solution of perchloride of mercury. Do not breed from these animals for a year. Disinfect the bull's sheath before and after each service, and change the grazing of the herd if possible.

It has been thought that carbolic acid given internally was of great benefit, but Dr. A. H. Hortwig, of Wisconsin, U.S.A., says—

"We may also increase the resistance of all the cows by means of food rich in nitrogen and by the giving of iron tonics. Subcutaneous injections of a two-per-cent. solution of carbolic acid have been experimented with, which have given variable results. Theoretically carbolic acid seems to be inefficient; in the organism it is rapidly transformed into sulphophenic acid, which is without effect."

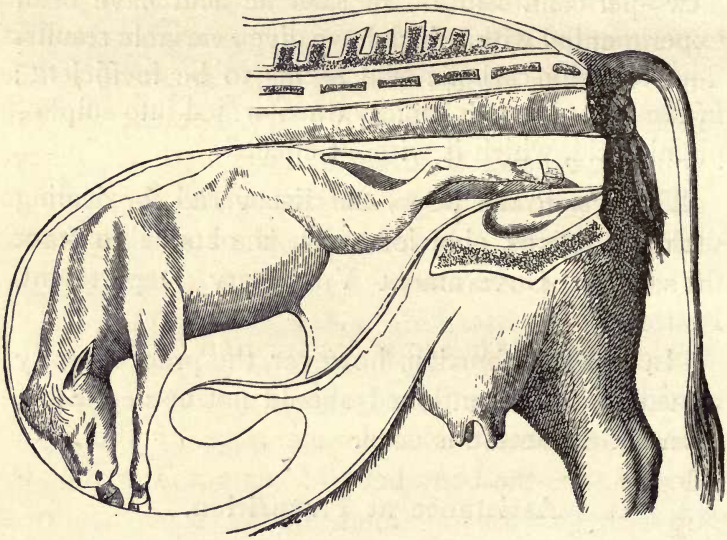
A vaccine has now been discovered for dealing with contagious abortion, and is obtainable from the Union Government Veterinary Department, Pretoria.

In cases of abortion, however, the precautionary measures afore-mentioned should not be neglected, even if the vaccine is used.

Assistance at Parturition.

Sometimes valuable cows are kept stalled, and have to bring down their young under observation. When this is so the cow should be in a loose box with a small window, but should not be disturbed more than is absolutely necessary. Noise or loud talking, or a bright light, may seriously affect parturition. If foaling or calving boxes are used it is advisable to make them round, avoiding corners. Should the cow lie down in an awkward position

when the fœtus is presented, she must be moved to prevent any injury being done to it. After each birth the bedding should be removed and the box disinfected. Do not rupture the water-bag too soon, as its action is to dilate the os and the passage. If the cow is interfered with or the bag



NORMAL PRESENTATION.
(*From Fleming's "Veterinary Obstetrics."*)

is ruptured too soon, it generally causes some difficulty and delay. The os may not be dilated properly, the fœtus may not be in the passage, and the passage will naturally be drier, and this retards birth. If the animal has much difficulty in getting rid of the fœtus once it has begun to appear, it may be assisted by putting weight on the fore legs or

head of the fœtus, but it must be pulled downwards and not straight. As soon as the calf is delivered see that its nostrils and mouth are clear; if it does not breathe at once, open the mouth and pull the tongue forward. It is sometimes useful to blow down the nostrils, or it may be necessary to employ artificial respiration. See that the mother licks the young animal, and that the young one gets the first milk from its mother as soon as it can stand. The mother must be milked out dry, because the calf will not be able to drain a dairy mother. Above all things, do not worry the animal, allow nature to take its course, only rendering the above assistance if seen to be necessary.

Abnormal Parturition.

This may be due to many causes, such as wrong presentation, abnormal size of the fœtus, dead fœtus, the body being decomposed and blown up with gas; or the fœtus may be some abnormal shape, or may be due to some structural defect in the mother, such as fractured pelvic bones. It may be also due to the womb twisting itself on its neck or vagina. In this case the only way to deliver is to cast the mother, tie the legs and roll her to try and untwist the womb. First try rolling in the direction of the twist, keeping the hand in the vagina all the time to feel if the twist is coming undone. It may be necessary to try rolling the

other way. This condition may be recognised by the fact that when you pass your hand up the vagina you cannot find the os, and the vagina appears to be twisted on itself. In all cases of difficult parturition where it is necessary to help the cow, before starting work be sure and have all the necessary assistance, such as plenty of light, oil for the hands, disinfectants, proper ropes, and to be properly clothed, and have, say, two boys in attendance.

First find out, by introducing your hand and arm very carefully, what part of the fœtus is being delivered, and then take time to consider which is the most common-sense way of removing it. Above all things, DO NOT HURRY!

Make sure that twins are not in the womb, especially after delivering one. Decide whether it is necessary to alter the position of the fœtus or to alter the position of the mother, such as raising the hind quarters.

Instruments which are necessary are a few ropes three or four yards long, smooth, fairly thin, and strong, about $\frac{3}{8}$ inch thick; a couple of hooks called calving-hooks, one blunt and the other sharp. These hooks must be fastened to rope similar to the foregoing. No other instruments are necessary.

There are many ways in which the fœtus has to be moved when it is coming the wrong way. It may have to be pushed back in order, maybe, to get a leg or the head up. Always use the hand

and arm. Do not use a crutch when moving the fœtus inside the womb. The hand is far better, not being so hard, while one can feel better what is happening. When it is found necessary to introduce the hand and arm into the womb, do not introduce them cold. First dip the hand in warm water to which glycerine has been added ; this will make the arm quite smooth enough. Do not introduce a questionable kind of oil into the womb.

If the pains or throes are very strong, wait until they cease. It may be necessary to raise the cow's hind quarters by using bags of straw. It is sometimes advisable to alter the position of the fœtus in the womb, either from a head to a tail presentation, or *vice versa*, or from a back or belly presentation to a front position. These are usually very difficult, but often essential in order to deliver the fœtus. The usual way for the fœtus to come out is head forward—that is to say, with its two front legs in the passage with head and nose stretched out along them. Always fix with ropes any part of the fœtus which comes out. This is the most important point to be noticed, for should it be necessary to push that part back into the womb, or should it slip back by accident, it may be very difficult to get it again. When one foot is bent down fix the other parts presented, then push the fœtus slightly back and try to find the other leg. It may be necessary to get a rope round the leg

when found. Draw it up into the passage, keeping the hand always over the foot as it comes into the passage, otherwise it may be pushed through the womb. Amputation may even be necessary, *i.e.* to cut off the head and leg presented.

When both forelegs are presented and the head is twisted round on one side, the legs should be fixed with ropes and the operator must try and reach the head. This is usually very annoying, as one is only able to touch the tip of the ear as a rule. Persevere with it, however, and try to get the hands round the neck or under the jaw or over the nose. Sometimes it is possible to move the head this way. Sometimes it may be necessary to put hooks into the opposite eye or under the jaw, and so get power on the head, but try with the blunt hook in the eye first. Great care must be taken on introducing the hooks into the womb, and on fixing into the eye or jaw of the fœtus, and above all the womb must not be injured. Allow only steady weight on the hook, say one man, and it must be released immediately there is any indication of it breaking away from the fœtus, otherwise the womb will be ripped up by the hook, and this is fatal.

In some cases the hind legs are presented in the passage with the forelegs. Examine them and make sure it is not a case of twins. If it is so fasten a rope on to the one and push it back. If they are the hind legs of the same animal it will be

impossible for the cow to deliver it in this position, and any attempt to help her to do so will probably kill the mother. In that case an attempt must be made to change the position of the calf by fixing a rope on to the forelegs. Push the fœtus back and then introduce the arm as far as it will go, trying to turn the fœtus into some better position. When the fœtus comes with two hind legs and tail in the passage and is lying on its belly, if not too large, it can usually be delivered without trouble. Sometimes, when it has been necessary to turn the fœtus from an awkward position, it will be found to have been turned on to its back while the hind legs and tail are coming in the passage. It is then easy to deliver in this position, but great care must be taken that the feet do not injure the womb.

There are therefore many extraordinary positions in which the fœtus may be presented, and these notes are not given with the idea of being hard and fast rules, except that whatever is presented first should be fixed with ropes so that we may get it again if necessary. But our purpose is that the reader may obtain some idea of how to handle the different positions, the most common of which have been stated.

In all cases take plenty of time, DO NOT HURRY or BE ROUGH, and try to get the fœtus in the most convenient position possible. Always before commencing to work the finger-nails should be cut very

short, otherwise when entering the hand into the womb they may cause an internal injury. Remember also, when putting weight on the fœtus to draw it out, to draw forwards and downwards. Also remember that *it is unwise to interfere with the cow too soon.* Only assist by the above means when it is seen that the cow *cannot* calve for some reason or other.

Inversion of the Womb.

This is commonly seen in cows, when the womb turns inside out and hangs down behind the animal. The chief danger is the inflammation of the womb, followed by the death of the animal. This is usually seen after a difficult case of calving where the mother is continually straining.

Treatment.—Reduce the inversion as soon as possible by putting it back. If the membranes or after-birth are attached to the womb remove them and disinfect the womb carefully. Then put a clean sheet under the organ and put two boys on each side to lift it. Get your closed fist in the most dependent part and try to pass it through the projecting womb back through the passage it came out of and back into the abdomen, working very gently and trying to pass in any loose folds which form at the mouth of the womb back again into the abdomen.

If the animal is straining it is often useful to

chloroform her. Have plenty of patience, and take care not to force the hand through the womb. When the womb is back, keep your arm in and try and smooth out the inside to its normal position with your hand. When the cow stops straining, slip your arm out and put three or four deep tape stitches through the vulva, allowing only just room enough for it to pass its water. Put the cow on to soft food and nurse her well. The stitches may be removed three or four days later when she stops straining.

Retention of Placenta, or "After-birth."

This condition is commonly found in cows, the great danger being that inflammation of the womb will set in and that poisonous substances formed in the putrefaction of the membranes will be absorbed into the system and cause death. It is mostly caused by premature birth, abortion, or a low condition of the mother, as is seen in bad seasons or with first calf.

Method of taking it away.—It is sometimes customary to put a weight on the end of the "after-birth." It is useful to give the animal a purgative —1 lb. of Epsom salts being the dose for a cow. But if it is not removed by this means it must be taken away by hand within two or three days after calving—not any later.

There are two ways of taking it away from a

cow. First, fasten the membranes between two sticks and slowly twist them round and round. This is not a good method, however, as the membranes are likely to break off, leaving a large part of them in the womb. The second method is to strip to the waist, take hold of the membranes with the left hand, putting gentle weight on them. Then pass the right hand into the womb and loosen the membranes from the cotyledons which are nearest the mouth of the womb first; and as you loosen a portion of the membrane pass that part back to the left hand. Put on slight weight again and loosen the membranes once more from the nearest cotyledons, and so on until you loosen the whole of the after-birth. It is like loosening or undoing a coat, taking the cotyledons one at a time between the first finger and thumb and unbuttoning. Take great care not to damage the womb or the cotyledons, undoing one at a time as though unbuttoning your coat. Great care must be taken not to pull off one of these cotyledons, for the resultant bleeding may prove fatal to the cow. If, however, this should be done by accident, cold water poured over the loins of the animal will be the best means of trying to prevent excessive bleeding. The finger-nails must be cut before starting to work. Some weak Condy's or Jeyes' fluid should be at hand, and the hands should be continually washed in this. Pump out or wash out the womb after-

wards with weak Jeyes' or Condy's. Use no force and take plenty of time. Reid's enema pump will be found to be the best for washing out the womb.

Inflammation of Womb.

This is a common sequel in difficult cases of calving, and is usually the result of some injury to the womb.

Symptoms.—These are loss of appetite, rise in temperature, dullness, stoppage of milk flow, shivering, signs of pain or weariness, a dark discharge from the vulva. The animal is generally constipated, while pressure on the side causes evidence of pain. In serious cases there is a sudden drop in temperature below normal usually before death. In favourable cases the temperature comes down slowly and the other symptoms gradually disappear.

Treatment.—In all cases of difficult calving where help has had to be given, disinfectants should be used. The womb should be washed out with a weak solution of Condy's or Jeyes' fluid. No calving case should be attended by a man who has just been cutting up an animal or handling any impure substance, or who has been handling a cow suffering from the above complaint. Put the cow into a clean stall or shed away from the other animals. Place a blanket over her, strapped on, and give her laxative or green food and wash out

the womb with a weak antiseptic. Give the cow quinine—2 drachms—three times per day. The womb will probably need washing out once a day for three or four days. It may also be necessary to give the animal stimulants. The milk should be stripped from the animal but never used.

Inflammation of the Udder. Sometimes called Mammitis.

This is nearly always due to some pus organism, in which case it runs a very acute course. In other cases, such as tuberculosis, it generally pursues a rather chronic course. The causes are: animals catching cold at calving time, irregular and bad milking—the quarters not being stripped clean, injuries. It sometimes forms a sequel to other conditions, such as inflammation of the womb.

Symptoms.—One or more quarters of the udder appear to be inflamed and are hot and painful. There is generally a loss of appetite; less milk is secreted, and it appears watery and does not keep. In some cases the udder forms matter, little abscesses forming in the substance of the gland which may break externally and discharge yellow matter, or most of the matter may even run off into the milk canal and be drawn off with the milk. In other instances the acute form gradually subsides into the chronic form; the quarter affected becomes hard, due to the formation of new tissue amid its

substance. There is little or no pain on handling, practically no secretion of milk; simply a gradual drying up and destruction of that quarter. In tuberculosis the disease usually assumes a chronic type from the onset, there being a slight hard enlargement at the top of the gland which gradually extends down until the whole of the quarter is destroyed. Ticks are also a common cause.

Treatment.—Avoid the various causes, for in the chronic form little or nothing can be done. In the acute state suspend a poultice made of bran on to the cow's udder by means of tapes over her quarters and simply cutting holes to allow the teats to protrude. Do not make the poultice too hot. The udder may be thoroughly bathed with hot water, but this is of little value unless thoroughly done several times a day and for about twenty minutes each time, after which the udder should be kept warm. It is sometimes of value to rub in an ointment such as belladonna or camphorated oil. The teats should be regularly stripped three or four times a day even if there is not any milk. This may prevent the formation of abscesses, and in the case of recoveries stimulates secretion of milk.

Gangrenous Mammitis.

This is usually a sequel to acute inflammation of the udder, and unless attended to usually causes the death of the animal. In this condition the udder

commences to decay, poisonous substances are absorbed into the blood-stream and so cause death from toxic poisoning. The udder develops a dark green appearance; it is painless and quite cold.

Treatment.—It is impossible to bring the udder back to its natural position. In some cases it breaks and discharges away from the body; but in many cases the suppurating matter is retained by the cow and she dies. The bad quarter or udder should be removed in the following way: Make a cut right round the affected part about halfway up, cutting through the skin only. Then make a cut down to the base of the udder. Skin back this part of the udder, leaving the skin attached to the body. Cut down carefully until you reach the big blood-vessels which are entering the udder at its base. Pass a threaded needle round these and tie securely. Then cut them below these ligatures and cut all that part of the gland out. Next wash out the wound with disinfectant. Pack the hole made with clean cotton-wool, and stitch the skin together. The wound will need dressing once per day until it has completely healed.

Torn Teats.

Attend to these as soon as possible after injury has been done. Wash with a disinfectant and sew up with silk. Do not pass the needle too deeply or it may go into the milk canal. Do not milk the

animal if you can help it until the wound is healed over. Rather use a milk syphon, but be sure and boil the syphon each time before use, and always disinfect the teat before passing the syphon up. The syphon must be passed up very gently to prevent injury to the teat canal.

Chapped or Chafed Teats.

Mostly caused by ticks, dirty hands of milker, or leaving the teats wet. Do not handle the cracks in the teats more than is necessary. Apply a soothing substance such as olive oil and glycerine in equal parts. Occasionally wash the teats with a little soap and water (warm). Keep them as dry as possible, and in bad cases it is better to use a syphon for drawing the milk.

Hoven or Blown Up.

This is technically known as Tympanitis and is a fairly common ailment seen in dairy cows, especially if turned on to a new and luxuriant pasture or given a big feed of freshly cut lucerne. It needs prompt attention, but may easily be dealt with by the farmer himself.

Symptoms.—The stomach of the animal is blown up, and when struck or tapped with the hand it sounds like a drum. The animal groans, stretches its neck, and generally appears to be restless, with great distress. There is grinding of teeth and ejection of wind.

Cause.—It is due to gases formed in the stomach brought about by the animal eating too much young and sappy green food, or sudden change from dry feed on to succulent green stuff or overeating lucerne, etc. It may also be brought on by the animal drinking cold water directly after it has had a bellyful of fresh lucerne.

Treatment.—Give the animal 1 lb. Epsom salts and 2 oz. of ground ginger dissolved in water. If this does not bring relief to the animal a veterinary surgeon should be called in if possible. It is as well to keep a trocar and canula always on the farm. This is an instrument for piercing the abdomen of the suffering animal and letting the gases escape. The point to pierce is midway between the last rib, the hip-bone and the back-bone, in the soft and slightly hollow part of the cow's stomach on the left side. Puncture the stomach in a downward and forward direction, withdrawing the trocar immediately afterwards and leaving the other part in to keep the hole open until all the gases are free and the animal has relief. Wash the wound with antiseptics such as Jeyes' or Condy's fluid, and see that it does not fester.

Ringworm.

This is a very common complaint seen on nearly every farm in South Africa where cattle are kept on the kraaling system, and once started it spreads

rapidly, principally among calves and young stock. It is due to a vegetable parasite which attacks the animals when they are in poor condition, especially young stock towards the end of our dry South African winter, when the blood of the animals is usually in a poor condition.

Symptoms.—Spots appear on the animal about the size of a shilling, enlarging afterwards to the size of a five-shilling piece, principally on the head and neck of the animal—round the eyes and nose being the chief places. The hair falls off the affected parts, and the patches are greyish with crusty wart-like growths which show up the affected parts.

Treatment.—This disease is conveyed from cattle to man, hence care should be exercised in dealing with it. Never handle an affected animal without gloves on. Wash the parts affected with strong carbolic soap and water, using a brush to do it with, and break the crusty parts over the surface. Then dry the parts and rub thoroughly but lightly, so as not to injure the animal. Use a mixture such as the following :—

Black sulphur	2 ozs.
Oil of turps	2 „
Sulphuric acid	½ „
Lard	½ lb.

Disinfect the calf pens with Jeyes' or Condy's or other good disinfectant, and give the animals a second dressing of the above mixture, if seen to be necessary.

CHAPTER IX

THE CHEMISTRY AND TESTING OF MILK AND CREAM

Milk.

MILK is a secretion from the mammary gland of the female mammal. It is composed of water, fat, casein, albumin, and ash. The condition in which these parts are present varies. The water is present in its usual form. The fat is held in suspension in the form of tiny globules which are invisible to the naked eye and require a powerful microscope to see them. The casein is held partly in suspension and partly in solution. The albumin is present in solution. The sugar is present in solution; while the ash or mineral portion is held partly in solution and partly in suspension.

If a small quantity of milk be heated until all the water is driven off, that is to say, if milk be heated to 212° F. (boiling point) until no further loss in weight occurs, the part that is left being solid is known as milk solids. As this includes everything in the milk except the water, we call it total milk solids; but as in a large part of dairy work we deal with the milk fat alone, we come to speak of total milk solids in terms of "Fat" and "Solids not fat."

$$\left.\begin{matrix}\text{Fat} \\ \text{Solids not fat}\end{matrix}\right\} = \text{Total milk solids.}$$

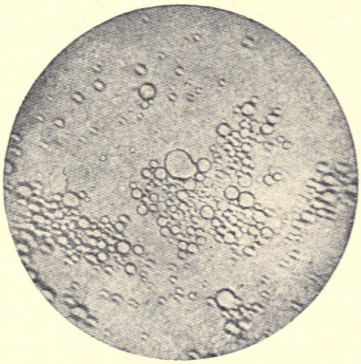
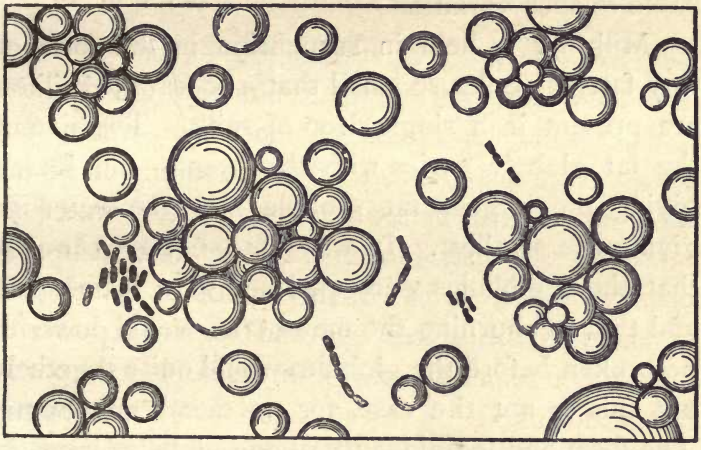


FIG. 10.—A SINGLE DROP OF MILK SEEN THROUGH A MICROSCOPE, SHOWING FAT GLOBULES.

The total milk solids in milk vary according to different animals, breed, age, etc. This variation has led to dishonest practice, so much so that a standard was decided upon by the English Law.



MICROSCOPICAL APPEARANCE OF ORDINARY MILK, SHOWING FAT GLOBULES AND BACTERIA IN THE MILK SERUM.

The cluster of bacteria on left side are lactic-acid forming germs.

The standard as fixed by law in England has to contain not less than 3 per cent. of fat and not less than 8·5 per cent. of "solids not fat." The average composition of milk, however, is :

Water	87 per cent.	
Fat	3·5 „	
Casein	3·25 „	
Albumin	0·5 „	"Solids not fat."
Sugar	5 „	
Ash	0·75 „	

Milk at.

The average percentage of fat in milk is generally put down at 3·5 per cent.—it may fall

below 3 per cent. or rise to 6 per cent. or more. The first milk drawn from the cow may register as low as 0·5 per cent., while the strippings may go as high as 10 per cent. The "solids not fat" are not liable to such variation.

Milk fat is held in suspension in the form of tiny fatty globules so small that 100 to 150 million are present in a single drop of milk. The size of the fat globule varies with the breed—the Jersey giving the largest fat globule and the Ayrshire giving the smallest. It was at one time thought that these globules were enclosed in a membrane, and that in churning the membrane would have to be broken before the globules would unite together, but this is not the case, for no membrane exists. The form and individuality of the globules is maintained by surface tension which, pressure being equal on all sides, causes the globules to assume a spherical shape. Milk fat is really a mechanical mixture of a number of different fats, and the physical properties of butter to be made from it are largely dependent upon the proportion in which these fats are present. The composition of milk fat is as follows:

Butyrin	6 per cent.	Milk fat.
Caprin	6 „	
Caproin		
Caprillin		
Laurin		
Stearin	50 „	
Palmitin		
Myristin		
Olein	38 „	

Some of these fats are known as hard and some as soft.

Palmitin and stearin are white, and are hard at the ordinary temperature and melting at a temperature of 146° F.

Olein makes up nearly 40 % of the weight of butter, and it differs from the others in that it begins to melt at the ordinary temperature, and is not hard unless in very cold weather or in the presence of ice. It has the property of melting the other fats, which accounts for the oily appearance of butter should the day be slightly warmer than usual. The larger the percentage of olein present in milk fat the softer will the butter be.

Butyrin is the characteristic part of milk fat, its presence or absence being the distinguishing point between pure butter or margarine. When this fat decomposes it sets free butyric acid, which has a rancid smell. The rancidity sometimes present in butter is due to its being set free. When the fats in milk decompose fatty acids are set free, which, being present in butter to the extent of 8 %, may be driven off in a current of steam. They are then said to be volatile. The amount of volatile fatty acid which may be set free from margarine is very low indeed, because animal and vegetable oil used in its manufacture contains no butyrin.

	Good butter.	Poor butter.	Margarine.	Suet.
	per cent.	per cent.	per cent.	per cent.
Total volatile fatty acids	8 to 9	7 to 8	0·8	0·44
Total non-volatile acids	82 to 82·9	83 to 84·5	93·4	91·12

Showing the difference between butter and animal fat.

Casein.

This is present in milk in suspension and partly in solution, the average amount being three per cent. The amount present is practically always the same, but it may vary slightly from 2·5 to 3·5 %, and it is the object of cheese-making to recover the casein from the milk, which is brought about by the activity of rennet with formation of lactic acid and change of casein into an insoluble form. It is then known as the curd, and contains the milk fat embedded in the mass.

Albumin.

The amount present in milk is from 0·5 to 0·75 %. It is present in solution, but when the milk is boiled it coagulates and forms a skin on the top of the milk. It is not coagulated by rennet, and it closely resembles the white of eggs. When milk is boiled it acquires a different taste to fresh milk; this is on account of the albumin being set free. The amount present in milk does not vary except in cases of newly calved cows, when the

colostrum or beistings contain as high as 17·6 % albumin, and this is why beistings turn thick when boiled.

Milk Sugar.

This is present in milk to the extent of 5 %. In appearance it is like confectionery sugar, but not so sweet. It is present in the form of solution, and varies from 4·6 to 5·5 %. It plays a very important part in the making of successful creamery products indirectly, being the part of clean milk from which the acid develops when it is allowed to stand. When clean milk has a sour taste it is the sugar which has been changed into lactic acid. This is brought about by small organisms known as lactic ferment or lactic bacteria. These lactic germs feed on the milk sugar and break it down into simpler forms of sugar known as grape and galactose, these being afterwards turned into lactic acid. When the lactic germs get to work in fresh milk the average acid test is about 0·2 %, even when the milk has no taste of it. When there is a distinctly sour taste the acid test is about 0·4 %, while the milk turns thick when 0·7 % has been reached. Milk very seldom develops more than 2 % acidity or lactic acid however long it stands ; this is because all the milk-sugar has been consumed and lactic acid formed ; the bacteria, having nothing further to work on, remain dormant or decay. The lactic ferment is,

when working in clean milk, a healthy ferment when the organisms are living and not harmful as a food. But should the milk have been standing three or four days and there is no more acid being formed, it is nothing but a putrid mass and should never be eaten.

Cream.

Cream may ordinarily be described as that part of the milk which rises to or near the surface when it is left standing for a short while. The milk fat being the lightest part of milk naturally rises, and thus cream is composed mostly of milk fat. The method of gathering cream by letting the milk stand is too long for present-day use. We therefore use a centrifugal machine which on receiving whole milk into its works divides it into two parts, the lightest and the heaviest. The machine used, of course, is the ordinary separator. Now the separator does not take out the fat in its pure form, but a certain proportion of water and other parts of the milk go with it. Thus, if we put 100 lbs. of milk through a separator at suitable temperature, 85° F. to 90° F., we shall get on an average 20 lbs. of cream and 80 lbs. of skim milk. The fat left in the separator milk, or skim milk as it is called, will vary from 0·05 % to as high as 0·25 %, while the proportion of milk fat in cream will vary from 8 % to as high as 60 %, according to the thickness at which the cream is taken or method of working the

separator. The "solids not fat" in cream are slightly less than in whole milk.

The Average Composition of Cream.

	Water.	Fat.	Sugar.	Casein and albumin.
	per cent.	per cent.	per cent.	per cent.
Thick cream	39·37	56·09	2·29	1·57
Thin cream	67·5	25·67	3·66	2·60

From the foregoing table it is seen that thick cream contains less water, sugar, and casein than thin cream, which accounts for the reason of thick cream keeping longer in hot weather than the thin. The larger the amount of sugar and casein present in cream the quicker it undergoes change and becomes bad. This is why the creameries prefer to receive a cream testing 50 per cent. of milk fat rather than one testing 25 per cent. in sunny South Africa.

Milk and Cream Testing.

The Creamometer.

This is a glass vessel for determining the amount of cream in milk. It is usually about 10 inches high and about 1½ inches in diameter. It is divided by a clearly marked scale beginning with 0 at the top and 100 at the bottom. The milk to be tested is put in until it reaches the top of the graduations where it is marked 0. It must be kept perfectly still and at an even temperature, when after 24 hours the percentage of cream can be read off. This

however is not entirely reliable, because some cows' milk throws up the cream better than others according to the breed. But this instrument can give some idea of what amount of cream one ought to get from 100 lbs. of the same milk put through a separator.

The Lactometer.

The Lactometer is an instrument for determining the weight or specific gravity of milk. It consists of a glass stem with a bulb at the bottom which contains either mercury or small shot. This is to enable it to stand upright in a liquid. The stem is graduated, generally ranging from 0 to 40; the point to which the stem sinks in pure water being 0, while 40 would be the point to which it sinks in a liquid whose specific gravity is 1040, the standard of water being taken as 1000°. Milk is heavier than water, while separated milk is heavier than whole milk and the fat is lighter than water.

Water	specific gravity	=	1000°
Milk	„	=	1030°
Separator milk	„	=	above 1034°
Milk fat	„	=	910°

A low specific gravity according to the lactometer indicates either that the milk is very rich in fat or that the milk has been watered. A high specific gravity indicates that the fat has been skimmed off the milk or that separator milk has been added to it.

When taking the specific gravity of milk by lactometer the temperature of the milk should be

as near 60° Fahrenheit as possible, in order to get an accurate reading.

Gerber Milk Test.

The Gerber Milk Tester is an apparatus used for testing milk, in order to find out what percentage of fat it contains. The complete tester, including bottles, pipettes, amyl alcohol, and sulphuric acid, may be obtained through any South African Creamery Co. or dealer in supplies.

We begin this test by measuring off the amount of sulphuric acid to be used—10 cubic centimetres. A special pipette or glass measure is supplied with the apparatus, which gives the different measures. Having measured 10 cubic centimetres of acid this is placed into the test bottle and followed by one cubic centimetre of amyl alcohol of the best quality, and this is followed by 11 cubic centimetres[1] of the milk to be tested. Care must be taken that these are all introduced into the test bottle in the order given. The cork may now be placed in position and the test bottle well shaken in order to mix the contents, care being taken to mix the acid in the neck with that in the body of the bottle. If more than one test is being made, place those bottles which have been prepared in a bath of hot water which should be at a temperature of 130° to 150° F. When all the bottles are ready place them in the machine as indicated, and turn the handle of

[1] Known hereafter as c.c.

the machine at a good speed for three minutes. The bottles are then taken out and replaced in a hot-water bath and then each bottle read. If, however, the layer of fat is not sufficiently high in the bottle the cork should be pushed in a little more, which will bring the fat layer completely within the division marked on the bottle. Each of these divisions is equal to 0·1 per cent. If the sulphuric acid used is too weak, particles of curd will remain undissolved and will accumulate during the whirling at the bottom of the fat layer; this must not be read in with the fat when determining the percentage. If the acid used is too strong, charring of the curd will take place, and the fat layer will be of a dark brown colour and be nearly impossible to read correctly. The sulphuric acid should have a specific gravity of 1·825 to be the correct strength for this test.

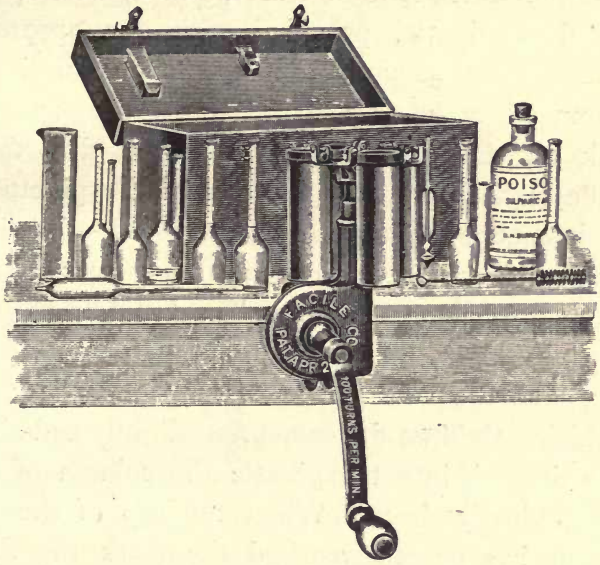
If froth accumulates on the top of the fat layer, the bottles should be placed in hot water for four or five minutes and then whirled in the machine once more.

If an odd number of tests are being made, the bottles must be arranged in the machine so that they will balance; if necessary, a bottle filled with water may be used to make an even number.

If separated or butter milk is being tested, place the bottles in hot-water bath for five minutes after whirling, then whirl them a second time, after which the fat may be read as with milk.

Babcock Milk Test.

The Babcock milk and cream tester is the simplest and quickest form of milk testing yet devised. The machine, together with all apparatus, may be purchased through any creamery company



BABCOCK TESTING OUTFIT.

or dealer in dairy supplies at a nominal cost. Every dairy farmer should possess one in order to find out the butter-fat yield of his cows.

The milk-test bottles are graduated to read up to 10 % butter fat; this amount, however, is rarely found in milk. The graduations on the bottle are made on the basis of 18 grammes of milk being tested, having a temperature of 60° Fahr. This is

equal to 17·5 c.c. by measure. But as some of the milk will adhere to the pipette by which it is measured, we use a pipette to hold 17·6 c.c. to ensure that exactly 17·5 c.c. will be delivered into the milk-test bottle. We therefore stir the milk well which is to be tested, and draw it up into the glass pipette, provided with the apparatus, by means of suction from the mouth until the column of milk rises in it above the 17·6 c.c. mark on the glass. Next slip the first finger of the right hand over the top of the pipette on the instant of removing one's mouth—this is to prevent the milk column from running out; holding the pipette between the thumb and middle finger of the right hand, this is easily accomplished. We now have the milk above the 17·6 c.c. mark, and by raising the first finger ever so slightly and allowing a little air into the pipette the column of milk will gradually drop. When the top of the milk column has exactly reached the mark the finger may be pressed down tightly to prevent the milk going any lower. A little practice will soon enable one to do this perfectly. Having now obtained the required amount of milk 17·6 c.c. to be tested, this may be run into the milk-test bottle by placing the end of pipette in the neck of the milk-test bottle, and removing the finger from the top and allowing all the milk to run into the bottle. We now add 17·5 c.c. of sulphuric acid. This should be measured, and *never drawn up by means of pipette*, for one may

put on too much suction and draw up a mouthful before being thoroughly aware of amount drawn up. This is a highly dangerous practice drawing up acid by the pipette, therefore see that there is a 17·5 c.c. acid measure with the outfit you buy. Having measured our acid, it may now be added to the milk in test bottle, putting it in slowly by running it down the sides of the neck of the bottle. This may be accomplished by holding the milk-test bottle in a position so that the neck of bottle leans at an angle towards the sulphuric acid which is being put in. The reason is to let the acid in slowly, to prevent charring or burning and so spoiling the test, and also to wash down any milk or cream clinging in the neck of test bottle. The bottle is next shaken gently, holding it by the neck, shaking slowly to and fro until the contents are darkened, which is caused by the hot acid dissolving everything in the milk except the fat. The test bottles with their contents are now placed in the machine, which is whirled rapidly by turning the handle for about five minutes, all the fat coming to the surface of the mixture in the bottle through centrifugal action. The bottle is now filled up with very hot clean water in order to raise the fat into the divisions marked on the neck of bottle. Whirl the bottles again in the machine for another two minutes, when the amount of fat may easily be read off, measuring it by means of a pair of compasses or dividers. Each division on the scale of the milk bottle is

0·2 % of milk fat, *i.e.* five small divisions to every big division marked. Three big divisions by this reading would mean that in every 100 lbs. of the same milk as tested there are 3 lbs. of pure fat. This is the only accurate means of finding out the amount of butter fat produced by each cow when the yield of milk has been recorded in lbs. for the entire lactation period.

Babcock Cream Test.

In testing cream the same machine is used as for milk, but we use a different test bottle and a smaller pipette. Babcock cream-test bottles are usually marked in divisions to read up to 30 % of fat. As in the milk-test bottles, the divisions are made on the principle that 18 grammes of cream have been delivered into the bottle. But as a great deal of South African cream will register over 30 % of fat, we use only half quantities and then multiply the result by two. The bottles for milk testing cannot be used for cream, so it is therefore necessary to see that the apparatus bought contains the different bottles for the two tests.

The cream to be tested should be first warmed in order to allow of its being thin enough to be sucked up into the pipette, especially if the cream is cheesy or stale, but it must be cooled down again so that the temperature is 60° when being measured off for the test, proceeding in the same way as with milk, only in this case using the smaller

pipette and measuring off 9 c.c. of cream. This is then run into the cream-test bottle. As some of the cream will stick in the pipette we wash this loose by drawing up a little clean hot water into the pipette up to the 9 c.c. mark and run this washing into the test bottle with the cream already there. We now measure out 17·5 c.c. of sulphuric acid and add slowly in same manner as for milk. Rotate slowly until all cream is dissolved and darkened in colour, proceeding with the test in the same manner as for the milk test. In reading the cream test the result is multiplied by two: Thus, if the result shows 25 divisions of fat in a 30-division bottle, the test is 25 × 2 = 50 per cent. butter fat.

Butter *v.* Butter Fat.

This means that in 100 lbs. of cream with above test there are 50 lbs. of pure butter fat; but if the farmer churns this 100 lbs. of cream he would get on an average 60 lbs. of butter suitable for market. This difference of market butter over the butter fat test is known as the "over-run." In this case the 10-lb. difference is made up of 1½ lbs. salt, ½ lb. curdy matter, 8 lbs. of water. A farmer should not be misled by comparing the results from a private churning with the test of the same cream as given by the nearest butter factory, for the average creamery only pays the farmer for the amount of pure butter fat in his cream, and not for the amount of butter which said cream might make.

Every farmer should own a Babcock milk-testing outfit, which should include at least—

2 milk-test bottles.
2 cream-test bottles.
1 milk pipette measuring 17·6 c.c.
1 small „ „ 9 c.c.
1 17·5 c.c. acid measure.
1 bottle sulphuric acid (specific gravity 1·825) sufficient for 100 tests.

Always keep the sulphuric acid where children and natives cannot reach it. Always stir the cream or milk thoroughly from which a sample is to be tested, for on standing the fat rises, and if a sample be taken from the top the result is an unfair and inaccurate test.

Composite Sample.

A composite sample is one consisting of a number of samples taken from the same source. In taking the composite sample of one cow's milk a quantity of milk must be taken at each milking in proportion to the amount of milk yielded. To do this, pour the milk into a can possessing perpendicular sides and flat at the bottom of the can. Introduce a glass tube to the bottom of the can, holding the tube straight up and down, and by placing a finger or thumb on the open end, withdraw a column of milk and run it into the bottle set aside for sample. This may be kept sweet by potassium bichromate, about as much as will cover the point of a penknife being used, placed in the bottle. Sometimes a few drops of formalin are used.

CHAPTER X

WHY CREAM TESTS VARY

By E. O. CHALLIS, Superintendent of Dairying of the Union of South Africa.

Object of Bulletin.—There are many reasons why a bulletin of this nature should be written, and issued by the Union Division of Dairying, as such Division is a disinterested party and has only one object in view, viz., to assist and develop the dairy industry of South Africa to its utmost capacity.

When properly thought out dairy legislation is introduced and enforced in this country, the systematic inspection of all creamery books will be carried out, and the amount of butter fat purchased will be compared with the amount of commercial butter sold, in order to ascertain whether the cream supplier is receiving just and fair treatment.[1]

Meanwhile, it is well to demonstrate, with the assistance of figures, why cream tests do and always will vary, and also to give a few practical hints to suppliers on the management of the cream on their farms, with the object of assisting both supplier

[1] This has since become law.

and creamery, by increasing the percentage of first-grade creams.

The Cream Separator.—The proper handling and management of the cream separator is becoming, I am glad to say, more generally known, but at the same time a vast number of our cream suppliers have still a lot to learn in this respect, so it will be as well at this stage to touch on some of the salient points which affect the perfect separation of the cream from the milk, especially in view of the fact that the reason why cream tests vary depends almost entirely on whether the separator is being worked correctly or the reverse.

It is not within the province of this bulletin to specify any particular make of separator, as there are several excellent machines on the market, as well as numerous bad ones. In selecting a machine the supplier should choose one that is simple and solidly constructed, easy to clean and turn, has a minimum of spare parts to be replaced, and, above all things, one that skims clean.

A cheap separator is dear at any price, as it quickly wears out, frequently requires new parts, and, after a comparatively short period, will cause no end of friction between the creamery management and the supplier owing to the variations from day to day in the consistency of the cream which these cheap machines produce. Another great mistake which is so frequently made when purchas-

ing a cream separator is to select one with a too small capacity. Except for those people who only keep one or two cows, I do not advocate the use of any machines with a capacity of less than 45 gallons per hour. The life of small machines is far shorter than that of larger-sized ones, owing to the increased time required for separation and the excessive speed at which they have to be driven ; neither do they perform such good work, especially if worked for any length of time, as the machine has to be frequently stopped to enable the bowl to be cleaned out, which owing to its small capacity easily becomes clogged.

To ensure good work being performed by any separator, the first thing to attend to is to see that the machine is firmly set up on a solid foundation, care being taken to ensure that the latter is perfectly level. These points are too frequently neglected, with the result that the machine quickly gets out of order, and clean skimming becomes almost impossible. In selecting a foundation for a machine, it should be borne in mind that those types of machines which have a suspended bowl can be placed directly on a cement floor, a cement block, or solid stone foundation. All other machines which have not the suspended type of bowl can be similarly fixed, but must have a wooden cushion inserted between the base of the machine and the solid block foundation. This latter precaution I

know from experience to be very necessary, as I have often observed good types of machines that frequently go wrong owing to their having been bolted down direct, on either a stone or concrete base.

The Principle of Separation.—Before coming to the main issue as to why cream tests vary, it will be as well to explain briefly the principal factors which actually cause the cream to separate from the milk, as when these factors are known, the reasons for variations in cream tests will be the more easily understood.

Generally speaking, the law of gravity as applied by centrifugal force is the principle on which all cream separators work. This law of gravity, when applied to milk in conjunction with centrifugal force, causes the cream to separate from the skim milk, owing to the former being lighter than the latter. Thus, when new milk is admitted to the bowl of a separator which is revolving at a great speed, the skim milk being the heaviest portion of the milk is immediately thrown to the most distant part of the circumference of the bowl, *i.e.* against the outer walls of the bowl, and the cream being the lightest portion cannot possibly be thrown so far, consequently it remains nearer the centre of the bowl. To make this point quite clear, take a cork in place of the cream and a stone in place of the skim milk, and exactly the same effect will be obtained, as no

person could throw a cork the same distance as he could throw a stone, neither can centrifugal force throw the cream the same distance as it can throw the skim milk. Having endeavoured to explain the broad principles upon which all cream separators work, it will be as well to look into some of the salient points which either produce clean or indifferent skimming. Many of the troubles which beset the user of a cream separator and often perplex the expert user can generally be overcome by using a little patience and common sense.

Given a first-class machine of reputable make, and avoiding the cheap and nasty variety, then indifferent or imperfect skimming can usually be ascribed to one of the following causes, or a combination of several:—

1. Too slow speed of handle.
2. Too cold milk.
3. Inflow too fast or too slow.
4. Irregular turning of handle.
5. Milk not fresh from the cow.
6. Bowl out of balance.
7. Machine not fixed firmly, and not level.
8. Bad and insufficient lubricating oil.
9. Bowl left unwashed from last skimming.

Any good make of separator will skim cleanly if the above points are all attended to, and the user handles the machine properly. It should also be

borne in mind that milk three or four hours old will skim as badly at correct temperature as new milk freshly milked will do when even 15° Fahr. below the correct temperature. Milk straight from the cow requires no reheating if it has not fallen below 86° F., but if the milk is older and the temperature has fallen considerably it should be reheated to 90° F. to obtain the best results and prevent loss of butter fat in the skim milk. In working a cream separator the following points are well worth the operator's consideration and attention :—

1. Too thick cream means a tendency to bad skimming.
2. Slow speed of handle or irregular turning results in bad skimming.
3. Too fast inflow results in bad skimming.
4. Too thin cream gives better skimming, but too thin cream will not keep, or travel well, so gets second graded.
5. Too slow inflow gives thicker cream and good skimming, but cream is apt to accumulate in the bowl, and cause bad skimming later on.
6. Too rapid speed of handle gives same results as No. 5.

Consistency of Cream.—Under this heading we at once touch on the root of all the trouble which

exists between the cream suppliers and the respective creameries, in so far as the variations in cream tests are concerned.

After a long and varied experience of dairying in every part of South Africa, I have come to the conclusion that creams which only vary in butter-fat content between 40 % and 50 % give the most satisfactory results. Personally I prefer a 45 % cream, but so long as the butter fat does not fall below 40 % or exceed 50 % excellent results can be obtained. What, however, is found to exist in actual practice is quite another story. One has only to examine the testing registers at the various creameries, when it will be noticed that cream tests vary from 15 % to over 60 %, and it is just these variations in the consistency of the cream which worry the life out of our creamery managers, and cause so much dissatisfaction among the cream suppliers. Further than this, how very frequently one hears the remark that So-and-so's test this week was 55 %, but So-and-so beat him as his test was over 60 %. Now if these suppliers would only think for one moment they would soon come to the logical conclusion that they are producing not only a very heavy-bodied cream which the creamery manager does not require, but are doing so at a considerable loss to themselves, for no separator will skim as clean when producing creams containing from 55 % to 60 % butter fat as it will when the test

is below 50 %. This is more especially true when inferior machines are used, or machines with a small capacity and which are usually worked too long before being stopped to clean out the bowl. If we consider that, even when separating is conducted on a farm under the most favourable conditions, ·10 of 1 % is usually left in the skim milk, and that when working under unfavourable conditions, such as producing a very heavy-bodied cream, the loss of butter fat in the skim milk can easily be raised to ·17 of 1 %, the monetary loss incurred, when spread over a year's working, is very considerable, and not only is it considerable, but the supplier is producing a class of cream which is neither asked for nor required.

Adjustment of the Cream Screw.—Being so frequently asked how to produce either thick or thin cream, especially among suppliers who are not familiar with the principles upon which cream separators work, and who possibly have no directions to guide them, I would at this stage lay down certain cardinal factors which should enable any supplier to adjust his machine whether he has directions available or not.

Every separator being provided with an adjustable regulating screw, the first thing for the operator to ascertain is whether this regulating screw acts on the cream or the skim-milk outlets. If the former, then if thicker cream is required, the regu-

lating screw is turned inwards, and if thinner, just the reverse. The reason for this effect being produced is that, owing to the fact that thick or heavy-bodied cream is lighter than thin cream, it consequently remains nearest the centre of the bowl, and also that less skim milk escapes with the cream when the regulating screw is turned inwards, and in the same way more skim milk escapes with the cream, should the screw be turned the reverse way. On the other hand, should it be observed that the regulating screw is acting on the skim-milk outlet in the bowl, which is the case with many machines, then the operator must adjust the screw in exactly the opposite direction to that required when the screw is acting on the cream outlet. This may appear to the uninitiated somewhat of an anomaly, but it is nevertheless true, as when a regulating screw which acts on the skim-milk outlet is turned inwards, it produces a thinner cream owing to the fact that by reason of turning the screw inwards it reduces the size of the skim-milk outlet, thus forcing more skim milk out with the cream and naturally resulting in the production of a thinner cream. By the same rule when the screw acting on the skim milk is turned outwards, the reverse effect is produced. It should also be borne in mind that, whether the regulating screw is acting either on the cream or skim-milk outlets, half a turn of the screw, one way or the other, makes a tremendous

difference in the consistency of the resulting cream.

I have dwelt at some length on the various points connected with the successful working of a cream separator, and I offer no apology for doing so, as the greater the knowledge our cream suppliers possess of the working of their machines the less likely are they to find any necessity for complaining in regard to the variations in their cream tests.

Why do Cream Tests vary?—In order to arrive at accurate and definite conclusions as to why cream tests will vary from day to day, a very large amount of detailed work has had to be undertaken. Through the kind permission of Mr. Kneen, the Transvaal Dairy, Pretoria, was placed at my disposal, and numerous speed trials were conducted there. Several other sets of experiments were also undertaken at the Schools of Agriculture, Potchefstroom and Cedara, by officers of this Division. A new 45-gallon separator of approved type was used in all the experiments, and only those results which were definite and proved accurate by check tests have been reproduced in this bulletin.

Perhaps the most important point of all, and the one most frequently neglected, can be summed up in the one word "speed." The importance of turning a cream separator at the correct speed cannot be over-estimated, as speed has such a far-reaching effect on the consistency of the resulting

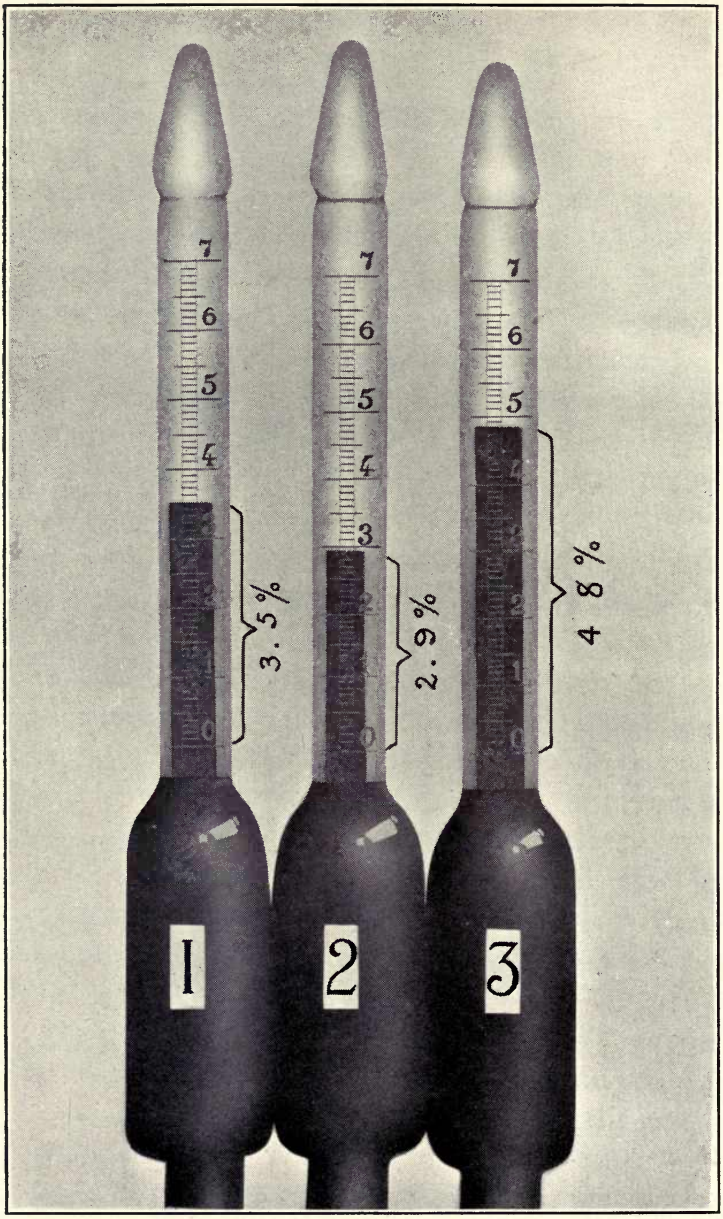


FIG. 11.

Representing percentages of butter fat contained in the milk used during the various trials, excepting speed trial No. 1, the butter-fat content of the milk used in this trial being 4·3 per cent. by the Gerber milk tester.

cream that too much care cannot be exercised in order to maintain a uniform and correct speed, as by doing so less variations in the cream will occur.

Fig. 11 above shows the percentages of butter fat contained in the various milks which were used throughout these trials (with the exception of the first), and it will be observed that these percentages vary from 2·9 % to 4·8 %. Table I. gives purely the result of working a separator at varying speeds. It will be noticed from the figures given that turning the handle at the correct speed, viz. 60 revolutions per minute, gave a cream containing 54 % of butter fat, but when the speed was reduced to 45 revolutions, using the same machine and the same milk, the percentage of butter fat in the resulting cream was immediately reduced to 26 %, whilst irregular turning, such as turning the handle sometimes too fast and then too slow, produced a cream containing 44 % of butter fat. All these factors go to show how very easily cream tests can fluctuate from day to day simply through varying the speed of the separator. I fear that cream suppliers do not realise sufficiently how important a matter speed is in connection with cream separating, as they have so frequently assured me that their separators are always turned at the correct speed, whereas I know from experience that this cannot be the case, especially with the class of labour usually employed in

this country. The best method to employ, especially with natives, is to use a simple little instrument called a metronome, shown in Fig. 12.

SPEED TRIAL.—TABLE NO. I.

Number.	Weight of milk used.	Per cent. of butter fat in milk.	Temperature of milk.	Number of revolutions per minute of separator handle.	Per cent. of butter fat in cream.
1	41 lbs.	4·0	86° F.	60	54
2	41 „	4·30	86° F.	55	46
3	41 „	4·30	86° F.	50	31
4	41 „	4·30	86° F.	45	26
5	41 „	4·30	86° F.	Irregular turning.	44

This can easily be adjusted to suit the speed of any machine, and the pendulum, which merely swings backwards and forwards, acts as a guide to the native working the separator; in fact, if the metronome is correctly set, and the handle of the machine is turned exactly in time with the swinging of the pendulum, then, and then only, can the cream suppliers safely say that the speed of their separators has been correctly maintained. It is always advisable to work a separator at the speed recommended by the makers, or if anything 3 to 5 % higher rather than lower. The only time when it is permissible to reduce the speed of any machine is when the feed tin is partially empty. This, however, can easily be regulated by watching the cream as it leaves the cream spout. If this turns in under

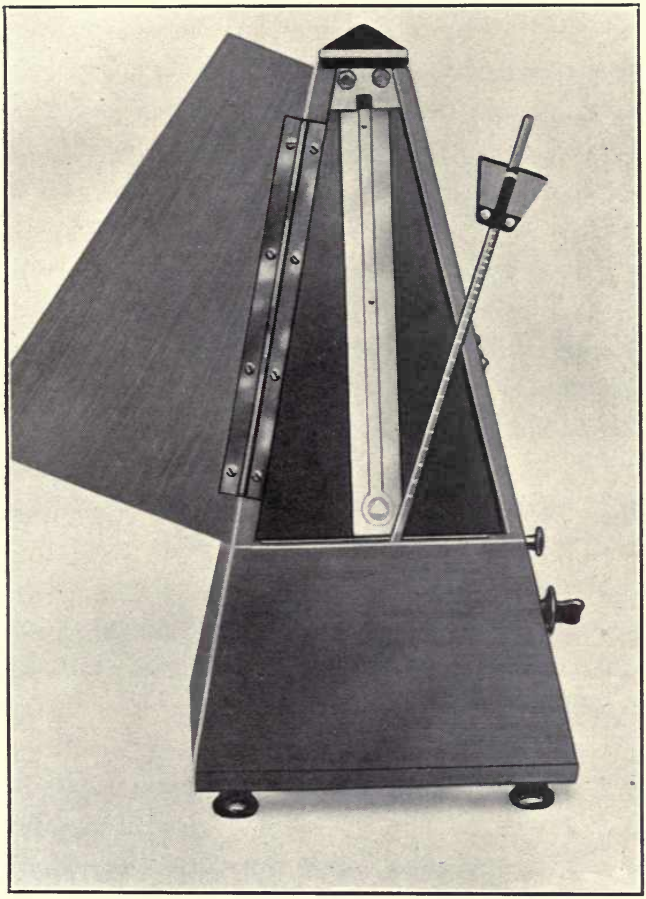


FIG. 12.—METRONOME.

A useful little instrument for checking and regulating the proper speed for turning the separator crank. Was employed during these experimental trials.

the spout, then it shows that the speed of the machine is too great for the amount of milk which is passing through the bowl; and on the other hand, if the cream shoots out from the spout with a slight twirl, then it shows that either the separator is not properly adjusted or else that the operator is turning too slowly. When the cream falls nearly but not quite straight from the spout to the cream bucket, this is usually with most makes of machines about the right consistency.

But these speed trials have conclusively shown how easily supplier's cream tests can vary from day to day, but there is another aspect which must not be lost sight of, and that is, that although cream tests do vary, it does not always follow that a supplier is receiving any less for a low test than he is for a higher one. For example, if two suppliers were given 50 gallons of milk each, containing 4 % butter fat, and each worked his machine at the correct speed and under equally favourable conditions, one supplier might produce a 45 % cream, and the other a 34 % cream, and yet both receive the same monetary value for the butter-fat content in the cream so produced, as the volume of the 34 % cream would be greater than the 45 % cream.

Assuming that the conditions of separating in each instance were identical, and the percentage of butter fat in the skim milk approximately the same, then it simply means that one supplier's separator

is regulated to produce a 45 % cream and that of the other a 34 % cream, and the only advantage gained, from a financial point of view, by the supplier who despatched a 45 % cream to the creamery would be through the extra amount of skim milk he would have available with which to feed his calves and pigs.

Table II. gives complete figures of a second speed trial conducted in Pretoria. It will be observed that when the machine was turned at the correct speed of 60 revolutions per minute it produced cream containing 34 % of butter fat; on the other hand, when the speed was increased from 60 to 74 revolutions, the butter fat in the resulting cream was increased to 52 %, thus showing that too high a speed will increase the butter-fat content of cream very considerably, just in the same way as too slow a speed will correspondingly reduce it. The figures in Table II. point to the fact that the best result is obtained when turning the machine at the correct speed. It must also be borne in mind, that when a machine is being worked every day under ordinary farm conditions nothing like the low percentages of butter fat would be found in the skim milk as are depicted in Table II. As previously stated, if under ordinary circumstances a separator only leaves 0·10 of 1 % in the skim milk, then it is performing very good work.

Fig. 13 gives a very good illustration of the

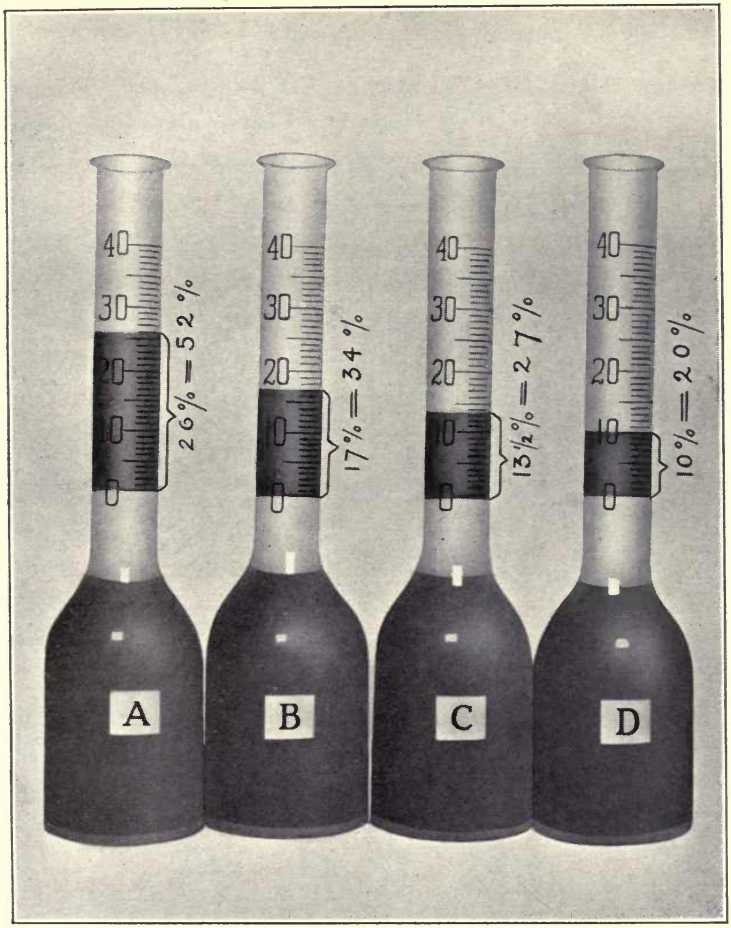


FIG. 13.—BY BABCOCK CREAM TESTER.

Representing the butter-fat contents of cream obtained from the same milk, the speed of the separator being varied in each instance. The following are the differences :—

Sample A, turning the separator crank too fast, namely 74 revolutions per minute, producing 52 % butter fat in cream.

Sample B, turning at correct speed, viz. 60 revolutions per minute, produces a cream containing 34 % butter fat.

Sample C, turning at irregular speed, produces a cream containing 27 % butter fat.

Sample D, turning at low speed, viz. 40 revolutions per minute, produces a cream containing 20 % butter fat.

(For full details of this trial see Table No. II.)

SPEED TRIALS.—TABLE NO. II.

Bottle labelled.	Trial number.	Weight of milk used.	Temperature of milk.	Test of milk.	Total fat in milk.	Number of revolutions of separator crank.	Weight of cream obtained.	Test of cream.	Total fat in cream.	Weight of skimmed milk.	Test of skimmed milk.	Total fat in skimmed milk.	Total fat in cream and skimmed milk.	Loss of whole milk during trial and separation.	Loss of fat adhering to utensils, etc., irrecoverable.
		lbs.	F.	%	lb.		lbs.	%	lb.	lbs.	%	lb.	lb.	lb.	lb.
A.	1	41	90	3·5	1·435	74	2·7	52	1·404	38·2	0·03	0·011	1·415	0·1	0·020
B.	2	41	88	3·5	1·435	60*	4·2	34	1·428	36·7	0·015	0·005	1·433	0·1	0·002
C.	4	41	86	3·5	1·435	Irregular	5·2	27	1·404	35·6	0·05	0·017	1·421	0·0	0·014
D.	3	41	88	3·5	1·435	40	7·0	20	1·400	33·9	0·05	0·017	1·417	0·1	0·018

* Correct speed.

various percentages of butter fat obtained in the second speed trial, and should prove very conclusively how easily the butter-fat content of cream can vary very materially even from the same milk, if the correct speed is not maintained.

In making the tests as shown in Fig. 13, 9 grammes of cream by weight were taken, so the percentage of butter fat as depicted in the necks of the bottles must in each instance be doubled.

Turning now to the third set of experiments, viz. the effect of separating under identical conditions naturally rich and naturally poor milks, we again arrive directly at another reason why cream tests vary, even though the separator be turned at the correct speed. Table III. gives the complete figures obtained in this trial, and Fig. 14 the percentages of butter fat contained in the cream from the respective milks. It will be noticed that the percentage of butter fat contained in the cream when using a 4·8 % milk was 49 %, whereas when a 2·9 % milk was put through the machine under exactly similar conditions only a cream containing 38 % butter fat was obtained.

This to my mind proves very effectively that even when working a machine at correct speed there still may be variations in the cream tests owing to the fluctuations from time to time which will occur in the butter-fat content of milk used for the production of cream. This is still more than

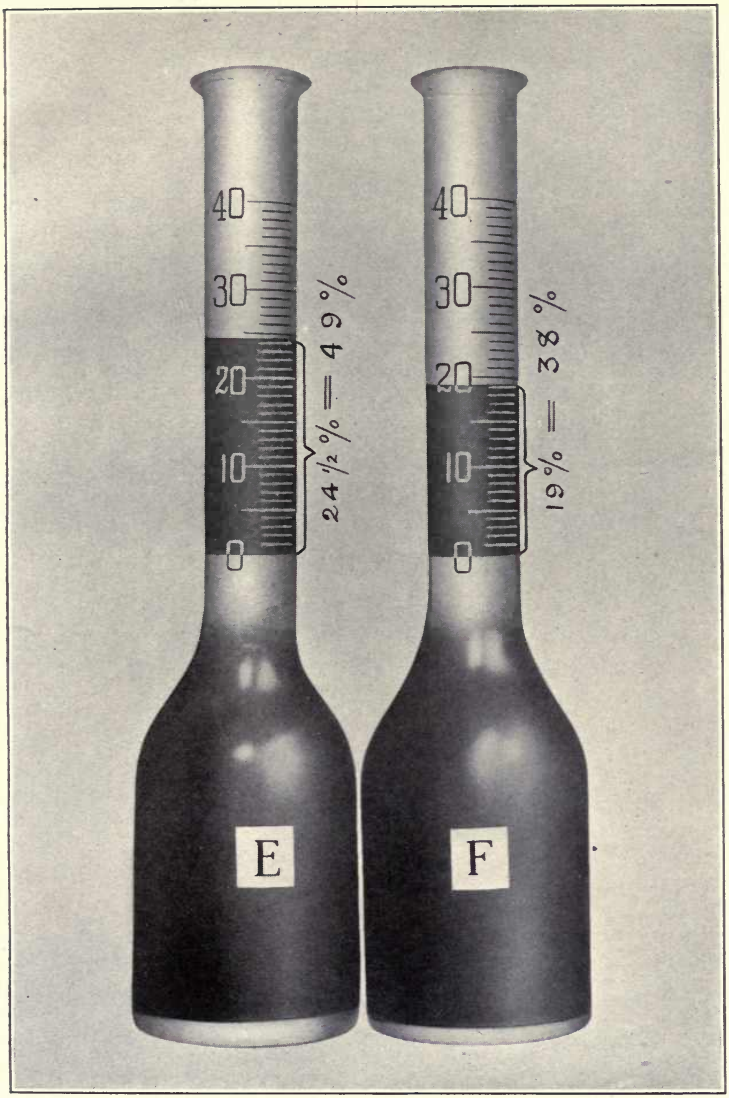


FIG. 14.

Representing the results obtained by separating naturally rich and naturally poor milk under identically the same conditions.
Sample E, at 60 revolutions of separator crank per minute, a cream containing 49 % butter fat was obtained from a 4·8 % milk, whilst
Sample F shows 38 % butter fat in the cream obtained from a 2·9% milk.

(See Table No. III. for complete results of this trial.)

RESULTS OF SEPARATING RICH AND POOR MILK.—TABLE NO. III.

Bottle labelled.	Trial number.	Weight of milk used.	Temperature of milk.	Test of milk.	Total fat in milk.	Number of revolutions of separator crank.	Weight of cream obtained.	Test of cream.	Total fat in cream.	Weight of skimmed milk.	Test of skimmed milk.	Total fat in skimmed milk.	Total fat in cream and skimmed milk.	Loss of whole milk during trial and separation.	Loss of fat adhering to utensils, etc., irrecoverable.
		lbs.	F.	%	lb.		lbs.	%	lb.	lbs.	%	lb.	lb.	lb.	lb.
E.	5	41	88	4·3	1·968	60	4·0	49	1·960	36·9	0·015	0·005	1·965	0·1	0·003
F.	6	41	88	2·9	1·189	60	3·1	38	1·178	37·8	0·02	0·007	1·185	0·1	0·004

ever true in South Africa, where the practice of hand-rearing calves is so conspicuous by its absence. The percentage of butter fat which milk contains under ordinary circumstances depends in a great measure on the manner in which the milking operations have been conducted. Native milkers on some days milk the cows out fairly clean, and if a greater proportion of the richest milk, more generally known as the strippings, be obtained, the milk on that particular day will be considerably richer. Similarly, if the milking is carried out indifferently, and the calf does the stripping instead of the milker, the milk on that particular day will be so much the poorer in butter fat, and the cream test correspondingly lower.

The fourth and final experiment was carried out purely to ascertain what effect separating milk at various temperatures would have on the butter-fat content of the resulting cream. Table IV. proves

RESULTS OF SEPARATING AT VARIOUS TEMPERATURES—TABLE No. IV.

Lbs. of Milk used.	Test of Milk.	Lb. of fat in milk.	Temperature of milk.	Revolutions of separator crank.	Weight of cream in lbs.	Test of cream obtained.	Lb. of fat in cream	Fat not recovered.
	%		° F.			%		
40	3·7	1·48	90	60	3·40	42	1·42	0·06
40	3·7	1·48	80	60	2·75	51	1·40	0·08
40	3·7	1·48	74	60	2·66	52	1·38	0·10

pretty conclusively that once more another definite reason is found for variations in cream tests. When the milk was separated at the correct temperature, viz. 90° Fahr., a cream containing 42 % of butter fat was obtained, but immediately the temperature of the milk was allowed to fall to 80° Fahr. a 51 % cream was produced. This to my mind, especially during the winter months, would account for cream tests becoming suddenly much higher on some days than others, even though the speed of the machine had been correct, and the regulating screw unchanged.

If a machine would do equally as good work at low temperatures, I should prefer during the summer months to separate at low rather than higher temperatures, as the resulting cream would keep better and arrive at the creamery in a sounder condition; but unfortunately we know from experience that separating milk which has been partially cooled can only be accomplished at the expense of clean skimming, owing to the more viscous condition of the milk. This is more especially true when the skimming operations occupy a considerable period of time.

Summary of why Cream Tests Vary.

1. Speed of machine being either too low or too high.
2. Fluctuations in the temperature of the milk.

3. Changes in the richness of milk, either from morning or evening milkings, and more especially through indifferent milking.
4. Separator running badly through using inferior oil, or bowl vibrating through being out of balance.
5. Amount of skim milk or water used for flushing the bowl, which often varies from day to day.
6. By removing the milk float, and overfeeding the machine beyond its capacity.
7. By using the cheap and inferior variety of separator.
8. Neglect to alter cream regulating screw in spring-time when milk is poor, and in autumn when milk is richer.

These, then, are some of the principal reasons why cream tests will from time to time vary, and they have been discussed at some length with the object of assisting the cream supplier to obviate as much as possible these fluctuations, as by so doing he will not only be assisting himself, but also our creamery managers.

CHAPTER XI

BACTERIA, AND WHY CLEANLINESS IS NECESSARY

Over three hundred years ago a scientist living in Holland startled the world by announcing that there was life in matter, which we could not see.

Later on another scientist named Cohn was able to prove its presence by the aid of the microscope. But of late years it has been left to Pasteur to demonstrate actually the presence of this life by making living cultures of these organisms in different forms. It is not known whether these organisms belong to animal or plant life, but they are known to be present in different substances in three forms known as Bacteria, Yeasts, and Moulds. In dairy work it is chiefly the bacteria with which we have to deal, and there are many endless varieties of these, but they are divided into two main groups known as Ærobic and Anærobic. The ærobic bacteria are distinguished from the others because they thrive and multiply in the presence of air, while the anærobic do not thrive where there is air. Both these groups, however, have the means of adapting themselves to the condition in which

they find themselves, between a plentiful supply of air and its entire absence in a free state.

Bacteria require food, a suitable temperature to thrive in, and also a certain degree of moisture before they thrive and multiply. Milk contains all these properties in an easily assailable form, therefore milk becomes an ideal home for these organisms to thrive and multiply. Many forms of bacteria which get into milk are harmful to the dairyman. Others again are useful, such as lactic bacteria, which have to do largely with the flavour to be produced in our dairy products. All milk is liable to undergo change through the influence of bacteria. While milk remains in the udder of the cow it is usually free from bacteria, but unless special precautions are taken thousands of bacilli per cubic centimetre will be found in milk soon after it is drawn from the cow. In his book "Elementary Bacteriology" Dr. M. L. Dhingra states, "Milk when secreted from the gland is practically germ-free, but by the time it has entered the pail it is very rich in bacterial contents. These come from all sources: from the milk buckets, the hands of the milker, from the air of the cowshed, and from dirt on the body and udder of the cow."

These bacteria breed or increase at an enormous rate when the temperature is suited to them, the most suitable temperature being that of blood heat, or a little below. They multiply, breed, or increase,

simply by splitting in two, thus if one bacillium be present in milk in half an hour it has split into two, and in half an hour these two have again split into other twos, and so it goes on. Cases are on record where this has been done, and thus from one bacillium seventeen million would be produced in twenty-four hours. As has already been mentioned, bacteria require a suitable temperature before they will increase rapidly; but there are some kinds which have a very remarkable character. Should the medium they are in become too cold or too hot for their ordinary living in, they have the power of forming what are known as "spores." If the milk they are in be frozen they produce these "spores" rapidly, which remain dormant until such time as they can again thrive. Also, all species of bacteria are not affected by great heat, for they also turn into "spores" when the temperature is too high. Ordinary boiling will not kill all species of bacteria, but those that are killed by this means are mostly the kinds which are unable to form spores. Many different diseases have been proved beyond the shadow of a doubt to be due to bacteria or micro-organisms. Typhoid or enteric fever has been found to be due to the typhus bacilli. Cholera is due to a special bacilli, while tuberculosis has also, along with diphtheria, been proved to be due to a micro-organism or bacilli.

Milk, as has already been remarked, is an ideal

home for bacteria to thrive in. Milk therefore becomes an ideal medium for the spread of disease. Dr. M. L. Dhingra, in his "Elementary Bacteriology," says, "As is well known, milk is a frequent carrier of the infections of Tuberculosis, Cholera, Scarlet Fever, Typhoid, and there is no doubt that various diarrhœa disorders are due to the bacteria which get into milk."

That these diseases get into the milk after it is drawn from the cow and not directly from the blood of the animal is shown by the fact that cattle are not subject to typhus, scarlet fever, or diphtheria. Yet it has long been recognised by all medical men that milk carries these diseases. This does not mean that milk is diseased, but that these different forms of bacteria have been found in milk, and yet they do not come from the blood of the animal. The typhus germ therefore gains entrance after the milk is drawn from the cow, and the chief source of infection is by using water for washing the buckets or bottles which has become contaminated with typhus germs. It may also be introduced by some one handling the milk or milk buckets or milking who has been nursing an enteric patient. Scarlet fever and diphtheria are also conveyed into milk by the same means. Tuberculosis may also be carried by milk if the milk from a cow with tuberculous udder be used, for the organisms from the unhealthy parts of the

udder are sure to be drawn in with the milk. From among a number of samples of milk selected at random by the London Clean Milk Society nearly ten per cent. were found to contain germs of tuberculosis. Diarrhœal diseases, as seen in young children and weak persons, are also due to bacteria which have gained entrance to the milk *after* it is drawn from the cow.

The bacteria in milk which produce this trouble in human beings are not very well understood. It does not appear to be the species of one bacteria, but due to the rapid increase of a number of different kinds of bacteria, the most common of which is known as *bacillus coli*, which is a bacteria derived from manure or dry particles of dung. This is a highly dangerous kind, for it possesses the remarkable power of forming "spores." To quote again Dr. Dhingra, "A short boiling of milk is sufficient to kill lactic and most pathogenic germs, but there are others which form spores, and these are not destroyed by boiling. A boiled milk may therefore be rich in bacteria and yet remain unaltered to the naked eye. If, however, such a milk be consumed by a little child, the "spores" develop into organisms which rapidly decompose the milk in the child's stomach (for the warmth there is favourable to their new growth) and give rise to gastro-intestinal disorders or diarrhœa."

There are hundreds of people who cannot be

made to believe these things and who will consequently take no precautions. But all scientists and medical men are agreed that these things are so. There is conclusive evidence before any one who doubts these things if he will pay a visit to the nearest creamery and see some of the milk and cream which has to be rejected on account of these proved dangers.

The dirty clothes of the milker are a great source of infection to the milk. A native wears the same clothes day and night, working, eating, and sleeping in them. The farmer changes his own clothes often because he knows they become filthy. The same farmer would not allow this boy inside his house because of the visible and invisible dirt on him. Yet this same boy is to be permitted to milk the cows, dip his fingers in the milk to moisten the teats, hold the bucket between the knees of his dirty garments, lean over the bucket, sweat into it probably, blow his nose with his hands, pick up a cake of dry dung to throw at a refractory calf, and then go on milking. Thus he inoculates it with millions of all kinds of germs. Then the farmer allows his children to get this milk or sends it to a creamery and wonders why he gets a poor price!

We who work in the creameries are forced to see the results produced in the milk, butter, or cheese we wish to place before the public. Bad

flavours arise, gases, moulds, ferments, disease, and the public still steadily refuse to eat filth and decomposing matter in their food, just as the average dairy farmer would refuse to eat a rotten egg.

Writing in the "Creamery Patrons' Handbook," Dr. H. L. Russell, Bacteriologist Wisconsin Experimental Station, says—

"A serious source of contamination of milk always comes from the animal herself. Drawn, as the milk usually is, in an open pail, the opportunity for entrance of loose hairs, particles of dung, fine dust, and fodder particles could not well be improved. Every hair of the animal's coat is laden with dormant germ life. When the animal is shedding her hair there is nothing to prevent the falling of these germ-laden particles directly into the milk. Even where the hair is not rubbed off, the movements of the animal and milker are constantly dislodging particles of fine dust that settle in a continuous shower into the warm nutrient fluid below. It may be thought that straining removes this source of filth. So it does the filth which can be seen, but not until the invisible living germ life has been washed off into the fluid, there to set up the various fermentations that it is capable of producing. The kind of organisms that gain access to the milk from this source is, generally speaking, thoroughly undesirable. They are largely fecal bacteria derived from decomposing animal dung. In a large number of instances they are spore-bearing bacteria that are very resistant, and the

type of fermentative activity they are capable of producing in milk is undesirable in cheese-making."

When milking, the cows should always have their flanks brushed and udders washed and wiped. This prevents a great deal of dirt entering the milk. Also the first few drops of milk should always be drawn on to the floor, for this contains bacteria from the dung the cows have been lying on or standing in. These germs gain entrance into the bottom of the milk canal, and will then be drawn into the bucket.

It has already been said that milk in the cow's udder is free from bacteria, but the bottom end of the milk passage is generally full of them. When the cow is kept under dirty conditions over 1,000,000 per cubic centimetre have been counted through a microscope. Always, then, draw the first few drops of milk on to the floor, and do not run it into the bucket.

In his book "Agricultural Bacteriology," Professor J. Percival, M.A., says—

"The milk from cows with brushed and washed udders was found by Russell and Orr to contain 330 to 472 bacilli per c.c., while the bacterial content of milk drawn from a mixed group of cows which had not been brushed and washed was as high as 11,000 to 15,000 per c.c."

Russell, writing on bacteriology in the "Creamery Patrons' Handbook," says—

FIG. 15.—BACTERIAL CONTENT OF MILK HANDLED IN ORDINARY WAY.

Each spot represents a colony growing on gelatine plate. Compare with Fig. 16, where same quantity of milk is used in making culture. Over 15,000 bacteria per c.c. in this milk.

After Russell.

FIG. 16.—BACTERIAL CONTENT OF MILK DRAWN WITH CARE.

Diminished germ content is shown by smaller number of colonies (330 bacteria per c.c.). Compare this culture with that shown in Fig. 15.

After Russell.

"If the milk is received in thoroughly cleaned pails, if loose hairs, dust, and dirt are prevented from falling into the pail during milking, if the barn air is pure and free from dust, and if the fore-milk from each teat is rejected, the bacterial content of the milk will be greatly reduced. In a series of experiments of this sort carried out by the author the following results were obtained. Milk received under ordinary conditions contained 15,500 bacteria per c.c. Milk received after taking above precautions contained 380 per c.c. Milk taken from the cow with this degree of care remained sweet over twenty-four hours longer than did that which was drawn in the usual manner."

We have now read how these germs gain entrance to the milk and what they are; so that we may now deal with what they do. Besides carrying diseases, they also produce diseases of the milk itself, which are harmful to dairy products, not so much by the mere presence of the different kinds of bacteria, but by what they produce.

The average man is inclined to laugh at these micro-organisms because they do not affect him directly. He has always used milk freely, and his fathers before him, without evil results. This was because the milk was used quickly, before any germs had time to develop properly. But in these days of keen competition and larger towns and cities, milk and milk products have to be kept longer than ever before, and the difficulty is to keep those

products in a wholesome condition without the aid of injurious chemical substances which may easily be added, but which destroy the flavour and purity of the product.

Among the different complications produced in milk by bacteria are lactic ferments, blue milk, red milk, yellow milk, bitter milk, stringy and soapy milks. Some of these are seen in the milk almost at once, others are not. The lactic bacteria get to work at once, and while these are useful to the creamery they must be controlled; for, as has been shown on another page of this work under the heading "Milk Sugar," the lactic bacteria attack the milk sugar and change it into simpler sugars, such as grape and galactose, finally forming lactic acid. This work may be interrupted by another set of organisms which attack the grape sugar formed by the lactic germs, converting it into an alcoholic fermentation. The milk or cream, therefore, should be delivered to the creamery or dairy as soon as possible after it is drawn from the cow, for it is better to allow the dairyman to control the work of the lactic bacteria for his own purposes.

Ropy milk is a condition frequently found on the farm. The milk does not become sour on standing, but when it has been kept standing for a couple of hours it becomes slimy and can be drawn out in long threads and has a sweetish taste. These "slimy" bacilli live in water, and when this

trouble is present the water-supply may be suspected. We should therefore use water as clean as possible for washing the cow's udder and also the milk buckets. If the water is not too clean a little Condy's fluid put in it before using will sometimes be enough to check this trouble.

Bitter milk may be due to improper feeding, such as giving the cow lupins or decaying cabbage leaves. But there is also a bitter milk which is produced from a species of bacilli coli found in the teats, and which have got there from the dung and mud in the kraal. Always drain the first few drops of milk on to the floor, and do not on any account take the first few drops of milk into the bucket.

Blue milk, *red milk*, and *yellow milk* are caused by bacteria which are so slow in their work that the milk is generally used up before anything occurs; but when butter and cheese are made from this milk, which appears to be all right, the results come out later and produce bad butter and cheese. These are avoided by cleanliness. When milk is red soon after drawing from the cow it is in all probability due to blood. Therefore the cow yielding such milk should be inspected, for it may be some udder trouble.

In the case of *soapy milk*, although it appears to look right the milk has a distinct soapy taste. This is from a bacilli which is found in dirty litter used for bedding which has become fouled with

urine and dropped into the milk. There are many other forms and conditions of bacteria which get into milk and which give no evidence of their presence until the milk is converted into butter or cheese; the most common complaint in this respect being what is known as "huffed" cheese. This is a swelled, gassy cheese due to the accumulation of gas beneath the cheese crust, and is the result of gas-forming bacteria, these having gained entrance to the milk before it was made into cheese. It is one of the most common complaints in South African cheese dairies. It is easy to find out which farmer is supplying this gassy milk, for by taking a small sample from each supplier's can and putting each sample in a glass bottle or jar and then heating it to 97° F., the sample which is giving the trouble will be seen with little gas-bubbles rising to the top in about an hour or two.

We have already mentioned that temperature and length of time or age of products have a great deal to do with the accumulation of these unfavourable germs, so that the farmer may ask, "Is it not possible for these bacteria to get into the milk after it leaves the farm and while standing in the creamery?"

This is a fair question, for bacteria may and do enter the milk at any stage of its being worked up into other forms through dirty surroundings, dirty utensils, or dirty cloths, or slipshod methods of

creamery operators. But the average creamery man understands these things and takes the necessary precautions by means of live steam for sterilising all utensils used in connection with milk, cream, butter, or cheese.

While it is possible to get milk contaminated in the creamery, it is, in nearly every case, where different forms of bacterial organisms have developed in the dairy products, due to the milk becoming infected at the farm end. It is therefore the better policy to keep as much germ-life as possible out of the milk at the farm; for no one can deny that even if the presence of bacteria in milk does not affect a person directly, the milk, cream, butter, or cheese would be far more wholesome if free from these invisible forms of life which produce such bad results. This may be achieved by paying attention to points already mentioned, such as washing the cow's udder before milking, drawing the first few drops of milk on to the floor, and generally paying attention to cleanliness in the milker's person and utensils.

CHAPTER XII

CARE OF MILK AND CREAM FOR DELIVERY TO FACTORY

THE success of the butter and cheese industry rests with the farmer. For although in these days of central creameries the farmer himself has nothing to do with the making of the products of milk, the success and quality of the products depend to a large extent on the class of milk or cream received.

The quality at present received by the butter and cheese factories varies to a very great extent, so much so that if a fully-qualified man was not employed to divide the cream and milk into its various classes on arrival at the dairy, our South African products would be very much poorer in quality than they really are.

There is still, however, much room for improvement. Time after time directions for the proper handling of milk and cream have been written and rewritten until the farmer has become somewhat tired of hearing of these things. But in repeating them the writer makes no excuse, for they are intended to remind those who may have forgotten,

in dealing with milk and cream which are really of such importance in getting a good quality in our products. It is all an old old story, but one which is not lost in the re-telling.

We have tried to show under the head "Bacteria and why Cleanliness is necessary" some of those which injure and spoil the milk and cream delivered to the creamery and are the result of carelessness. Dirt and bacteria usually go hand in hand; but, while it is quite possible to avoid filth, the sources of bacterial contamination are not always to be avoided.

The many investigations of Stevens and others upon milk and cream for delivery to the dairy have shown that the first infection or taint or bad handling at the farm has a greater influence upon the butter and cheese to be made than the handling of the same in a creamery.

The first sources, therefore, from which bacteria, dirt, and their evil influences come should be checked as much as possible on the farm. It is generally impossible to keep all classes of bacteria out of cream and milk, but the worst kinds are excluded by cleanliness. The farmer can, however, control to a very great extent the quality by paying attention to some or all of the following suggestions.

In "Dairy Bacteriology" written by Freudenreich and translated by J. R. Armsworth Davis B.A., we have the following: "Light, especially

direct sunlight, generally exerts a weakening action on bacteria; this supports the opinion of specialists in hygiene that the free access of light is desirable." Light, then, we see, becomes an important factor, and we should have plenty of this in our dairy or separating room. Dark, musty, hot, low-roofed buildings are not suitable for storing cream and milk. Have light and fresh air in the dairy or where you store your milk and cream or do your separating. Professor E. H. Farrington of the Wisconsin Dairy school says, "Cows ought to be milked in a clean, thoroughly drained, and *well-lighted* place." Do not be afraid of light—it costs nothing, and it benefits you more than you know.

Care of Milk for Cheese Factory.

The need of cleanliness in milking has been dealt with in another article, but one of the first points to be noticed in care of milk is that of

Straining the Milk.

The milk should always be strained whether it is to be separated or not, and preferably while it is still warm from the cow.

It should be poured through a cloth strainer made of cotton flannel or through cheese-cloth folded four times. A wire strainer is not enough,

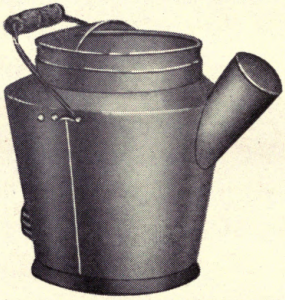
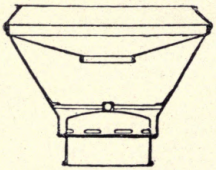
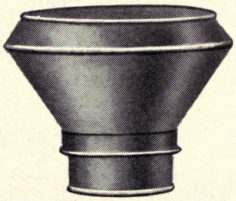


FIG. 17.—THE "GURLER" SANITARY MILK PAIL FOR MILKING CLEAN MILK.





NO. 1.

FIG. 18.—"ULAX" STRAINER.

as it is never fine enough to keep all dirt out, and it is the very fine dirt which we have to look for.

When supplying milk for cheese-making this point of straining is most important, and one cannot be too careful to see that it is properly performed. There are many milk-strainers on the market which are worthless, and unless one can use some such strainer as the "Ulax" or even the Gurler sanitary milk-pail, both of which are provided with a straining cloth of cotton which can only be used once, it is best to use the four thicknesses of cheese-cloth or to use a piece of clean white flannel over the mouth of the milk can and strain the milk through this. In this case, *i.e.* with the flannel, the milk *must* be strained while still warm in order for it to run through the flannel easily. In every case the cloth must be rinsed out in warm water immediately after use, and then dipped in boiling water and hung up to air until used again. This is a very important point, and if neglected the cloths will soon smell, which is fatal.

Cooling and Airing the Milk.

Two things are necessary to deliver a sound, wholesome milk for cheesemaking. The first is to see that the milk does not take up any bad smells or flavours, such as from the cow kraal, pig-sty, storeroom where onions and potatoes are stored, etc.; the second is to prevent the development of

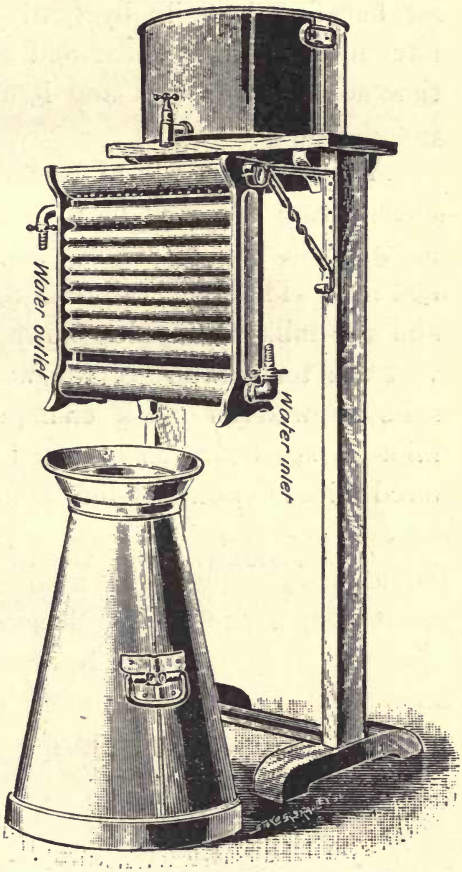
bacteria. We have already shown that cleanliness goes a long way towards helping this; but however careful we are it is impossible to keep all bacterial taint out of the milk. Hence we must check this development, and the way to do this is by airing and cooling the milk.

Bacteria are governed by the same laws as those which rule plant life—just as in the same way our crops will not grow in winter, so bacteria in milk are prevented from growing by airing the milk and lowering its temperature.

There are several types of milk coolers on the market, and every farmer supplying milk to a cheese factory should have one, and it will have to be a part of his dairy equipment just as much as his cream cans and separator. No cheese factory should accept milk from a farmer who does not put it over a cooler, and these coolers or aerators will have to be supplied by the companies on the same terms as cream cans and separators.

The milk should be run over the cooler as soon as it is all drawn from the cows, for this system not only improves the quality of the milk, but it gives the cheese-maker more control over it. The process is quite simple. It is simply the warm milk passing over a layer of pipes containing running water. The milk passes over these pipes in thin layers, and is cooled suddenly, and exposed to air and light, thus giving off its animal heat and taints.

The cooler must stand in a place where the air is fresh and pure away from all bad smells and dust, otherwise the benefits of airing are spoilt. If no properly ventilated room is available for this purpose, it is much better to do it outside in the fresh air as long as there is no dust or foul air.

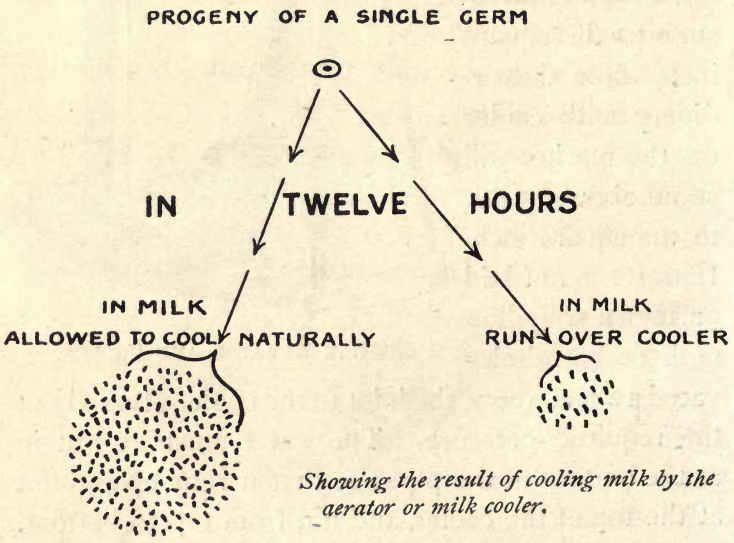


MILK AERATOR AND COOLER.

The circular type of aerator will only stand about 8 lbs. of water pressure to the square inch, while the ordinary milk cooler on the market will stand about 25 lbs. to the square inch. If water is not laid on, then a 50-gallon tank or barrel elevated 12 feet above the inlet to the cooler gives about the required pressure. The water must be put in at the bottom of the pipes so that it runs up and out at the top of the cooler, and not from top to bottom.

The advantages of cooling are that the growth of germ life is checked, and the exposure to the air benefits the milk by getting rid of gases, bad flavours, and animal heat and odours, at the same time absorbing oxygen and light with their health-giving properties.

A study was made of bacteria in milk at every hour during a period of forty-eight hours. Some of the milk had been aired and cooled, the other had not. The temperature of the room was 93° F., and the milk was cooled down to 54° F., as that was the temperature of the water used. The results showed as much change in the uncooled milk in six hours as occurred in the cooled and aired milk after twenty-four hours.



Showing the result of cooling milk by the aerator or milk cooler.

Evening and Morning Milk.

The morning's warm milk should never be mixed with the cold milk of the evening, as this is sure to spoil both. They must both be kept in separate cans and delivered to the factory in different cans.

The cans of milk which are being kept waiting before sending them away should have the lids off and be covered loosely with butter muslin to keep flies and dirt out, and also be kept in a cool, clean, fresh place until ready to send away, when the lids may be fastened down.

Some "Don'ts" for milk suppliers.

Don't send in the beistings or new milk, as this will spoil the lot.

Don't use the milk from fresh cows until after the tenth milking.

Don't feed cabbage or ensilage or turnips just before milking.

Don't use dirty milk pails.

Don't use rusty or patched tinware in the milk business.

Don't let the milk stand about in the cow kraal.

Don't forget to strain the milk from each cow before putting it all altogether.

Don't forget to strain again when running it over the cooler.

Don't let the milk get warm again after it is once cooled.

Don't use milk from sick cows.

Care of Cream for Butter Factory.

When one is sending cream to the dairy it is unnecessary to cool the milk before separating, because the warmer the milk (within reason) the more perfect is the separation. The milk should be as near to 90° F., or rather blood-heat, as possible. As soon, however, as the separating is finished the cream should be cooled at once as low as it is possible. This will, on the ordinary farm, be to about water temperature, and is best done by placing the cans containing the cream in a wood, iron, or cement trough, as the case may be, and letting cold water flow around them. If a running stream of water is near the homestead, standing the can of cream in this at a shady spot will answer admirably. These are the best ways of cooling the cream ordinarily available to the farmer. But it must be well stirred while it is being so cooled, for the organisms of healthy cream ripening belong to the ærobic class, *i.e.* those which thrive where there is air. Therefore the more air present in cream the better, and it cannot be stirred too much provided it is not churned, of course, during the stirring. Any neglect to stir the cream produces butyric ferments which makes the butter rancid.

Cream coming fresh from the separator should never be mixed with cold cream. It is best to wait until they are both of the same coolness before mixing.

When adding new cream to the bulk you already have on hand, stir it well to produce a uniform quality and ripeness.

When sending the cream away by rail in hot districts, add 1 lb. "preservitas" mixed with 3 lbs. of salt, and use 1 tablespoonful of this mixture to every 3 gallons of cream in hot weather, as this will prevent the cream from coming into the factory "over-ripe."

In hot weather have the cream thicker, as it carries well, but not so thick that it cannot be stirred with a stick; a cream testing about 45 % butter fat is about right. In the cold weather you can afford to have the cream a little thinner, as it ripens better—a 35 % test being about right for winter cream.

Keeping Cream on the Farm.

The cream must be kept in a perfectly sweet-smelling room, and not where potatoes and onions or other farm produce are usually stored. Care must be taken that nothing objectionable gets into it.

Keep the cans of cream standing with the *lids off* before sending them away, but covered with

butter muslin to keep flies and rats out. Then, when it is ready to send to the factory, the lids may be put on.

The writer has examined hundreds of cans of cream on arrival at the butter factory, and in nearly every instance he can tell how the cream has been kept even without visiting the farm to see. Some of it shows great care. A good deal of it, on the other hand, smells of native boys. In some cases he has found dried peaches in the cream; at other times bits of roll tobacco, once a plate, once a saucer, once a cup, once a spoon! Once he found a dead rat in a supplier's cream!

From the smell alone we can tell that in some cases it has been near a pig-stye or stable.

These are the things to be guarded against, but at the same time expensive buildings or contrivances for storing cream are not necessary, the chief points being keeping it cool and in a sweet-smelling place where there is plenty of pure air.

Cream should never be kept too long; send it to the factory as often as possible, every day if you can, but never less than three times per week. If the weather is hot, it is best to tie a wet sack round the can when sending it away.

CHAPTER XIII

CARE AND USE OF DAIRY UTENSILS

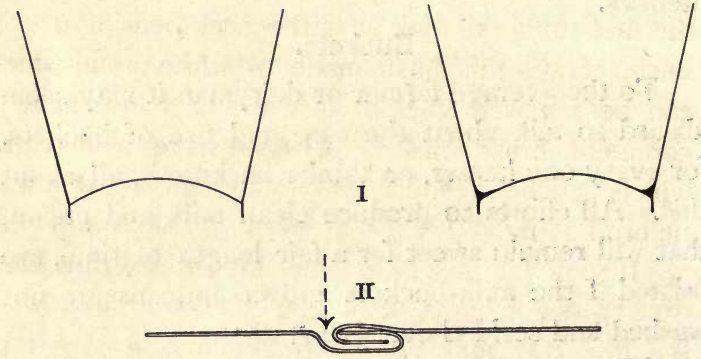
In dealing with utensils it is always more economical to use the "best." There are many firms in the Union dealing with dairy requisites who are only too willing to furnish illustrated catalogues showing their goods at reasonable prices, so that there is no need for using middling or out of date utensils.

Buckets.

To the average farmer or dairyman it may seem absurd to talk about the care and use of buckets, for every one knows, or thinks he knows, all about this. All efforts to produce clean milk and cream, that will remain sweet for a fair length of time, are wasted if the milk-buckets and cream-cans are not washed and scalded every day.

After use, the buckets should be rinsed out with cold water to clean the inside thoroughly, and then washed in boiling hot water. After this they should be put in the sun to dry where there is no dust, or where they cannot be knocked over. Tin ware should never be wiped dry—always use boiling water and sunshine.

Never let the milk dry inside the bucket, but wash immediately before the bucket dries with the milk sticking to the sides. Never allow sour milk to stand in the buckets, neither allow skim-milk to stand in them too long. All joints in the buckets should be flushed with solder so that no dirt can collect in the crevices. It is always best to use a seamless bucket. The writer has seen buckets used for milking where on using an ordinary pocket-knife the dirt could be "peeled off" the inside of the utensil. At other times he has seen pigs nosing in the buckets and these same buckets used for milking without being washed.



(I) The above is a diagram showing corners of a bucket and how it should be flushed with solder so as to clean easily.

(II) Shows a joint in ordinary tinware, and the arrow shows where milk gets in, dries, and turns bad and so is difficult to clean. This should be closed with solder.

Separators.

In choosing a separator three things must be considered, and they are most important; (1) simplicity of parts, (2) clean skimming, (3) ease with which the machine may be cleaned.

There are many makes of separator on the market; some are good, others are bad, but it is not within the scope of this work to recommend any particular kind. Whichever make you have, there are a few points in the using and care of them which must not be lost sight of.

1. If the machine you use is vibrating, one of the first things to look at is the neck bearing or top bush. Have this bush made of white metal which can be renewed when it is worn. Do not have a complete brass bush. Always have a machine which can be cleaned easily, and look to this well before buying.

If any fat is left in the skim-milk more than 0·15 (which is high), it may be: (1) that the bowl is too low; (2) that the bowl is vibrating; (3) that the milk running through is too cold; (4) that the machine is not level and not bolted down firmly.

2. If the bowl is too low, then readjust by the screw underneath. The bowl must be about a quarter of an inch above the cream-escape.

Always have the machine bolted down, and not screwed on to its foundation. Do not bolt the

machine down to a cement floor without having some kind of cushion underneath, such as wooden blocks cemented into the floor, and machine bolted on to these. This, of course, does not apply to smaller kinds of separators, which may be bolted on to heavy tables.

Wherever the machine is put up it must be level, and this level will need to be taken all ways on the bowl.

In oiling a separator one drop in seven or eight seconds should be running. The cog wheels should never be oiled, *i.e.* on the cogs themselves ; use a little cart-grease.

All separators require a thin oil, so we must use separator oil, as machine oil will not do. The best substitute is lard oil with a small quantity of paraffin mixed in it.

If the separator you use is a "Mèlotte" and it is not working properly, look first to the cords and see that these are not worn and they are holding the spindle in a true perpendicular ; also see to the little spring on the top of spindle. If these do not put the machine right, look to the ball bearings.

Should the spindle of the "Mèlotte" separator be bent, a new one will have to be bought. In this make of separator never forget to oil the three top holes ; this must be done *always*, or the spindle will go wrong.

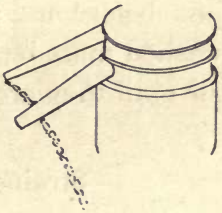
With all makes of separators, when they are

small-capacity machines, *i.e.* 18 to 30 gallons, never get full speed up until allowing the milk to flow into the bowl.

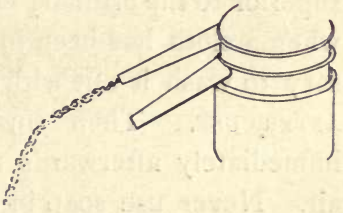
Remember that the faster a machine is turned the richer is the cream and more perfect the separation. When turning below the speed given in the instructions with the machine, a loss of fat will result in the skim-milk, and also a thinner cream is produced.

How the cream runs down :—

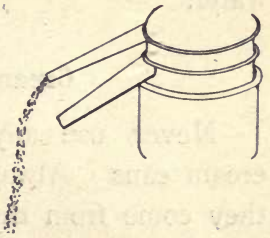
(1) When turning too fast.



(2) When turning too slow.



(3) When turning right speed.



Always run some warm water through the machine before putting in the milk, especially with small machines. All separators should be washed immediately after use, first with warm water and then with boiling hot water, after which place the different parts to dry in the sun where there is no dust.

Do not put the separator together again until just before use; the bowls and parts after being washed must be left loose and exposed to the fresh air until they are again required for use.

Strainers and Straining Cloths.

Never forget to use these always. A butter muslin or cheese cloth folded four times is infinitely superior to the ordinary class of strainer used—only, when a cloth has been in use it is absolutely necessary to wash it out with warm water IMMEDIATELY AFTER USE. Then rinse it with boiling water immediately afterwards and hang the cloth up to air. Never use soap in a dairy; a hard brush and warm water is better, followed by the use of boiling water.

Cream and Milk Cans.

Never use anything but seamless milk and cream cans. Always take the lids off as soon as they come from the creamery and stand them in

the sun where there is no dust, or turn them upside down on a rack so that they may air properly. Wash them again with hot water before use, and never wipe them dry with a cloth.

Avoid bringing whey or skim-milk back to the farm in cream or milk cans, and don't use them on the farm for anything else but for sending away milk or cream.

Never use soap in dairy work, but the occasional use of a cleaning powder such as "Wyandotte" (which can be had from your creamery) is not bad and can be used safely, but all traces of it must be washed out of the cans before putting milk and cream in.

Never use boiling water on a cream or milk can or bucket until it has first been washed clean with ordinary warm water. Boiling water causes the cream or milk to "stick," and should only be used after the cans are washed with a brush and water.

CHAPTER XIV

SUGGESTIONS AS TO PROPER MILKING

Milking by Machinery.

In these days of mechanical ingenuity when many devices are used to save labour, it is not surprising that milking machines are fast coming into popularity. Good hands for milking in a thoroughly clean manner are very scarce in South Africa. We therefore look for mechanical helps. While the milking machine on a small scale has not yet been perfected to bring it within reach of every dairy farmer, there are several motor-driven machines at work in South Africa by which a great number of cows are milked, thus saving labour and time.

The milking machine, as seen on the South African market—principally the "Omega"—is quite effective, and by the use of a motor-driven pulsator the cows are milked as thoroughly and as comfortably as though their own calves were at work.

The advantages of milking cows by machinery are:—

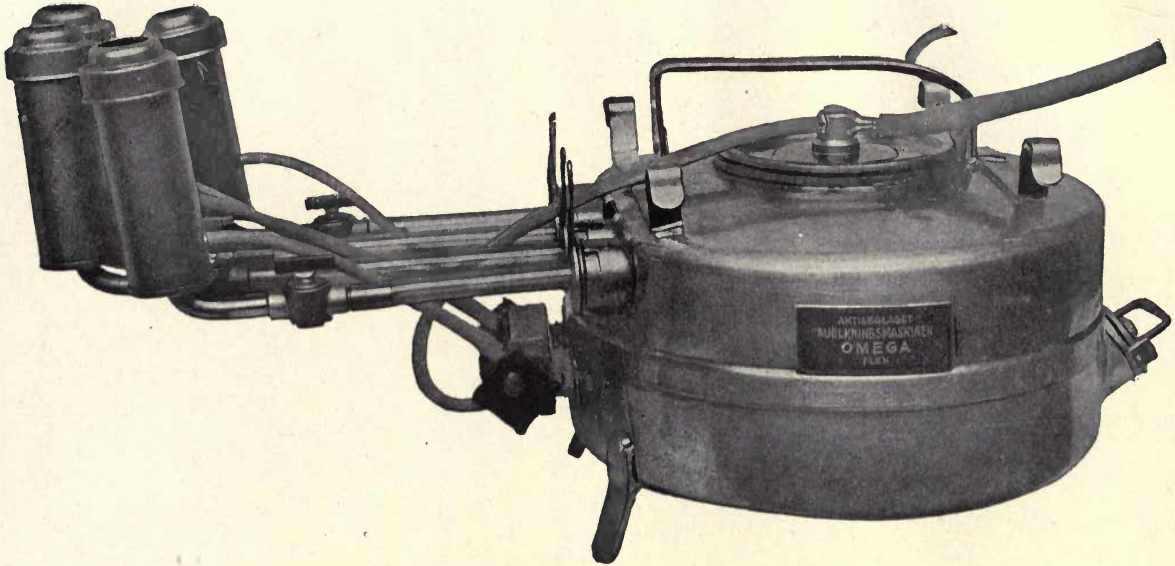


FIG. 19.—"OMEGA" MILKING MACHINE

1. Cleaner milk is obtained.
2. No waste of milk.
3. It imitates nature better than hand milking.
4. It saves labour and time.
5. The cow is milked completely dry.
6. Bacteria is eliminated by 90 %.
7. Milk keeps longer.
8. Does away with irregularities of natives.
9. The machine being a fixture is always at hand.
10. Cows like it.
11. The working cost is smaller than where five or six boys have to be employed.
12. There are no chapped or sore teats.
13. When once used the old style is never again adopted.
14. More intelligence is required to work it; but this is an advantage, for any extra knowledge spent on a dairy cow means cash.
15. Dust and dirt in the stable do not get into the milk.

Milking by Hand.

In South Africa the general practice with regard to milking is to have it performed by native boys. This is peculiarly a South African method and one adopted from the black population, and this system is entirely different from any other dairy country in the world. In Africa the men milk and the

women hoe; while in Europe the women see to the milking while the men do spade work. It seems impossible to change this method in South Africa because of conditions of labour, but where machines cannot be used we must make the best use of our native "boys."

The objection to the native milker is that he is not clean, but by careful supervision and training he may be made useful in handling high-class dairy animals and getting the milk in a clean condition. As we have mentioned in another chapter of this work, the keeping qualities of milk, cream, butter, or cheese depends on cleanliness and freedom from bacteria. We must therefore take every precaution in milking operations to be as clean as possible.

Where the cows are milked under dirty conditions, *i.e.* in a muddy kraal or dung-soaked kraal, it is as well to have one boy go round to each cow a few moments before the milker comes along and let this boy brush the udders and flanks of the cows; following this up with washing the udders and drying them afterwards with a clean cloth. More especially is this necessary in the morning when the animals have been resting in their own excreta, often owing to the owner's neglect. This is necessary, because, although it is very seldom carried out, a better class of milk is produced which benefits every one. The excuse about time wasted does not hold good, because this method has been

adopted by progressive men and has been found to pay.

Where the cows are kept under clean conditions, *i.e.* they have clean bedding to sleep on or clean veld to lie on, a brushing of the loose hairs off the udder will be sufficient. But where the udder is soiled with dung and urine it must be washed and *wiped dry*. This latter is important, because udder trouble may develop if they are not dried. The time taken for doing this is very short indeed, and not half the trouble which some farmers imagine.

Dry Hand Milking *v.* Wet Hand.

At one time a great deal of controversy arose as to whether the hands should be dry or wet for milking. In the Debating Society of the Cape Elsenburg Agricultural College, the matter was discussed and the two systems stood on trial. Each system was vigorously defended by its advocates. It was pointed out that the hands should never be wetted, as this was liable to render the milk impure. Also it was urged that if any one competed for honours in a milking competition at any agricultural show in Europe or America he was quickly disqualified if he milked with wet hands. But so many points were raised by the defendants that the chairman in his capacity as judge had some

difficulty in summing up. Therefore we cannot do better than quote Mr. E. O. Challis, Superintendent of Dairying to the Union Government. He says :—

"Undoubtedly dry milking is the cleanest and best method to adopt, but I have still to find, at any rate, the native milker who can milk with dry hands. He usually, to begin with, milks a little milk in each hand, and afterwards, when his hands again feel dry, dips them in the bucket itself. This of course is a most objectionable practice, but nevertheless it is a daily occurrence which from personal experience I know only too well. Nearly all owners of dairy stock are quite aware how it is almost impossible to get native milkers to milk in the correct way, and it is equally impossible to get them to milk with dry hands. Such being the case, many years ago I carried out numerous experiments by substituting, in place of the necessity of wetting of the teats, the use of a small quantity of vaseline on each teat. This method I found to work admirably with native milkers, for, besides reducing the friction on the cow's teats, which is pretty severe owing to the finger and thumb process of milking employed by the natives, it also removes one of the chief causes of cracked teats, viz. turning cows out with wet teats when a cold wind is blowing."

Manner of Milking.

The boys should be made to move among the cows quietly, not whistling at them or beating them

with sticks, or chasing them for half an hour before capture. A quiet but firm handling of a cow always gives better results than noisy methods. For where noise is abundant good work cannot be done.

The way the boys milk should be watched. See that the two front teats are milked first, and then commence on the two back ones. When one fore teat and one hind one are taken together this should be immediately stopped, because you very seldom get a uniform quantity from these two quarters. There is no connection between the four quarters of the cow's udder, and if cross milking is indulged in, one quarter may be emptied while its neighbour remains painfully full. This hurts the cow. It is therefore necessary to milk the two quarters together which contain the largest amount of milk first, and then the next two.

Strippings.

Always see that the cows are stripped properly, and do not let the calf do this, because the strippings contain the most butter fat, often giving as high as 6% over that of the first milk. Be sure, therefore, and draw the last milk into the bucket, because it is rich in fat and has been known to yield as high as 10%.

The following table shows the result of the

analyses of milk [by Boussingault] drawn from a cow at six different stages of the same milking :—

ANALYSES OF ONE MILKING.

Portions . .	1	2	3	4	5	6
Total solids .	10·47	10·75	10·85	11·23	11·63	12 67
Fat . . .	1·7	1·76	2·1	3·54	3·14	4·08
Solids not fat	8·77	8·99	8·75	8·69	8·49	8·59

Speed of Milking.

The slow milker is to be condemned, for the cow may go dry before her time and become restless ; while on the other hand very fast milking is liable to set the cow kicking, and she may, without warning, kick the milkpail and milker into the manger or scuppers. There was a Fries cow on the Government Farm, Elsenburg, which was a good cow and yielded her 8 gallons daily. But many a student had cause to regret trying to milk her, for while she was generally quiet she would often kick the full pail over together with the hasty student in the most unexpected manner. This was because the milk was being forced down the passage quicker than the stream could be conveniently taken, thus causing the cow the most acute pain.

"Drying off" the Cow.

This advice is hardly necessary in South Africa, where the average cow dries naturally and all too

soon; but there are many herds containing good milkers, and these are sometimes dried with difficulty.

Milking once a day for about ten days, and then once a week, and so on, and gradually lengthening the intervals of milking, will prove effective in stopping the flow; although the cow must be milked dry at each of these milkings, otherwise trouble will result. The feed should be reduced, especially if it is a milk-forming diet; poorer food is a great help at this time, and together with 1 lb. of Epsom salts the animal will dry completely.

One other point which must not be lost sight of is

Regularity of Milking.

Always aim at milking at the same hour each day, as the cows get to know this, and any change from this proceeding affects the quality of the milk. Also the intervals between milking should be as much alike as possible, for where the intervals between milkings are very unequal it has been found that a higher proportion of fat is present in the evening's milk.

RESULTS OF EXPERIMENTS AT LEEDS UNIVERSITY, ENGLAND.

	Cows milked at			
	'5 A.M.	11 A.M.	5 P.M.	11 P.M.
Average per cent. Fat . . .	2·8	3·6	3·8	3
„ amount of Milk . .	40 lbs.	23½ lbs.	24 lbs.	24 lbs.

From these results it appears that the milk secreted between 5 a.m. and 5 p.m. is much richer in fat than that secreted at night, and that by far the largest amount is secreted in six hours after 11 p.m.

CHAPTER XV

ENSILAGE FOR PROFITABLE DAIRYING

In South Africa, where we have only a six months' pasture owing to our dry and cold winter, it becomes an important matter to the dairy farmer to provide for his cows—in advance—suitable feed for this period of scarcity. This may be accomplished by growing drought-resisting crops, crops less resistant with continual cultivation, by irrigation, and by haymaking or by ensilage.

Of these several methods for conserving cattle food for times of scarcity, ensilage is undoubtedly the best, cheapest, and most reliable. It consists of green crops harvested before they are ripe and preserved in a green and succulent state to overcome periods of drought or scarcity.

Ensilage has all the corrective and laxative qualities of good summer pasture, so that it is almost equal to "grass in winter."

By ensilage stock may be kept in a healthy and sleek condition, and dairy cows fed on it will give greater quantities of milk during the dry season than they would if fed on hay.

Many different crops may be used for converting into ensilage—such as oats, oats and pease, vetches, lucerne, cowpeas, wheat, barley, rye, sorghum. But one of the surest and most productive of forage crops suitable for this purpose is undoubtedly the humble mealie, to which all the other crops have to give pride of place. Mealies or maize can be grown in nearly every part of the Union where dairying is carried on, and its reliability, together with its enormous yield of green fodder per acre, and the ease with which it may be handled, makes it almost indispensable for making ensilage where the production of milk is required to be profitable.

Ensilage may be defined as green food which has been preserved in its succulent state by fermentative changes brought about by the absence of air and by the force of pressure; while the silo is the means by which this problem is solved.

The silo may consist of a deep pit in the ground which is lined with boards, corrugated iron, bricks and cement, stone or concrete; or it may be a raised structure built of wooden staves after the style of a huge barrel; or it may be a raised structure built of brick or concrete with small doors to facilitate filling and feeding.

Whichever form of silo is adopted and whatever it is built of, it should be made circular, as it is stronger than a rectangular form to withstand the weight of the sinking ensilage, which increases with

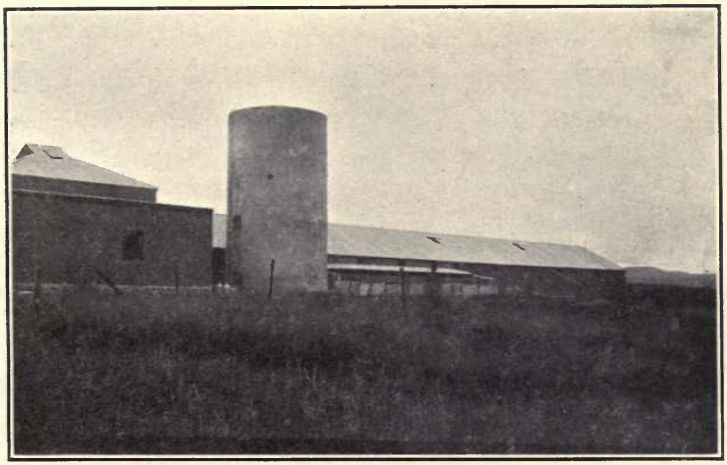


FIG 20.—SHOWING SILO AND COWSHED ON FARM "GLEN GRAY."
Owned by L. R. Clarence, Esq., Winterton, Natal.

chaffed stuff at the rate of 11 lbs. per foot for every 10 feet of depth. It is also proved that the ensilage packs down better in a circular silo than in any other form. If the silo is built of corrugated iron or wood, or if a pit silo is lined with these, the corrugations and joints of the wood must run perpendicularly and not horizontally. If the inside of a silo is of cement it must be smoothed over in the proportion of 1 of cement to 1 of sand. When the silo is to be a raised structure, whatever its construction—*i.e.* brick, iron, wood, or stone—it must be built strong enough to stand against wind when empty.

Locality.

The silo should be built near the place where the ensilage is required to be fed, because being heavy stuff we desire to avoid much cartage. It should preferably be built near the cow byre, and if possible secured to the building to prevent high winds blowing it over. The silo should never be near the dairy. If a pit silo is being made, the best place to dig is on a slope, as water is not likely to be struck, neither is it likely to rise from the bottom. Also, being on a hillside, we can keep flood-water from entering it by draining the water away on each side.

Capacity.

The size of the pit or raised silo will depend on the amount of fodder we wish to conserve or the amount which we require for our cows for a certain period. A silo say 16 feet in diameter by 26 feet high or deep, will be suitable for holding enough silage to keep 20 cows going for six months' feeding-period. A cow will eat about 40 lbs. of ensilage per diem.

The size will also depend on the rate of feeding, for it has been found by experience that when beginning to off-load for feeding it is best to remove a complete layer at a time, which must not be less than 1½ inches to 2 inches per diem. This is to prevent moulding and waste which takes place where uneven and irregular off-loading is practised.

The following table shows the diameters of silos required to prevent moulding to feed cows at the rate of 40 lbs. per day for 180 days.

No. of cows.	Total silage in tons for 180 days.	Inside diameter required to prevent moulding.
10	36	10 feet 4 inches
20	72	14 „ 7 „
30	108	17 „ 10 „
40	144	20 „ 8 „
50	180	23 „ 1 „

The weight of ensilage increases with the depth and also diameter of the silo.

It has been found that a silo 35 feet deep contains five times as much as one only 10 feet deep, and that a silo 30 feet in diameter contains nine times as much as one only 10 feet in diameter. The larger the silo is, within reason, the cheaper it becomes to conserve a ton of silage. This is due to the increased density by settling—it is best not to build less than 25 feet deep or high.

Silos with the above diameters and 25 to 30 feet deep will contain on an average about enough ensilage in 1 cubic foot to feed one cow per diem.

Filling.

Mealies which are to be converted into ensilage should be planted in the ordinary way as for seed, so as to secure a fair percentage of cobs on the plants. Planted in rows, the crop can be gathered with the mealie reaper and binder.

The time to cut for filling is just when the lower leaves begin to turn yellow, *i.e.* when the ears have passed the "milky" stage and are in what is known as the "doughy" stage, *viz.* when the seed on the ears is just beginning to glaze.

When filling the silo, the bottom of the pit or raised structure, as the case may be, should be covered with a good layer of dry or worthless material to absorb moisture. The fodder required to be conserved should be placed on top of this.

Particular attention must be paid to the age at which the crop is cut for ensilage. Immature stuff should never be used. On the other hand, it should not be overripe. The crop must be cut in the "doughy" stage while the plant is still green. Legumes such as lucerne, cowpeas, vetches, peas, or soya beans, if required for ensilage, should be cut when they are in full flower during the morning and left lying on the field, and put into the silo as late as possible after the hottest part of the day. With mealies the crop should be harvested in the cool part of the day, except when it is to be filled in at once, to prevent wilting.

When filling the silo, the intervals between filling should never be so long as to allow the top of the last layer to become mouldy.

Before placing the mealie crop in the silo it should be chaffed, *i.e.* put through the cutter and cut into lengths of 1 inch to 1½ inches. This is to ensure it packing better, to exclude air, and also for ease in handling when it is required to be fed. With a pit silo the cutter may be placed close to its mouth so that the fodder drops straight down. It must be well packed and tramped down round the sides to exclude air. Should it be a raised silo it must be filled through the top door, and a blower or elevator will be required to fit on to the cutter.

Should the silo be filled rapidly and weighted down heavily the temperature of the mass will not

rise above 95° Fahr., and the result is "sour" silage. If the silo is filled gradually and weighted less, then we have a higher spontaneous heating, and the temperature rises rapidly to 120° Fahr. and on to 160° Fahr.; the resulting material has a sweet smell and a sweetish taste, and is good silage. If the temperature rises above 160° Fahr. the fodder becomes burned, and it loses its value as a food.

The silo should be slowly and steadily filled, and great care should be taken in packing it round the sides, and if the silo is not deep the mass should be weighted. The deeper the silo is the less weight it requires should the crop be well packed, and the temperature is more easily controlled in a deep silo. When putting in the last or final layer worthless green stuff may be put on and packed well down. The air may also be excluded by spreading about 18 inches of bran on top and keeping it moistened, or by sowing oats thickly on top, say 6 inches, and keeping them damp until they germinate, when they will "mat" and exclude air.

Pressure is applied in different ways, such as use of stones, bags of sand or paraffin tins filled with stones or rough cement blocks. The deeper the silo is the less pressure is required. A boarding about 2 inches less than the inside diameter of the silo should be used to put the weights on. The weights may be left on until it is required to use the

ensilage. Should the temperature of the ensilage be rising too high the pressure should be increased.

Feeding.

Ensilage is one of the best feeds for dairy cows where pasture is scarce or parched from drought or perished by frost. Dairy cows are unusually fond of it when once they have learned to know it; but we should commence feeding it in small quantities until they are used to it, when they may have up to 40 lbs. per diem. When first feeding ensilage it is best to feed it along with some other food until they grow accustomed to it.

Cattle will often eat poorly made silage although it may have lost much of its value through being badly made. Ensilage should not be fed before milking or while the milking is going on.

About 25 to 40 lbs. per diem is the amount usually fed to cows, depending on the capacity of the various cows, and also on what other foods they are receiving.

Calves, when they are weaned, *i.e.* when they are five or six months old, can have up to 10 or 15 lbs. per diem.

Silage is not adapted to pig-feeding, except to provide a change if being stall fed.

The writer does not recommend the use of silage for horses, in this case its use being attended

with some risk. It is good for sheep, 3 to 5 lbs. per day.

Summary of Important Points.

1. Maize or mealies make the best ensilage.

2. Do not cut the mealies for ensilage before the lower leaves turn yellow, or before the ear begins to glaze, or the result will be sour ensilage.

3. Do not allow the crop to wilt heavily before filling.

4. Cut the mealie stalks, together with the cobs, into 1 inch and 1½ inch lengths.

5. Pack well to keep out air.

6. Tramp well around the edges.

7. Fill the silo slowly and steadily. Three to six days may be taken with a big silo, provided fresh material is filled in daily.

8. There is no need to wait for dew or rain to dry off the crop before filling, for water (within reason) does no harm.

9. When feeding, always remove a complete layer from the top, except in case of a stack silo.

10. Don't feed horses on ensilage.

11. If you have no experience with ensilage, get hints from some one in your district who has made it a success.

12. Don't give up the idea of making ensilage because your friends failed at it. It is the surest remedy for shortage of pasture.

Stack Silo.

This is done by building the green mealie stalks into the form of an ordinary haystack, and by means of sand-bags, stones, or tins of earth bringing pressure to bear upon the mass.

The stack silo should be as near the feeding place as possible; it should be sheltered from the wind; the site should be drained and fenced in.

The stack silo should be square-shaped, or it may be rectangular.

Always place a layer of worthless stuff on the ground, and start packing on this. This prevents moulding from the bottom.

When feeding stack ensilage begin to use it from one end only, removing a complete layer from top to bottom. This leaves as little surface exposed as possible.

Advantages of Stack Method.

1. No building or digging is necessary.
2. Chaff-cutters and blowers are not required.
3. If properly made, well built, and looked after, it is nearly as good a method as the other.
4. It may be built in any convenient place.
5. The site may be changed every year to suit changes in management.
6. The pressure can be removed gradually, only

removing the weights from the end required to be fed.

7. The stuff is easily off-loaded.

Disadvantages of Stack Silo.

1. The decay is very often considerable.

2. There is greater loss by evaporation, as four sides are exposed to the air, and the ensilage is therefore likely to be less succulent.

3. Unless well thatched, it is liable to injury from rain.

4. It does not pack so satisfactory, or exclude air when being built.

N.B.—When feeding a stack silo do not forget to commence using it from the end and not from the top, thus only removing the weight from the portion immediately required.

CHAPTER XVI

THE FEEDING OF DAIRY COWS

This all-important subject is one on which no hard and fast rules can be laid down. What may be suitable feed in the Western Province may not suit on the coast of Natal, or what may suit the coast may not do for the Transvaal. By this we do not mean to imply that cows in different parts of South Africa do not eat the same foods, but in dealing with this subject we have to remember first and last that we wish to feed our animals economically by making the best use of those foods nearest to hand.

Oats and oat hay are extremely valuable feeds for dairy cows. Where they are easily grown, as in the Cape, they may be fed with a liberal hand; yet this advice to feed oats would not necessarily be good for, say, Durban district, because of the expense of such foods there. On the other hand, maize ensilage, the cheapest and most effective feed in Natal, would be an expensive item at the Cape, and so on.

The subject of feeding dairy cows is a large one. In America and England it has been reduced almost

to an exact science, but we can at once say that the cheapest, best, most reliable and economical feed can be summed up in five letters, viz. grass; it is therefore wise to pay attention to one's grass veld by dividing large camps into smaller paddocks, to top dress with bone dust, lime, farmyard manure or kraal manure as the case may be, to improve the land in order to produce more and better grass. By having a series of paddocks, dairy cows may be most economically fed during summer (winter in the Cape), and provision in the form of "roughage" duly made to supply the bulk of food needed in the dry season.

Maize ensilage is the next in line for economical feeding, but when highly bred milking stock are being handled they will have to have some form of grain ration in order to supply more nutrients and variety.

In composing a ration for your cows never for a moment forget variety. A ration, to produce good results, should as far as possible be composed of a reasonable number of feed stuffs, since any cow does better on mixture of feeds than when fed only on one kind of grain or roughage; at the same time frequent changes in a ration should be avoided, as this causes imperfect digestion and assimilation.

Always grow as much of your feed as possible on your own farm, and we may say here that the average farmer in South Africa need never buy one

halfpenny worth of feed for his cows. It is folly to do so, when maize forms our staple crop and beans are so easily grown. With mealie fodder (green), cow-pea hay, and grass for roughage, mealies, oats and beans for grains, suitable rations could be given the cows to suit all their requirements. Lucerne hay should have been added to the above, but unfortunately every farmer does not grow it. A dairy farmer should first of all be a maize grower, and then a lucerne grower, or if he cannot grow lucerne, then he should grow cow-peas ; it is a poor farm which will not grow a crop of peas or beans of some description.

Too often farmers say it does not pay to feed, because they have landed themselves with a lot of stock and made no provision for feed stuffs, and have had big demands on their purse in consequence. But by growing the feed and knowing the amount one has in sight, one can also determine from this the amount of dairy stock one can profitably keep.

All feed stuffs are divided into two heads, viz. roughage or bulky foods, grain foods or concentrates. These all have different values depending on the amount of digestible nutrients contained in them.

The following are some of the most common foods available on the ordinary South African farm, and most of the figures show the proportion of digestible nutrient in each.

TABLE SHOWING DIGESTIBLE NUTRIENTS IN 100 LBS. OF FEED.

Roughage or Bulky Foods.

Name of feed.	Digestible protein.	Carbohydrates.	Ether extract.
	lbs.	lbs.	lbs.
Green maize stalks	1·0	11·6	0·4
Maize stover	1·7	32·4	0·7
Pasture grasses (mixed)	2·5	10·2	0·5
Blue grass	3·0	19·8	0·8
Orchard grass (in bloom)	1·5	11·4	0·5
Oats (green)	2·6	18·9	1·0
Rye (green)	2·1	14·1	0·4
Sorghum	0·6	12·2	0·4
Barley (green)	1·9	10·2	0·4
Oats and peas (green)	1·8	7·1	0·2
Peas and barley (green)	1·7	0·2	0·2
Oat hay	4·3	46·4	1·5
Wheat straw	0·4	36·3	0·4
Rye straw	0·6	40·6	0·4
Oat straw	1·2	38·6	0·8
Wheat chaff	0·3	23·3	0·5
Oat chaff	1·5	33·0	0·7
Lucerne (green)	3·9	12·7	0·5
Cow-pea (green)	1·8	8·7	0·2
Soya bean (green)	3·2	11·0	0·5
Lucerne hay	11·0	39·6	1·2
Cow-pea hay	10·8	38·6	1·1
Soya bean straw	2·3	40·0	1·0
Maize ensilage	0·9	11·3	0·7
Sorghum ensilage	0·6	14·9	0·2
Lucerne ensilage	3·0	8·5	1·9
Cow-pea ensilage	1·5	8·6	0·9
Soya bean ensilage	2·7	8·7	1·3
Beetroot (common)	1·2	8·8	0·1
Mangold wurzel	1·1	5·4	0·1
Turnip	1·0	7·2	0·2
Carrot	0·8	7·8	0·2

Concentrates or Grain Foods.

Name of feed.	Digestible protein.	Digestible carbohydrates.	Digestible ether extract.
	lbs.	lbs.	lbs.
Maize	7·9	66·7	4·3
Corn and cob meal	4·4	60·0	2·9
Mealie bran	7·4	59·8	4·6
Wheat	10·2	69·2	1·7
Wheat bran	12·2	39·2	2·7
Pollard	12·8	53·0	3·4
Rye	9·9	67·6	1·1
Barley	8·7	65·6	1·6
Malt sprouts	18·6	37·1	1·7
Brewers' grains (wet)	3·9	9·3	1·4
Brewers' grains (dried)	15·7	36·3	5·1
Oats	9·2	47·3	4·2
Oat hulls	1·3	40·1	0·6
Buckwheat	7·7	49·2	1·8
Kaffir corn	7·8	57·1	2·7
Millet	8·9	45·0	3·2
Cotton-seed meal	37·2	16·9	12·2
Palm-nut meal	16·0	52·6	9·0
Sunflower-seed cake	31·2	19·6	12·8
Peanut meal	42·9	22·8	6·9
Peas	16·8	51·8	0·7
Soya beans	29·6	22·3	14·4
Cow-pea	18·3	54·2	1·1
Horse-bean	22·4	49·3	1·2

Miscellaneous.

Name of feed.	Digestible protein.	Digestible carbohydrates.	Digestible fats or ether extract.
	lbs.	lbs.	lbs.
Cabbage	1·8	8·2	0·4
Sugar-beet leaves	1·7	4·6	0·2
Pumpkin	1·0	5·8	0·3
Rape	1·5	8·1	0·2
Dried blood	52·3	0·0	2·5
Meat scrap	66·2	0·3	13·7
Cows' milk	3·6	4·9	3·7
Separator milk	3·9	5·2	0·3
Butter milk	3·9	4·0	1·3
Whey	0·8	4·7	0·1

Proportion of Roughage to Grain.

As it is at all times necessary for the cow to have enough food to satisfy her appetite, the proportion of roughage to grain feed must be adjusted to her needs. When dry or yielding only a very small amount of milk, very little grain feed will be required, if any at all, as long as she has enough bulk to satisfy her. If the cow is doing medium work, one-third of the nutrients should be supplied from the grain feed, and the other from the roughage. When in full milk, and giving a good quantity, half the nutrients should come from the grain feeds.

If it is desired to keep the cow in the dairy during her natural life, these precautions should be maintained, but if a record is being worked for, *i.e.* a huge yield in a short time, two-thirds of ration should be grain food.

Object of Feeding.

The object of artificial feeding is to provide sufficient roughage to satisfy the animal, and to supply the amount of each nutrient needed for the work she is doing at the pail. If the ration lacks bulk she will be discontented ; if it contains an excess of nutrient needed for maintenance of body and milk she is yielding, a gradual gain in weight will follow, which we do not want; and, on the other hand, if it is deficient in the nutrients there will be a decrease in yield of milk.

Nutrients described.

The principal nutrients in feed stuffs which give them their value are known as protein, carbohydrates, and fat. These are technical terms, but they are few and not hard to follow.

Protein is the principal of the nutrients, and should always be considered first when we talk of feeding stuffs; white of egg is a good example, also the gummy substance which we find in wheat if we chew a few grains at a time. Protein is usually the most expensive item in feeding and the one most thoroughly needed for milking-cows, as it is necessary for building up the foetal calf and for forming the albumin and casein in the milk.

The carbohydrates are next in importance. Sugar and starch are pure carbohydrates, and when dissolved in the digestive process serve the animal for production of fat, body heat and energy, and also help form the milk sugar. Oats, wheat, barley, mealies are all rich in carbohydrates as they are composed chiefly of starch.

The fats in feeding stuffs have the same work as carbohydrates. When fats are burned they give off $2\frac{1}{2}$ times as much heat as starch, hence by multiplying the fats present in a given food by $2\frac{1}{2}$ we are able to find their value in terms of carbohydrates.

Thus a feed containing—

Protein.	Carbohydrates.	Fat or ether extract.
12 %	45 %	6 %

may be expressed

12 % protein and $6 \times 2\frac{1}{2} + 45$ carbohydrates
= 12 P. and 60 cbds. = 1 to 5

This brings us to the term "Nutritive ratio," which means the proportion of digestible protein to the digestible carbohydrates plus the digestible fat reduced to carbohydrates equivalent. This is found by dividing the percentage of carbohydrates by the percentage protein as in above example, which gives a nutritive ratio of one part of protein to five parts of carbohydrates, expressed 1 : 5.

Balanced Ration.

The next question which presents itself is, how much of the above nutrients must be provided for the production of milk and maintenance of body for a cow giving say 25 lbs. of average quantity milk daily? According to Haecker, cows use 0·05 lb. of protein to 1 lb. of average milk, or to give his table, "Feeders' Guide to Rations," we find—

Feeders' Guide to Rations.

	Protein.	Carbo-hydrates.	Fat.
For food of maintenance per cwt. of cow	0·07	0·7	0·01
Nutrients for 1 lb. of milk . . .	0·05	0·22	0·017
„ „ 10 lbs. of milk . .	0·50	2·2	0·17
„ „ 15 lbs. of milk . .	0·75	3·3	0·26
„ „ 20 lbs. of milk . .	1·00	4·4	0·34
„ „ 25 lbs. of milk . .	1·25	5·5	0·43
„ „ 30 lbs. of milk . .	1·50	6·6	0·515
„ „ 35 lbs. of milk . .	1·75	7·7	0·56
„ „ 40 lbs. of milk . .	2·00	8·80	0·69

Therefore a cow weighing 1000 lbs. and giving 25 lbs. average quality milk daily will need—

	Protein.	Carbo-hydrates.	Fat.
For 25 lbs. of milk.	1·25	4·4	0·34
For food of maintenance . . .	0·70	7·0	0·10
Nutrients needed in ration .	1·95	11·4	0·44

Suppose we have cow-pea hay, corn, stover, mealies, and barley on hand, and have to supply as near as possible the above nutrients; as the cow is doing medium work we should supply about a third of the nutrients from the grain feeds, hence we take—

Name of feed.	Amount.	Protein.	Carbo-hydrates.	Fats.
	lbs.	lbs.	lbs.	lbs.
Mealies.	4	0·32	2·67	0·17
Barley	4	0·35	2·62	0·06
Cow-pea hay. . . .	10	1·08	3·82	0·11
Mealie stover . . .	10	0·17	3·24	0·07
		1·92	12·35	0·41

With the aid of "Feeders' Guide to Rations" as tabulated here, one is able to feed very economically, *i.e.* without undue waste of protein, the expensive item of feeds.

In making up a ration consideration must also be given to the fact that the cow has to give nourishment to the calf she is carrying, and also the

nature of the pasture she is on must be considered, *i.e.* whether hilly or flat, whether she has to go far or near by for water, etc.

In ending this chapter the writer must add that the analysis as tabulated from Henry's "Feeds and Feedings" will not be found to correspond in figures with those given by the Union Department of Agriculture, Pretoria; the analysis of food stuffs as shown by the latter are mostly chemical analysis and do not show what part is digestible as Henry's do. It is only the digestible analysis which is of practical value in compounding rations according to scale.

The following medicines are almost indispensable on a dairy farm :—

Salt.
Sulphur.
Stockholm tar.
Epsom salts (at least 10 lbs.).
Carbolic acid (at least 1 pint).
Raw linseed oil (at least 8 pints).
Oil of turpentine (at least 1 pint).
Vaseline.

The following instruments should always be in stock :—

Calving hooks and ropes (1 blunt and 1 sharp hook).
Two milk syphons.

Two clinical thermometers.
½ dozen dairy thermometers.
Bull punch and rings.
Hair clippers.
Milk scales.
Milk-testing outfit.
Sample jars.
30 yards of good ½-in. rope.
Butter muslin and cheese cloth.
Enamel buckets for cream.

In making up drenches according to prescription the following approximate weights are useful :—

A threepenny piece = 20 grains.
A sixpenny piece = 40 grains.
A threepenny piece and sixpenny piece = 60 grains or 1 drachm.
A shilling piece = 80 grains.
Three pennies and a threepenny bit = 1 oz.

Approximate measures :—

1 teaspoonful = 2 fluid drachms.
1 dessertspoonful = 4 fluid drachms.
1 tablespoonful = 7 fluid drachms.
1 wine glass or large beer bottle = 1⅓ pints.

CHAPTER XVII

SEPARATOR MILK AND THE BREEDING OF PIGS FOR BACON

A WORK of this nature would not be complete without reference to the great and profitable secondary use of successful dairying, viz. the selection, breeding, and feeding of pigs for bacon. It cannot be stated too often that dairying can be made more profitable and the returns from each cow greatly enhanced by feeding pigs with the surplus separator milk, and sending them, when they are in prime condition, to the bacon factory. The creameries in the Union have to-day grown to such an extent that the economic future and prosperity of the dairy industry rests entirely in their hands; that a widespread feeling is abroad, that the time has come for a forward movement in the direction of co-operative effort in the production of bacon and hams.

It must not be thought, however, for one moment that the success of the bacon industry is going to depend entirely on the companies who produce the capital necessary for working a bacon factory. For,

while capital and knowledge of how to cure a first-class article are very important items, the chief point is the supply of pigs. It is easier to guarantee that £40,000 for financing bacon factories, together with the knowledge of how to work such concerns, would be forthcoming within a year, than it is to guarantee that 20,000 suitable pigs would be forthcoming in the same length of time to keep that capital well employed. From this we see that the success of the bacon industry, whether it is co-operative or not, must primarily rest with the farmer who is to supply the pigs of the desired quality.

It has often been stated that in dealing with pigs there is "more in the feed than in the breed." This however is only true in a sense. For in these days of high-priced land, labour, fertilisers, and implements, we have to study economy in production and see that we get as much for our efforts as possible. We therefore have to study such features as economical use of food available, length of time the animal has to be fed, and the proportion of offal to useful carcase, etc. It is best, then, to use pure-bred pigs or first crosses between two recognised pure breeds, as such animals have those desirable qualities which help to make the production of pigs for bacon profitable.

The principal recognised pure breeds are the Berkshires, Large Blacks, Large Whites or York-

shires, Small Whites or Yorkshires, and the Tamworth.

The Berkshire Breed.

This is a very hardy breed of pigs, and is bred extensively in all bacon-producing countries. They are of medium size, compact, and well shaped. The colour for pure-bred Berkshires should be black, with white points, such as on feet, on tip of tail, and a splash of white in the face. The head is medium in length, with short nose slightly dished but not turned up. This breed has a good proportion of lean meat to fat, and therefore provides good pigs for the bacon factory, as they slaughter well, giving a nice shapely carcase. They cross well with other breeds.

Large Whites.

This is the largest variety of pigs known. They are very fast-growing animals, but will not fatten as quickly as a Berkshire, as they use more of their food to make a bigger frame. Once they have grown well they fatten readily. But for supplying this breed, as a pure bred, to the bacon factory, it is doubtful if it will command "top price" as they grow to such a great size and rather larger than the factory requires to turn out a first-class product. This breed, however, is very fast and good at

breeding, as many as 20 often being obtained in a single litter. The objection to them in the Union is that their white skin is sensitive to the sun where they are required to graze.

Small Whites or Yorkshires.

This is a useful breed for crossing purposes. They do not grow quite so fast as the Large Yorkshire, but they fatten readily and produce good-quality pork. They are medium breeders. The objection to them is the white skin, which, like the larger variety, becomes blistered in our hot climate.

Large Blacks.

This, as the name indicates, is a large black breed growing to a very large size, but fattening readily at any age. The colour is coal black, with straight hair and large drooping ears. They are considerably larger than the Berkshire in frame, being more lengthy and not so compact. They are fairly quiet pigs and easy to handle. At the same time they are active and very suitable for grazing. They are very prolific and produce from 10 to 20 in a litter, and are well suited to a sunny climate such as that of South Africa. They have a large proportion of lean meat to carcase. These pigs have been largely imported into South Africa,

and there are some notable herds scattered over the Union. In many places they are preferred to the Berkshire.

Tamworths.

This is a large red pig having a long head and snout, long legs and long body, with deep flat ribs. This breed grows very slowly, but they grow to a large size and they are very hardy indeed, being one of the hardiest breeds known. They have the largest proportion of lean meat to fat of any breed known, and for this reason they are looked upon by the curers in the bacon factory as the very best pig for bacon. It is also noticeable that in advertisements for pigs suitable for bacon curing, the different firms offer more for pigs which are half Tamworth blood than they do for other breeds. The Tamworth sow produces very small litters, very seldom more than 6 or 7 in a litter.

Cross-breeding.

A cross-bred pig, *i.e.* a first cross between two pure breeds, generally has a stronger constitution, and grows more rapidly and is usually more profitable for ordinary purposes than a pure-bred pig. It is always advisable to use a pure-bred boar if cross-bred sows are to raise litters.

In crossing pigs, if we want size and early

maturity, we must undoubtedly use the Berkshire and Large Black. They may be bred either way, but a Berkshire boar with a Large Black sow will produce a pig that is hardy in constitution, a quick grower, a thrifty animal, growing to a large size, and making excellent gains on skim milk and crushed mealies.

The Tamworth crossed with either Berkshire or Large Black gives the ideal bacon pig, but although it will grow to a large size it does not grow so quickly as the above-mentioned cross. Although the bacon factories pay more for a Tamworth cross, it is a questionable point whether the extra ¼*d.* or ½*d.*, as the case may be, pays. For being a slower-growing animal it takes longer to reach the desired weights, and therefore requires more food.

In crossing with Tamworth pigs, only the Tamworth boar should be used, as the sow of this breed produces a small litter. When the Berkshire or Large Black sow is used with the Tamworth boar the litters are good in numbers. These are points which have to be considered in the economic production of bacon pigs.

Breeding Sows.

In dealing with breeding sows and boars it is impossible to lay down any hard-and-fast system as to how they should be managed, for this will

depend largely on the farmer himself—what class of farming he adopts and what class of foods are available. If young sows have been well bred and raised—*i.e.* fed on suitable food in suitable quantities, and have a good frame, and are not too fat—they may be mated to the boar when they are eight months old. It will be found that well bred and fed pigs will show signs of heat at four to five months of age. But they should not be bred at this age, as they are too young and too small, and would remain stunted and would produce weak litters. The period of heat in the sow lasts about three days, and it is sometimes the custom to let the sows run with the boar until they show signs of being "in pig." But from experience it has been found that one mating is quite sufficient to produce a full-sized litter, and when so mated the sows may be removed into a camp, pen, or "put out" on the lands to graze, depending on the system of farming adopted.

When the first signs of being "in pig" are noticed, which will usually be about six or seven weeks after mating, we may begin to feed them with more nourishing food if they have been out grazing and foraging for themselves. Separator milk may now be given them, together with plenty of green food, such as lucerne. This is to help build up the young which she is carrying, for a litter of ten to sixteen pigs is a big drain on her system. This feeding should begin some time

before she farrows, as it is not advisable to change the food when farrowing is almost due. If the sows have been running loose, they should be confined to the camp or sty in which they are to pig a few days before they are due, so that they will be accustomed to the strange place. It is not advisable to have two sows farrowing in the same place, as they injure each other's offspring.

Where pigs are run on the grazing system, and where a good number of sows are "in pig," a good plan is to have at least two camps, so that as the sows advance in pregnancy they may be removed from those which are not so far advanced and where they can get suitable shelter. This removal should take place about five weeks before they are due to pig.

Sows which have not been run on grass veld or in the lands should be kept well supplied with green food, such as green mealie stalks, lucerne, vetches, green barley, pumpkins, and the like.

Sows generally carry the litter for sixteen weeks—old or weakly sows will perhaps farrow a day or two before this, but those in good condition will farrow on the 112th day. Extra strong sows may go a day or two beyond. The litter should not be disturbed for a few days, and the sow should not be fed too much. After which time plenty of separator milk may be given, together with crushed mealies and usual green food.

Breeding Boar.

If the breeding boar is to be raised on the farm, he may be left with pigs of the same age and fed generously on separator milk, together with lucerne if available. Free range in an enclosed camp will make him healthier and hardier, and this method may be continued until he is about five months old, when he should be removed from the others, and the food should be increased both in quality and quantity. The age at which the boar should be used for service will depend on how it has grown and filled out. If the animal is strong and vigorous he may be used at eight months, but if he is not too well developed and has not been too well fed he should not be used before ten months of age.

The boar should not run continually with the sows, for these remain in heat a good while, and if he is frequently serving the sows his litters become smaller and the pigs produced are not so robust. One service has been proved, beyond controversy, to be as good as a dozen matings, and the boar is thus able to serve more sows in a season. For a good average well-grown boar fifty to sixty sows are quite enough for him to serve in a season. The more work he is doing the better he should be fed, and separator milk and mealies, together with lucerne, etc., may well be given him at this time. When not being used for service, green food is

quite sufficient for him. Otherwise, if he be fed largely on skim milk and mealies, he becomes too lazy and not active enough for service, and thus less likely to get a big litter when he is used.

Raising Young Pigs for Bacon Factory.

The secret of successful and economical raising of young pigs for bacon begins at the time of weaning, and lies in the fact of never letting the young pigs lose their "baby flesh" or fatness. It was at one time thought that pigs would grow anyhow—on air probably—might eat anything, and then when they were about a year old they could be caught, penned up, and fattened. Others again believe that a pig wants a lot of exercise and running about in order to produce lean meat; also they would feed him well on fat-forming foods to produce the desirable "streaky" bacon. But it has clearly been proved by experiments in feeding that this is a fallacy, and that by feeding it from the weaning stage on a food rich in albumenoids such as separator milk, food, time, and money are saved. To carry this out successfully we must have quick-growing, strong-constitutioned animals, well adapted for this class of work, and these may be found in the breeds already described, the parent stock of which is handled in the manner already described. As we have already said, the secret is to retain the

"baby" flesh and keep them coming on in weight and size until they are fit for the factory. Before weaning the youngsters from the mother, they should be able to get to separator milk or separator milk and meal mixed, away from the sow, so that they are well used to this food before the mother is removed. This should be commenced when the piglings are about four weeks old, and they should be fed twice a day, during which time the sow may be turned out. This may be continued for about three or four weeks, when they may be altogether removed from the mother without harm to either side. More pigs are ruined at weaning time than at any other stage, for if the above course is not adopted, they miss the mother milk and refuse to take food until they are nearly starving. Then they eat greedily and to excess, which causes an attack of looseness of the bowels. They become pot bellied and never seem to thrive. Like most young animals, piglings want feeding little and often, and there is no better food for them, for the first two or three weeks after weaning, than skim milk to which a little mealie meal or barley meal or pollard has been added. The great object is to feed always so as to retain the "baby" flesh, allowing them no check in their growth; and as the stomach of the pig is small and will not hold much at a time, they must be fed "little and often." Those not intended for breeding should be castrated

when about six weeks old, or about ten days before they are to be weaned. Castration in pigs does not have much risk attached to it, but it is advisable to fast them for about twelve hours previous to the operation, and to only let them have milk food for the next day or two. Young pigs will be well fed on a diet of separator milk and meal such as mealie meal, barley meal, and pollard. It will be found that they will use from 5 to 6 lbs. of meal per 100 lbs. live weight per day, mixed in the proportion of 1 part of meal to 3 parts of separator milk and well soaked. As the pigs increase in size the weight of meal given will be increased, but found to decrease in proportion to live weight, when 4 to 5 lbs. will be found to be all they will eat per 100 lbs. live weight per day. Pigs fed in this manner on mealie meal and separator milk in the proportion of 1 to 3 should weigh from 100 to 120 lbs. live weight, or from 70 to 90 lbs. dressed dead weight when they are 4 to 5 months old. Another month or six weeks of this feeding will give a carcase suitable for the bacon factory, which will secure a higher price per lb. than the carcase of a pig which has been allowed to grow anyhow for a year and then fattened for six months. The most profitable way is to breed only from those animals which have the points mentioned, viz. quick growth, early maturity, fine quality of bone and offal, and to feed the animal as described so as to secure full advantage of these points.

The following table gives the average weight of a number of pigs from birth until the tenth week, and the percentage in gain per week.

Age.	Weight.	Gain in week.
At birth	2·5 lbs.	— per cent.
1st week	4·4 „	76 „
2nd „	7 „	59 „
3rd „	9·8 „	40 „
4th „	12·5 „	28 „
5th „	15·6 „	25 „
6th „	18·6 „	19 „
7th „	22·6 „	22 „
8th „	27·8 „	22 „
9th „	33·1 „	19 „
10th „	38·5 „	16 „

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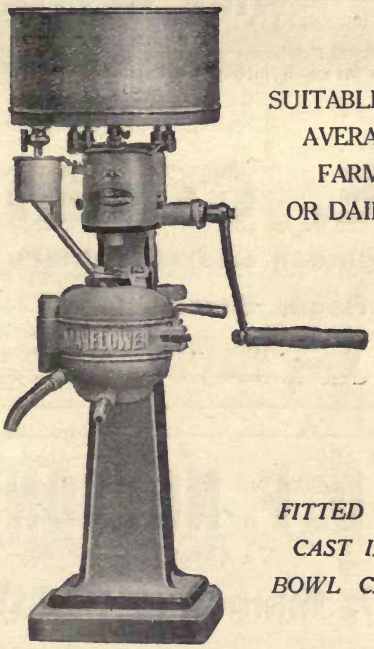

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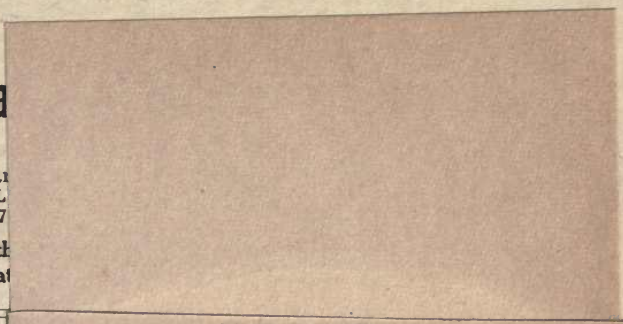

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