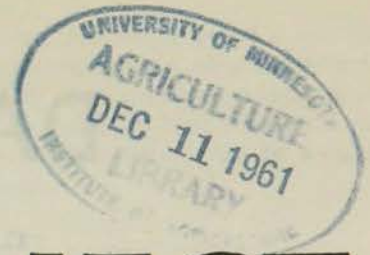


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4-H DAIRY PROJECT



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AGRICULTURAL EXTENSION SERVICE • U. S. DEPARTMENT OF AGRICULTURE

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4 - H

DAIRY PROJECT

C. L. WILCOX, J. W. MUDGE, and R. W. WAYNE

ARE YOU INTERESTED IN WORKING with livestock? Then this 4-H dairy project is excellent for you. It will make growing up on a farm more interesting now and more meaningful throughout life. Although you may later select some career other than dairy farming, your project work will remain an interesting and valuable experience.

For this project you will select your own dairy calf and follow her through her stages of growth. A good goal is to develop your calf into a cow producing 500 pounds of butterfat per year.

This bulletin will aid you throughout the project. You may read how the animal grows, how feed is di-

gested and used, how milk is made, how heredity works, the effect of environment, and how to best care for your animal.

Your father and mother, an older brother, a successful dairy club member, or dairymen in your community can also help you.

Selecting Your Project Animal

UNLIKE SOME CLUB PROJECTS, it is desirable to keep the same animal throughout several years of dairy work. Therefore, select a calf that can be developed into a profitable cow. Then you will be proud to work with her for some time.

Registered Or Grade

It costs no more to raise a registered calf than it does to raise a grade. However, a calf from a registered heifer will be worth more and be a better foundation animal for a herd. Artificial insemination makes good sires easily available; therefore, it is possible to build a registered herd from your registered club calves.

Nevertheless, a registered calf usually costs more to buy. Therefore, if your funds are limited, you may want to buy a good grade calf to start your project. Later, you could use some of the profits to buy your first registered animal. A top quality grade can be a better investment than an average purebred.

Where To Buy

If your father has a good herd, that would be a fine place to get your calf. Your father knows each cow family and its individual characteristics. He can help select your calf. A neighbor breeder, who has had a good herd for several years, is also a fine source of club calves.

Moreover, some state and local breed association sales offer suitable calves and may give a small dis-

count to club members. Your county agent or breed fieldman often knows where good calves are for sale. These people can also advise you on your choice of a project animal.

Points To Consider

Heifer calves born between July 1 and December 31 of this year will show as heifer calves next year. Within an age group the older calves have an advantage in the show ring. Therefore, between two nearly equal calves, some advantage may be given to the calf born nearer to July 1.

Junior yearlings are born between January 1 and July 1. January and February calves have the age advantage in this group.

The calf selected should be sired by a good bull and from an outstanding cow for she inherits her various characteristics from them (see page 12). The bull should be a desirably proved sire or a carefully selected young one. The dam's production records should be above the herd average. She should have a well shaped, good quality udder; good body capacity; dairy character; and good feet and legs.

A clean-cut head, long lean neck, and sharp withers are an indication of dairy character. Good width

and depth of chest, with deep well sprung ribs, gives adequate body capacity. Her general appearance should include a strong alert head, a straight top line, and strong feet and legs. She should be healthy and well grown for her age.

If you are an older club member, starting a dairy

project for the first time, you might select a yearling. Otherwise, you would have to wait an extra year for the calf to develop. The same selection principles apply to a yearling. If she has been bred to a good sire, she will be worth more. Her calf should be a valuable addition to your herd.

Dairy Calf Feeding and Management

The New Born Calf

IT IS IMPORTANT THAT THE CALF has a good start. The new born calf is low in vitamin A and the antibodies that protect it against infection and disease. Therefore, see that the calf gets a good feed of colostrum, the first milk that the cow produces after calving.

Colostrum is easily digested by the calf. It contains protective antibodies that are transferred to the calf's bloodstream. If the calf does not nurse within an hour, help it to nurse or take some milk from the cow and feed it to the calf. If the calf is not left with its mother, be sure to feed it the colostrum for the first 4 days.

HOUSING

When the calf is removed from her mother, place her in a clean, dry, well bedded, draft-free pen. If it is not possible to give her a separate pen, stanchion the calf or tie her at feeding time to prevent sucking.

FEEDING

Feed either whole milk or milk replacer at the rate of 1 pound per day for each 10 pounds weight of the calf. If grade B milk is sold, it is often as cheap and easier to feed whole milk. If grade A milk is sold, it may be cheaper to feed milk replacer, especially during the base milk period.

If milk replacer is used, feed it according to the manufacturer's directions. Feed either milk or replacer at the same temperature every day, preferably 95°-100° F. Wash milk buckets thoroughly each time. Limiting the milk fed to 10 pounds per day encourages early eating of grain and hay.

To interest the calf in grain, put a little grain in the bottom of the milk bucket after feeding. Or, you might rub a small handful of grain on the calf's muzzle just after she finishes the milk.

Allow the calf to eat all the starter she will—up to 4 pounds per day. A good calf starter may be made by mixing the following: ground corn, 40 pounds; ground oats, 30 pounds; soybean meal, 30 pounds; trace mineral salt, 1 pound; and dicalcium phosphate,

1 pound. Or, if you prefer to use a commercial starter, many good ones are available.

Mixed hay is often preferred for young calves because it is not as laxative as alfalfa. It should be free from mold and have good color. Feed hay often in small amounts. Calves prefer fresh hay that has not been "blown" on.

If the calf is thrifty and growing well, the milk or milk replacer may be gradually decreased and discontinued when 6 weeks old. Continue to feed starter grain mix until the calf is 4 months old.

If the calf scours, reduce the amount of milk until she is normal. An antibiotic, such as aureomycin, often reduces the scours problem. This can usually be purchased in capsule form. Follow directions given on the package or by your veterinarian.

If skim milk is available, it is an excellent calf feed. When your calf is about 3 weeks old, gradually sub-

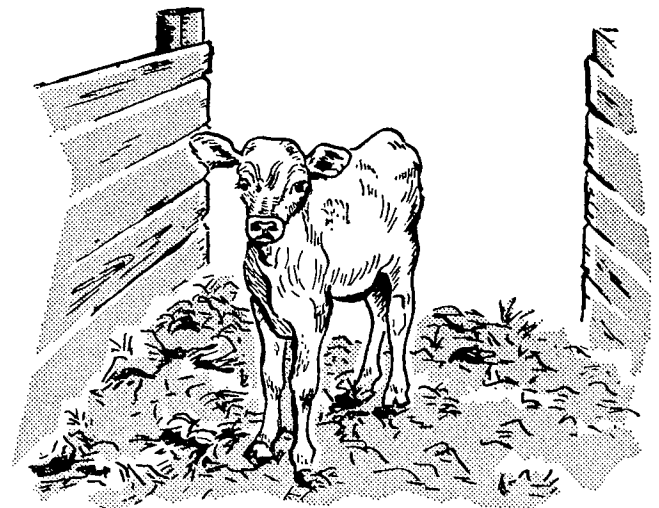


Fig. 1. Provide a clean, well bedded pen.

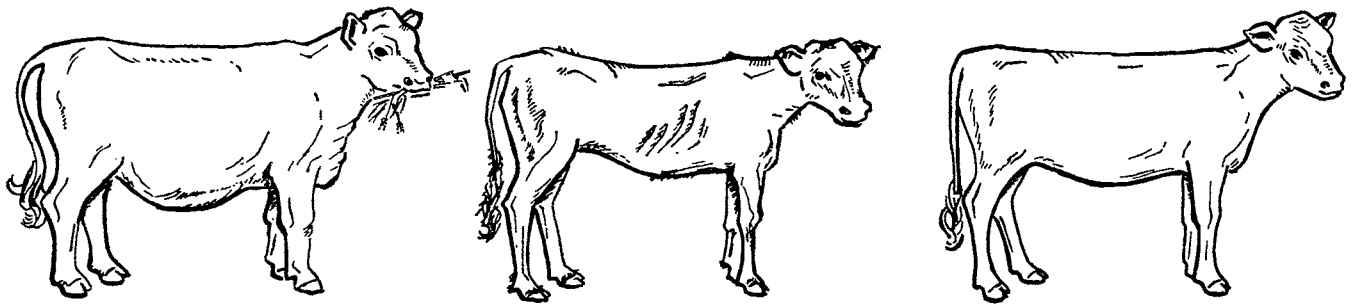


Fig. 2. Left: too fat. Center: too thin. Right: just right.

stitute skim milk for whole milk. The skim milk should be fed until the calf is 4 months old. Limit calves to 16 pounds daily. If skim milk is fed, the grain mixture may consist entirely of home grown grains.

DEHORNING

Most dairy cattle are dehorned. Less feed space is then required and there are fewer injuries. Removing horns at an early age results in less setback for the calf. If caustic potash or commercial paste is used, complete the job before the calf becomes 2 or 3 weeks old.

Clip the hair from the horn button. Scrape the section over the button with a knife blade until it has a reddish appearance. Apply the caustic or paste to an area about the size of a quarter. Cover the horn bud and a small ring of skin around it. Be sure to prevent the caustic from getting into the eyes.

If the hot iron method is used, the area completely around the base of the horn must be heated so the growth tissue is destroyed.

After 4 Months

FEEDING

After the calf is 4 months old, she may be fed the same grain mix as the milking herd. She should receive all the good quality hay she wants. When 6 months old, reduce the grain somewhat, particularly if excellent hay is fed.

The grain ration fed depends on the quality of hay and silage. In table 1 grain rations are suggested for the quality of roughage listed. Salt and minerals should be provided free choice.

The calf should be kept growing well, but don't let her get too fat. This can be harmful because the calf deposits fat in the udder. After calving, therefore, she might have a meaty udder. She might also become coarse in the throat, neck, and shoulders; round ribbed; and thick in the thighs.

Silage

Until the calf is 4 months old, leave silage out of the ration. The calf's paunch is still fairly small. If she eats silage, she has little room left for the needed grain and hay.

After 4 months, silage may be fed in small amounts—3 to 5 pounds per day. Gradually increase this amount as the heifer grows.

Pasture

Keep 4-H calves off pasture. They are then easier to fit for showing and have more bloom of hair.

Yearlings

Because the feed requirements for yearling heifers are easily met, this age group is often neglected.

They should be kept in a thrifty condition, not too fat but growing continuously. If the hay and silage quality is only average or fair during the winter, feed some grain to keep the heifer growing. If they have plenty of good quality roughage (pasture in season or good hay and silage) they usually require no grain until 60 days before calving. The amount to feed at this time depends on the heifer, but 4 to 6 pounds per day is suggested. Extra conditioning at calving time will usually result in more milk production.

Table 1. Grain ration to be fed with different quality roughage

Grain ration	Roughage		
	Excellent	Good	Fair
	pounds		
Corn	500	500	500
Oats	500	400	300
Soybean meal	100	200

The time to breed a yearling heifer depends on age and size. Well grown heifers should be bred to calve when about 24 months old. Well grown Jersey heifers may be bred to calve 1 to 2 months earlier. If the heifer is small, breeding should be delayed. Jerseys should weigh at least 500 pounds at breeding time; Guernseys, 550; Ayrshires, 600; Holsteins and Brown Swiss, 750 to 800. Heifers that calve in the fall usually produce more milk than those calving in the spring and summer.

With artificial insemination available, you may have a choice of several sires to use.

Normal Growth And Development

Is your heifer as large as she should be considering her age and breed? You can check this by comparing her weight with the figures in table 2.

Normal growth charts for Brown Swiss are not available. Their weights and Milking Shorthorns' are close to those of Holsteins.

If you do not have a scale to weigh your heifer, estimate her weight by measuring her heart girth with a heavy cloth tape or a steel carpenter's tape. Place the tape just behind the front legs and shoulders and pull it snug.

Breeding Time

When your heifer is ready to breed you will probably want to consult several people before selecting the sire. Your father can advise you. Also talk with some artificial breeding technicians who can pro-

Table 2. Normal growth chart for various breeds

Age	Ayrshire	Guernsey	Holstein	Jersey
months			pounds	
Birth	71	65	93	50
1	86	79	115	70
2	114	105	155	96
4	190	177	260	176
6	281	267	379	268
8	371	350	491	357
10	451	427	589	432
12	518	490	685	495
14	576	556	752	549
16	635	605	820	597
18	690	663	890	644
20	743	712	961	694
22	790	763	1,038	742
24	845	818	1,104	785

Table 3. Estimated weights for different heart girths

Heart girth	Weight	Heart girth	Weight
inches	pounds	inches	pounds
26	60	55	501
27	68	56	526
28	75	57	552
29	85	58	579
30	95	59	607
31	108	60	637
32	118	61	668
33	128	62	700
34	138	63	732
35	148	64	766
36	158	65	800
37	168	66	835
38	180	67	871
39	192	68	908
40	208	69	947
41	224	70	987
42	240	71	1,027
43	257	72	1,069
44	275	73	1,111
45	294	74	1,153
46	314	75	1,197
47	334	76	1,241
48	354	77	1,285
49	374	78	1,331
50	394	79	1,377
51	414	80	1,423
52	434	81	1,469
53	456	82	1,515
54	478		

vide service from a number of sires. They usually know the strong points and weaknesses that each sire is transmitting to his offspring. If you select a sire that is strong where your heifer is weak, the calf should be better in these areas than its mother.

It is easier said than done to improve dairy cattle by allowing only the best sires and dams to parent the next generation. Many dairy cattle breeders work a lifetime without making great progress. It is difficult to know how good or bad an animal is. The best measure of worth is performance.

Milk production is influenced by the inheritance received from the parents plus the opportunity to express this inheritance. If an animal does not meet expectations, it may be due to poor inheritance or failure to provide the right feeding and management.

Although the sire does not produce milk, his role is just as important as the dams in determining the inheritance for milk production. To evaluate the sire, study his pedigree, his ancestors, and his offspring.

Fitting and Showing

FITTING AND SHOWING IS AN IMPORTANT PART of dairy club work. The member whose animal is not good enough to win her class on type may, through effort and skill, top the class in fitting and showing.

Training

Train your calf while she is still young—don't wait until a couple of weeks before the show. Training the calf to lead will be easier if you tie her with a double loop rope halter for a while each day. Also accustom your animal to the halter to be used on show day. (See Ext. Bul. 192, Univ. of Minn., *Ropework—Practical Knots, Hitches, and Splices.*)

Pull quickly to the side to start the calf until she learns to lead. After she leads well, train her to walk slowly with short steps. She will then be easier to move into position and to pose.

An animal that takes long steps usually stretches too much, gets off balance, and looks awkward. Study your calf to see in what position she looks best while standing. She should stop with her head up and alert.

Grooming

Brush the calf daily so she has a soft, clean, shiny hair coat. A currycomb is too rough on the skin, so use a fairly stiff bristled brush at first. Make short, quick strokes with a snap of the wrist to remove old dead hair and dirt.

While brushing, keep the currycomb in one hand. After several brush strokes, draw the currycomb across the brush bristles to remove dust and hair. Brush in the same direction as the calf's hair lies.

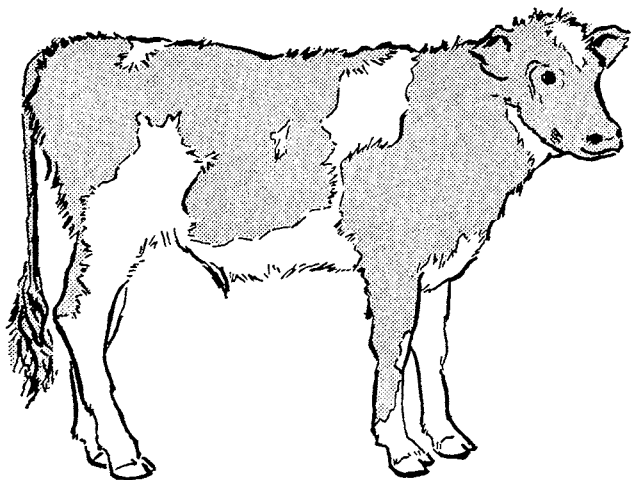


Fig. 3. Your calf may look like this at first.

Finish grooming with a soft, close bristled brush. Rub the hair with your hands to bring out the oil in the hide and give a soft, glossy coat.

Blanketing

Blanketing makes the hair lie down and causes shedding. This leaves a short, sleek hair coat. A blanket can be made from used burlap feed sacks. If you have a good khaki duck blanket, you may want to save it for fairs.

Feeding

If your heifer is to be well fitted, she must be well fed. A heifer that is too thin usually has rough hair that lacks luster. But she should not be too fat.

Linseed oil meal gives extra gloss to the hair. It may be substituted for soybean oil meal for a couple of months before show season. A good fitting ration is: 5 parts wheat bran, 3 parts ground oats, 1 part ground corn, and 1 part linseed oil meal. If the animal needs more flesh, substitute corn for part of the bran and oats.

To increase hay consumption and get more middle on your calf, feed her a variety of hay. If the calf's droppings are too loose, reduce the legume hay and feed more grass hay.

Beet pulp helps the animal take a good fill on show day. Some calves do not eat it readily at first, so feed it for a few weeks before the fair. Soak the dried beet pulp in water for half a day before feeding.

Feed about a gallon of the soaked beet pulp twice a day to heifer calves and more to older animals. Feed grain on top of beet pulp. Also have the calf accustomed to drinking water from a bucket before fair time.

Hoof Trimming

If the heifer's feet are too long, trim the hoofs so that she will stand squarely. Use nippers or a chisel and mallet. If the chisel is used, place the foot on a board. Do not cut too much at one stroke. Trimming too short results in lameness.

If the sole of the hoof needs trimming, you may want to throw the heifer. Tie a knot that won't slip around the calf's neck in front of the shoulders, a half hitch behind the shoulders, and another half hitch

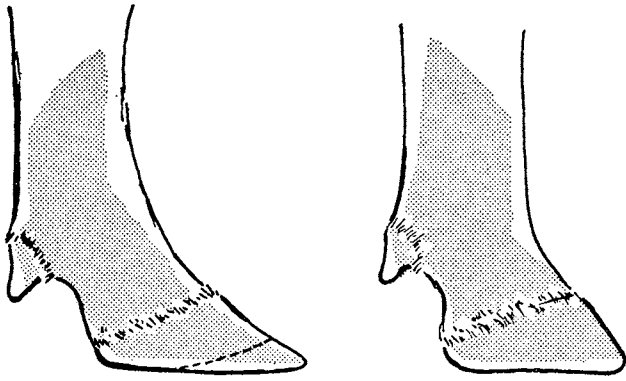


Fig. 4. Trim hoofs for good posture.

in the flank. A steady pull on the rope will make the calf lie down.

Horn Polishing

If your heifer is not dehorned, shape and polish her horns before fair time. Horn trainers may be necessary to get horns shaped like those on the true type picture of the heifer's breed.

First smooth the horns with a half round rasp. This also helps shape them. Then scrape them with a wood scraper or a piece of glass. Do not remove too much of the shell as it may weaken the horn, causing the shell to be easily knocked off. Next use emery paper and then steel wool to get a very smooth finish.

Just before the show, apply a metal polish and shine horns with a wool cloth. Finally apply a little olive oil with a cloth before entering the ring.

Clipping

A good job of clipping improves the appearance of your animal. Clip about 3 weeks and again 2 or 3 days before the first show. That way you can correct mistakes made in the first clipping. Never clip an animal all over.

The clipper should have sharp blades properly adjusted. Put sewing machine oil in the oil holes. Frequently dip the running clipper head in a mixture of equal parts of kerosene and 10 weight oil. This keeps it in good operating condition.

Brush the animal before clipping so less dust gets into the clipper. Clip the tail starting about an inch above the switch. Work against the hair to the tail-head. If the rump is uneven, clip the hair from the high spots but leave hair in the low spots.

Pose your heifer so she stands properly before clipping the shoulders. Starting at the point of the shoulder, remove the hair from the shoulder blade. Leave all the hair in the crops. If the animal is ewe necked, leave some hair on the top of the neck to

make this less noticeable. Otherwise, clip all the hair from the neck and head. Brown Swiss showmen usually leave the hair in the upper half inside the ear.

Always clip against the hair except when blending between clipped and unclipped areas. Clip the udder and belly of cows but not heifers. Look carefully for skipped patches before quitting.

Washing

Washing may remove stains that brushing does not. Avoid frequent washing as it makes the skin dry and the hair rough. Jerseys are seldom washed except for feet and legs. Other breeds are usually washed before leaving the farm and again the day before each show.

Clean the stall before washing the animal and put down a deep bed of straw. Tie the heifer with a short chain so the halter will not get wet. Keep water out of the animal's ears. Wet the animal thoroughly, lather with soap, and scrub with a brush.

Rinse and give a second soaping for a more thorough job. Then rinse again to get all the soap out. Use your hands to remove as much water as possible.

If available, keep the animal warm with a clean blanket while the hair dries. This makes the hair softer. The switch should be washed daily for several days before the show in order to remove stains. A little bluing in the rinse water helps.

Show Day

It is a good idea to "fill" your calf at home a few times to see how she looks best. Save your best hay to feed on show day. Feed extra soaked beet pulp with a little grain on top to get the desired fill. Hay and beet pulp stay with the animal longer and are more satisfactory than a fill of water. Regulate feeding to have the animal filled for your class time.

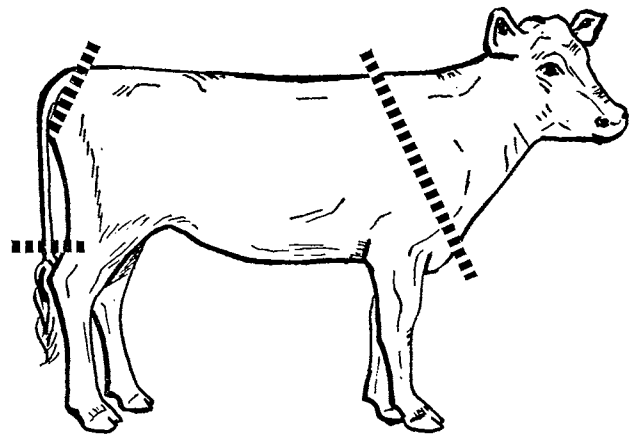


Fig. 5. Clip closely in the indicated areas.

Brush the animal thoroughly just before ring time. Then go over her with a wool rag moistened with equal parts of olive oil and alcohol. Instead of braiding, fluff the switch by combing or rubbing with your fingers in the opposite direction of the hair. Repeated braiding may cause loss of hair.

Adjust the show halter to fit properly. Snap the lead strap to the right ring and pass it through the left one.

Ring Procedure

Be ready to enter the ring promptly when your class is called. Always lead from the left side of the animal. Walk your calf slowly, moving in a clockwise direction. Lead with the left hand, and walk backwards so you can watch the judge at all times.

When the judge signals to stop, pose your animal with her feet properly placed and head up. If possible, stand her with front feet a little higher than the rear feet. Keep the front feet out of holes.

Leave room between you and the animal ahead so you can move forward a little, if necessary. If your animal has not posed properly, move her forward until she stops just right. Be ready to move promptly when the judge motions you into line.

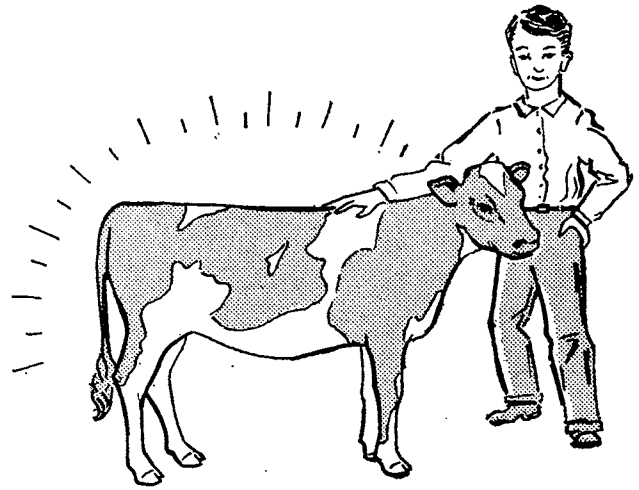


Fig. 6. Your calf should look like this after fitting.

Be a good sport; win modestly or lose graciously. Study the type of the winning animals. Resolve to do a better job of fitting and showing next year. You can learn by watching and talking with those who placed above you.

The 2-Year-Old and Advanced Project

WHEN YOUR 4-H DAIRY ANIMAL FRESHENS, start using the advanced record book. Summarize and copy all previous records into this form as explained. Fill in information as soon as possible, such as calving and breeding dates.

If your home herd is tested in the DHIA program, use this information for your record. If not, weigh and sample 1 day a month and have a butterfat test run at your creamery or high school agriculture department. Then you can complete your record.

Summarize your record as directed. Your record as well as your animal will be scored for placing if you exhibit at the State Fair. It will also serve as information for you later.

Feeding And Care

Now that you own a milking cow, you are a dairyman. Therefore, you should read dairy literature such as breed and dairy papers.

For further information, see USDA Farmers Bulletin 1998, *Selecting Dairy Cattle*; USDA Farmers

Bulletin 1443, *Dairy Cattle Breeds*; and YMW Circular 4, *Starting In Dairy Farming*.

BEFORE CALVING

If you are not already doing so, start feeding your heifer grain 60 days before calving. This is to have her in good condition at calving time. Moreover, it accustoms her to the ration she will receive after calving. From 4 to 6 pounds of grain daily is suggested. A cow or heifer will produce more milk of a higher test if in good flesh at calving time. The grain ration fed to your animal can be the same as fed to the rest of your herd.

Barn feed your heifer for a few days before calving. This acquaints her with the surroundings before she calves and starts milking.

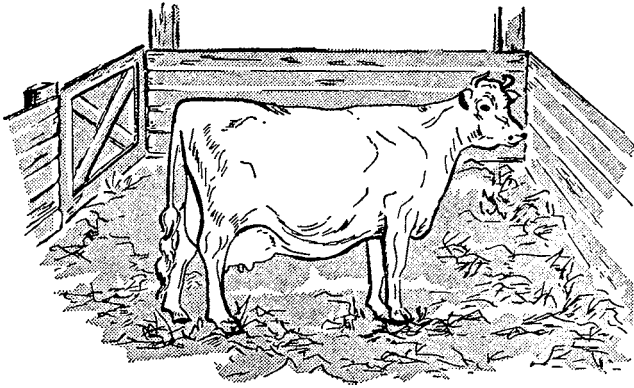


Fig. 7. A clean, well bedded box stall is desirable at calving time.

AT CALVING

A clean, well lighted, well bedded box stall is a good place for your heifer to freshen. Calving on a clean area in the pasture in summer is also desirable. However, if she has difficulty, it may be easier to care for her in the stall.

If you do not have a box stall, place your heifer in a large stall. Pack the gutter with straw to give her more room—a bale or two will do.

Keep your heifer dry and warm after calving. Shut off her water cup and give her lukewarm water the first day. If your cow fails to get up within 1 or 2 hours, watch for milk fever. She will usually die from this unless treated immediately. Call a veterinarian as soon as the symptoms appear.

When a cow freshens and starts secreting milk, there is a sudden drain of calcium from the blood into the milk. Sometimes the cow's body does not react quick enough to take more calcium from the feed. Thus, the calcium level in the blood gets abnormally low. The cow then goes into a coma known as milk fever. Your veterinarian can inject a calcium salt, calcium gluconate, directly into the blood to cure her.

Save the first two milkings of your heifer to feed to her calf. This first milk, colostrum, is high in vitamins (especially vitamin A), antibodies (disease fighters), and protein (see page 15).

AFTER CALVING

You will probably give your heifer what your father feeds the rest of the herd. Generally, the best ration for most dairy herds is high quality alfalfa hay, corn, or hay crop silage; home grown grain (corn, oats, or barley); a high protein concentrate such as soybean meal; trace mineralized salt; and either steamed bone meal, dicalcium phosphate, or a mineral mixture high in phosphate.

The amount of grain to feed depends on the cow's condition and production and grain prices. A suggestion is 1 pound of grain to each 4 pounds milk.

A cow can usually eat 16 to 18 pounds grain daily without going off feed. If she goes off feed and refuses to eat at all, cut back a little and continue at that amount. It usually pays to increase the amount of grain fed as long as enough extra milk is produced to pay for the extra grain.

Breed your cow at the first heat period following 60 days after calving. If she has a vaginal discharge, delay breeding and have her checked by your veterinarian.

Watch your cow closely on the 19th, 20th, and 21st days after breeding for signs of heat. It is likely to occur then if she did not settle on the first service.

Table 4. A cow pantry for 1 year

Animal	Food for 1 year	
Calf to 1 year	Whole milk	350 lbs.
	Calf starter mix	300 lbs.
	Herd grain mix	800 lbs.
	Hay	1¼ tons
Yearling	Grain mix	400 lbs.
	Hay	1¼ tons
	Silage	3 tons
	Pasture	136 days
Cow (producing 10,828 pounds milk, 3.7 per- cent 400 pounds but- terfat—Minnesota DHIA average, 1960)	Grain mix	3,300 lbs.
	Hay	2½ tons
	Silage	3¾ tons
	Pasture	136 days

Cattle Ailments

MANY CATTLE AILMENTS RESULT FROM INFECTIONS of disease germs or viruses. These organisms enter the animal's body through the mouth, respiratory system, reproductive tract, cuts or abrasions of the skin, or naval cord (in the newborn calf).

The disease organisms enter the blood stream and multiply. The animal's body produces antibodies that can eventually destroy these organisms. However, the animal may become sick or die beforehand.

Animals who are poorly fed or kept in dirty, damp, or drafty quarters catch diseases more frequently.

Common Scours

Causes—Poor nutrition; overfeeding; dirty feeding equipment; feeding milk at variable temperatures; and damp, dirty pens.

Symptoms—Watery, foul smelling droppings; dull appearance; and loss of appetite.

Prevention—Correct the management problems listed under causes.

Treatment—Reduce the amount of milk fed. Use of antibiotics will often help.

Infectious White Scours

Causes—Virus and bacterial infections.

Symptoms—Whitish, thin, watery droppings; and sunken eyes. Calf weakens rapidly. This occurs 2 or 3 days after birth.

Prevention—Isolate sick calves. Thoroughly clean and disinfect all infected quarters. Avoid bringing carrier animals into clean herd.

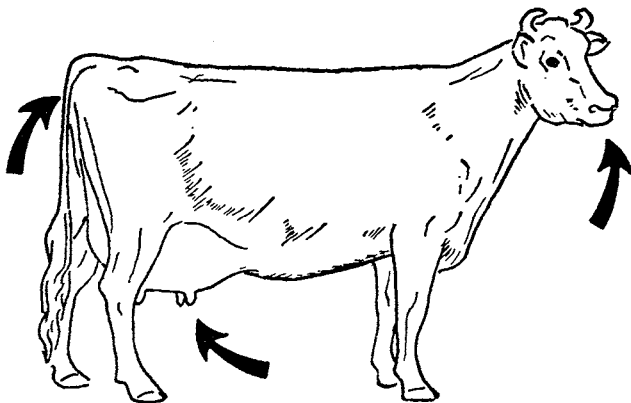


Fig. 8. Disease organisms may enter the body in various ways.

Treatment—Treatment is usually ineffective. Check with your veterinarian.

Pneumonia

Causes—Bacteria and viruses. This often follows exposure to drafts and damp quarters.

Symptoms—Coughing, discharge from nose and eyes, fever, lack of appetite, and fast breathing.

Prevention—Dry, draft-free quarters with sufficient bedding.

Treatment—See your veterinarian. Antibiotics are usually used.

Brucellosis (Bang's Disease)

Cause—Bacteria.

Symptoms—Abortion, usually at about 7 months of pregnancy.

Prevention—Test and remove reactors from the herd. Calfhooed vaccinate when 4 to 8 months old.

Ringworm

Cause—Fungus.

Symptoms—Circular areas of hairless, scabby, crusted skin usually on head, neck, and shoulders.

Prevention—Prevent contact of clean animals with infected animals. Disinfect contaminated pens.

Treatment—Scrub infected areas with brush and soapy water. Then paint with tincture of iodine or fungicide.

Lice

Cause—Contact with infested animals.

Symptoms—Rubbing, scratching animals; loss of hair in patches. Infestations cause loss of weight.

Prevention—Keep animals away from infested ones.

Treatment—Dust with 1½-percent rotenone powder.

Repeat treatment in 2 weeks.

The Whys of Nutrition

THE DAIRY CALF NEEDS many of the same nutrients as the growing boy or girl. The calf, however, has a four compartment stomach so that much of its needs may be obtained from roughages. The cow's ability to make milk from these roughages that man can't use is the basic reason for the dairy farm.

The Cow's Stomach

The first compartment of the cow's stomach is the rumen or paunch. It is filled with micro-organisms (bacteria, protozoa, yeasts, etc.) that break roughages down into simple nutrients.

The second compartment is the reticulum. This strains out foreign materials such as wire, nails, etc.

The third compartment is the omasum. It is often called manyplies because of the many folds in its walls.

The fourth compartment, abomasum, is more like the human stomach. Here digestive juices are secreted and most digestion takes place.

Food Needs

Two of the most important needs of the animal are: (1) carbohydrates and fats for energy and milk production, and (2) proteins for body growth and repair and milk production. Grains provide the most concentrated source of energy. The most common sources of protein are legume hays, immature grasses, and oil meals.

Some minerals are also necessary. Iodized trace mineralized salt should always be available. Salt is needed for making some digestive juices. Iodine is used by the thyroid gland which regulates many body functions.

Milk is one of the best sources of calcium for humans. The cow uses large quantities of calcium in

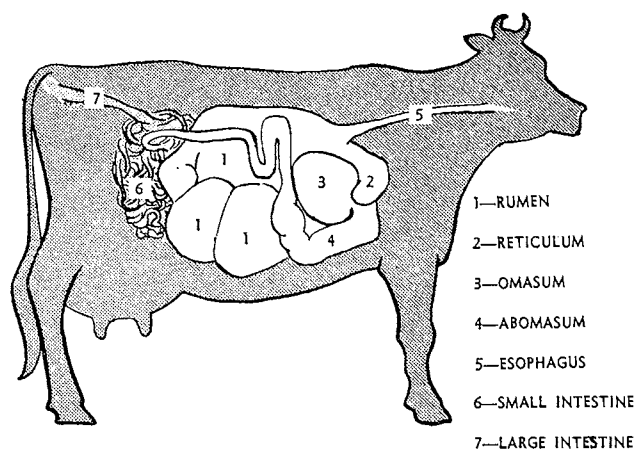


Fig. 9. The dairy cow has a very efficient digestive tract.

Table 5. What's in feed

Nutrient	Function	Feed Sources
Protein	Growth, repair of body tissue, milk production	Oil meals, legume hays, skim milk, immature pasture
Carbohydrates	Energy source for: body maintenance, growth, milk production	Grains, hay, silage, pasture
Fats	Energy source	Grains
Minerals	Skeleton, essential parts of enzymes and hormones	Trace mineral salt, dicalcium phosphate, steamed bonemeal, calcium in legume hays, phosphorus in grain by-products
Vitamins	Growth, reproduction, and general health	A-green, leafy roughages, yellow corn B-produced by bacteria in rumen C-produced in digestive tract D-sunlight, fish oils, irradiated yeast E-grains

production. Calcium and phosphorus are necessary for good bone growth. Legume hays grown on soils with sufficient lime furnish most calcium for cattle. Dicalcium phosphate and steamed bone meal provide both calcium and phosphorus. If these are fed free choice, cattle will eat all they need.

Cobalt, magnesium, iron, copper, zinc, manganese, and sulfur are other minerals needed by cattle. They are usually present in sufficient quantities in normal rations. Use of a simple trace mineralized salt will guard against their deficiency.

Vitamins are essential for life. Vitamins B and C are produced in the cow's body. Vitamin E is plentiful in grains and grasses so it is not a problem in dairy rations.

Vitamin A is made from carotene, a yellow substance found in green leaves of plants and the seed coat of corn. Cattle can store it in the liver when they receive more than their needs by eating good pasture or green leafy hay. It protects against colds and infections.

Vitamin D is necessary for efficient use of calcium and phosphorus in bone growth. Cattle receive it from the sun's rays or sun cured roughage.

The Interesting Story of Inheritance

THE WORD "INHERIT" means to receive something from our relatives or friends. Usually we think of this in terms of money or property. But, of greater importance is the inheritance we receive from our parents at birth. This largely determines our mental and physical characteristics. Genetics is the science that deals with inheritance.

Chromosomes And Genes

Let us see how inheritance works in dairy cattle. A calf comes from the union of two sex cells—one from the sire or father and one from the dam or mother. The sire's sex cells are called sperm and the dam's are called ova or eggs.

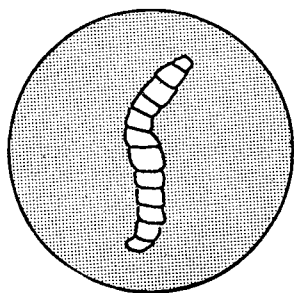


Fig. 10. A chromosome with genes.

In the center of the nucleus of these cells are chromosomes. These are made of disk or beadlike particles called genes. The chromosomes are similar to a string of beads with each bead representing a gene.

The gene is the basic unit of inheritance. One gene pair determines whether the animal will have horns, another concerns coat color, others influence milk production, etc.

Chromosomes always occur in pairs except in the sperm and egg where only one of each pair is found. When the sperm and egg unite, the chromosomes pair and the offspring has the same number as the parents.

Figure 11 is, of course, greatly simplified. Actually, there are 30 pairs of chromosomes in dairy cattle and thousands of gene pairs.

In dairy cattle usually one egg is formed at a time. However, millions of sperm are produced. At the time of mating, these are deposited in the reproductive tract of the cow. But only one sperm enters the egg. Thus each parent contributes equally to the inheritance of the offspring.

Bull Or Heifer

With this background in genetics, let us now see what role the genes play in determining whether the new animal will be a bull or a heifer. In figure 12 are the male and female reproductive cells (the sperm and the egg). For purposes of illustration the sex chromosomes are labeled X and Y.

In the male cell one chromosome is labeled X and the other Y. In the female cell both chromosomes are labeled X.

When the cells divide, the male cell forms one sperm which carries an X chromosome and another which carries the Y chromosome. The female cell forms only eggs with X chromosomes.

If the X chromosome from the male unites with one of the X chromosomes from the female the offspring will be a female. If the Y chromosome from the male unites with one of the X chromosomes from the female the offspring will be a male. Chance alone determines what will happen.

The inheritance for milk production is more complicated. In this case, let us say that three gene pairs are involved.

The capital letters in figure 13 stand for 100 pounds of butterfat production and the small letters for 50 pounds. If the AbC chromosome from the sire unites

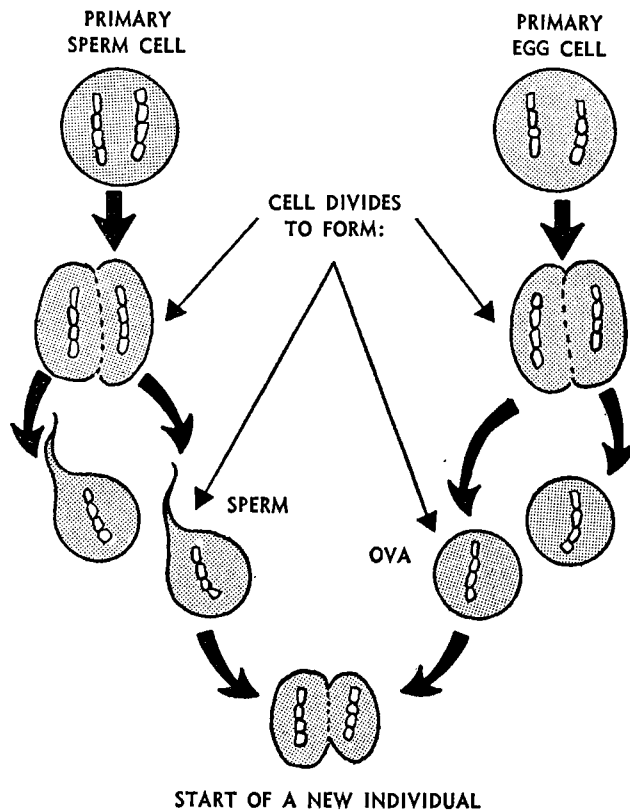


Fig. 11. Each reproductive cell goes through a process of reduction-division before fertilization takes place.

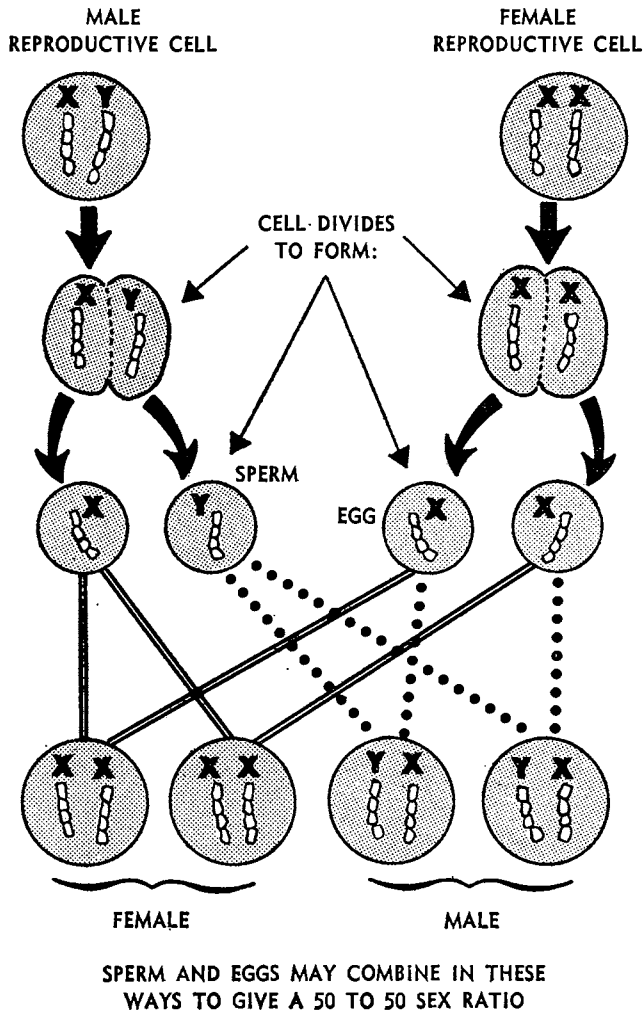


Fig. 12.

with the AbC chromosome from the dam, the new offspring will have the potential to produce 500 pounds of butterfat. However, if the other two chromosomes

unite the individual will have the potential to produce only 400 pounds.

Basically, this is the way inheritance works. But, it is more complicated. Usually hundreds of gene pairs are involved for each characteristic. It has been estimated that 20 to 400 gene pairs are concerned in milk production. Some pairs are better than others. Therefore, we find a wide range of differences among cows in milk-producing ability.

Environment

Good inheritance, however, is not enough. If a cow with the best genes of the breed does not receive good feed and care, she cannot fully use her superior inheritance. Thus, environment (feed, care, and management) plays an equally important role.

We might compare this situation to an expensive new automobile. We must provide the right fuel, operate and control it correctly, and handle it properly if it is to perform at its best. This is equally true of the cow.

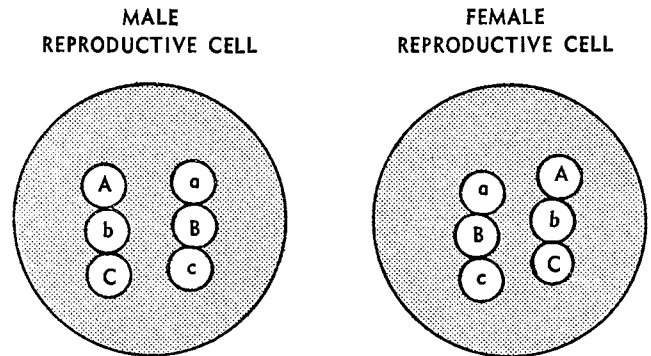


Fig. 13. Each of these genes makes a small contribution to the butterfat production.

The Story of Milk Secretion

THE DAIRY COW is actually a milk manufacturing machine. In addition, she may leave several females to replace her, as well as male calves that can be used for veal. And after a long productive life, she may end up as beef.

The cow's reputation of being the most efficient producing farm animal results from her highly specialized equipment. Let us begin with the basic raw materials and see how the cow uses them to make milk.

The Digestive System

Food taken in at the mouth goes to the stomach by way of the gullet. Here is found one of the secrets to the cow's success for she has not one but four stomachs. Food enters the rumen first where millions of tiny one celled animals break the food down into smaller units. In addition, they may build things such as the B12 vitamins.

As the food material passes through the digestive tract, many different processes reduce it to basic chemical units. All along the tract these units are absorbed into the blood stream. The blood stream carries them to other parts of the body where they may be used for energy, for growth, for milk production, etc. This begins the story of milk production.

The Udder

The mammary gland or the udder is made up of four separate quarters, each drained by a teat. The mammary gland is actually a skin gland. It is fastened to the body by strong suspensory ligaments and connective tissues. In the center is a canal where the blood vessels and nerve cables enter the udder from the cow's body.

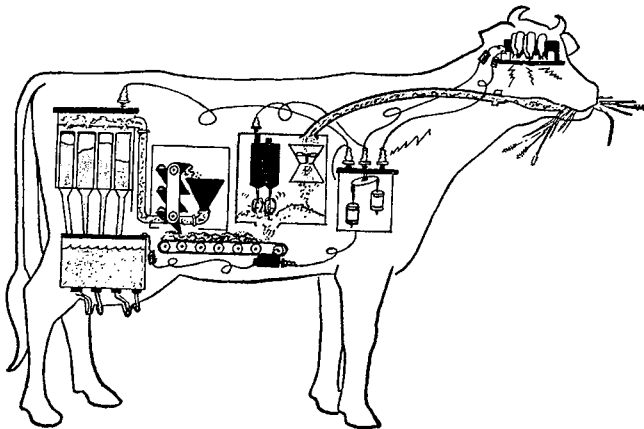


Fig. 14. A milk manufacturing machine.

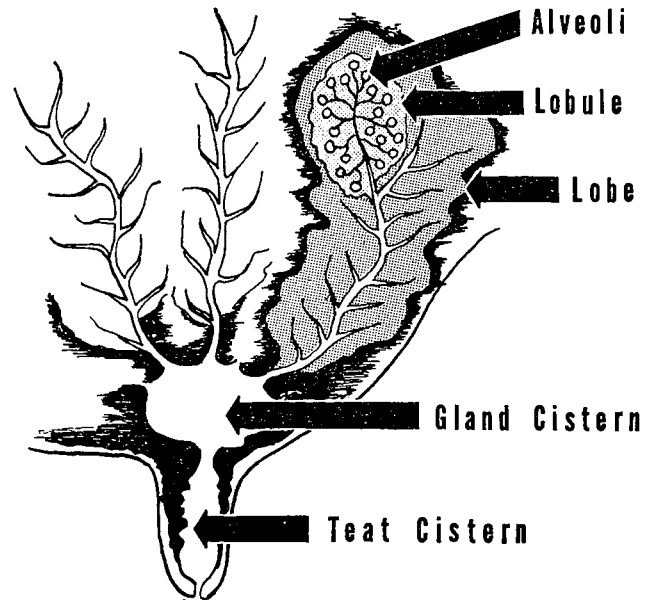


Fig. 15. Each quarter of the udder looks like a tree.

There are 5 to 20 lobes in each quarter. These may be likened to a tree with the lobules representing branches. The branches end in the alveoli or milk secretory cells which may be compared to a bunch of grapes (see figure 16).

As the rich blood passes about the alveoli the cells choose certain chemical units with which to make milk. These cells are selective. They follow a certain pattern or recipe as a cook preparing a dish of food.

Usually the composition of milk is quite constant. Rather than produce milk of a poor quality, the amount is reduced and limited by the amount of the lowest ingredient. Casein or milk protein, lactose or milk sugar, and butterfat are found nowhere else in nature.

Milking Process

When the calf begins to suck or the cow is prepared for milking by washing the udder with warm water, the nerves in the teat send a message to the brain. The brain is the command post. It then sends the message to the pituitary gland located at the base of the brain. On receiving orders, the pituitary gland

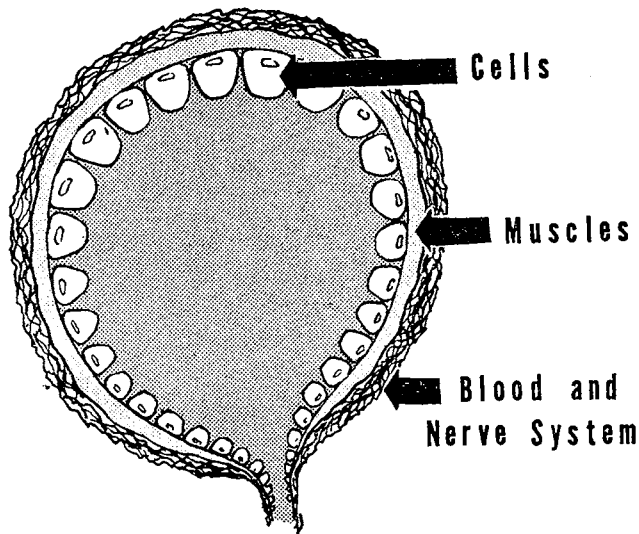


Fig. 16. The alveoli are the basic milk-secreting structures.

releases a batch of oxytocin or milk letdown hormone into the blood stream.

When the oxytocin reaches the muscles surrounding the alveoli, the muscles contract and squeeze the milk out into the lobe duct. It may then drain freely down into the gland cistern and out through the teat opening during the process of milking.

This description of milk secretion is greatly simplified. It has been estimated that there are over 1 million alveoli per cubic inch in the udder. And to produce 1 pound of milk, 400 pounds of blood must be pumped through the udder. It is not uncommon for a cow to produce 10 times her body weight in milk each year.

Milk As A Food

No other food has received such wide acceptance as milk. It is often referred to as "the most nearly perfect food known to man." Why is it so valuable?

At first glance one would think that milk has very little food value because it is almost 90 percent water. We are often fooled about the solids present in a liquid material. Actually milk has more solids than many fruits and vegetables. And a beef steak may even contain 50 percent water.

WHAT IT CONTAINS

Protein—mainly in the form of casein. Protein may be thought of as building blocks. Muscles, skin, hair, and most body organs are made mainly from proteins. One cup of milk supplies 12 percent of the protein needed by the average adult each day.

Butterfat—serves as a source of energy or "fuel for the muscles." It is also a carrier of vitamins A, D, E, and K.

Lactose—or milk sugar is a carbohydrate. Like butterfat, it serves as a source of energy.

Minerals—serve as building blocks for the skeleton of the body. Nearly two-thirds of the calcium in household food supplies come from milk or milk products. One cup of milk provides 36 percent of the daily calcium needed by the average adult. Phosphorus, potassium, and other minerals are also found in milk.

Vitamins—A, B, C, D, E, and K are found in milk. Of these vitamin A is the most important. A pint of whole milk provides nearly one-sixth of the daily vitamin A needed by an adult.

Thus, we see that milk is an excellent source of the nutrients needed for growth and energy. Furthermore, this high quality food is relatively cheap. In 1960 milk products provided about 28 percent of the U. S. food supply at a cost of only 19 cents of each dollar spent for food.

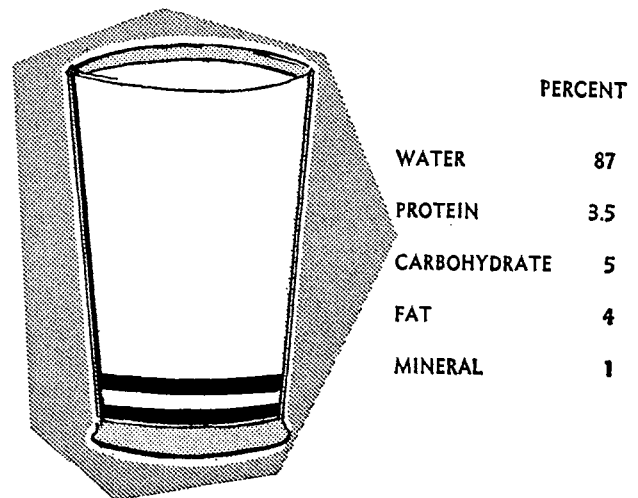


Fig. 17.



Summary

The dairy cow is a wonderful animal in so many ways. That is why she is so interesting to work with.

Your experience as a 4-H dairy club member will help you become a successful dairy farmer, perhaps a purebred breeder. For someone who likes to work with dairy cattle, dairying offers real challenges.

A recent survey of the state champion dairy club members over a 20 year period showed most of them operating their own dairy farms. The average herd

production of these former 4-H members was 428 pounds of butterfat per cow.

Or, perhaps you elect to do something else than farming. Experience as a 4-H dairy club member will still be valuable to you. Many of the basic principles taught in this project apply in other fields. The friends you made, the love of working with animals, and the value of caring for something of your own—all are enriching experiences you can always cherish.

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