

1974

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1973-74 DAIRY REPORT

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Prepared by the staff in Animal Science and cooperating Departments for use in the Extension and Teaching programs

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Management Makes the Difference

P. H. Cole
Extension Dairyman

We asked Nebraska's top 10 dairymen, "In order for a dairyman to be successful today he must _____." They answered:

"He must like dairy cows and dairying."

"I feel that a dairyman can't neglect any one of these (feeding, breeding, health, water, management, replacements, conception rate) keys—he must put it all together and be interested in dairying. It's a way of life—quite demanding—but it has many compensations."

"In this day and age a close relationship with a milk marketing coop is essential. A good dairyman culls his herd closely and uses his DHIA records in many ways."

"In order for a dairyman to be successful today he must have the highest possible production. To achieve this goal, he must have: a good feeding program, a good breeding program, use records in all phases of his operation, use good milking techniques and have a good herd health program including routine veterinary checks."

"He must be willing to put in the long hours which go along with this kind of work. It is a great help to be able to raise one's own feed, but he must remember that the cows come before everything else. He needs to have sheds, corrals, bunks and barns, and a way of keeping these

areas clean. It is a combination of these and many other things which make a successful dairyman."

"He must realize that every *little* thing that he can do to improve his operation is very important because these little things are more numerous than we realize and if they remain undone, they have a great affect on the entire business."

"I have made the statement before—to be a successful dairyman, you have to have *almost* as much love and concern for your cows as you have for your wife."

"I guess I'll have to say that dairying and high production boils down to a 24 hour job, year round with care, breeding, feeding, milking, etc., all of great importance."

"I consider management a factor which includes testing and keeping accurate records of production so that a culling program can be carried on continually."

During the summer of 1973, Don Kubik, Area Dairy Specialist, Northeast Station and I visited the top 10 herds in the state. The purpose was to make a detailed study of some top managed herds with the hope that by closely observing their decision making process we could pick out some techniques that would be helpful to other dairymen.

The 10 herds visited, selected on the basis of their 1972 DHIA production, are listed in Table 1.

ACKNOWLEDGMENTS

Eli Lilly and Company, Greenfield, Indiana 46140.

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BZD Livestock Products, Lincoln, Nebraska.

Chas. Pfizer and Company, Terre Haute, Indiana.

MaNuVa Products, Inc., Salinas, California.

Mid-America Dairymen, Omaha, Nebraska.

Table 1. Top 10 dairy herds based on 1972 DHIA production.

Name	Address	Cows	Breed	Production	
Cedar Farms, Inc.	Falls City	65	H	15,764	586
Marion Condon	Aurora	57	H	15,905	618
Francis P. Goin	Wymore	37	G	12,426	578
Lloyd & Roland Johnson	Hershey	48	H	16,317	617
Charles McConnell	Hershey	65	H	16,554	603
Carl Ossenkop & Sons	Lincoln	26	H	16,632	631
Charles Sandfort	Humboldt	61	H	18,514	677
Duane Stelling	Bloomfield	58	H	15,919	605
Willard Trimble	Humboldt	51	H	15,769	576
Meinert Wissman	Falls City	41	H	15,462	585

Table 2. Top ten vs. all herds—herd size and production.

Year	Top ten ^a			All herds		
	Herd size	Milk	Fat	Herd size	Milk	Fat
1972	51	15,926	608	54	11,998	451
1967	44	13,632	511	44	11,736	436
1962	37	12,358	470	41	10,550	406
1957	32	11,931	446	26	10,163	390

^aBased on 9 herds in 1967; 8 herds 1962; 6 herds 1957.

Following the farm visits each dairyman was asked to write down what he thought were the five most important keys to maintaining high production. They listed:

Item	No. times mentioned
1. Breeding	10
2. Feeding	10
3. Care and comfort	8
4. Herd health	4
5. Milking practices	5
6. Production testing	3
7. Culling	3
	43*

* Not all operators listed 5 items.

Key Management Factors

It is interesting to compare items listed by Nebraska's top dairymen as being important with those of other top dairymen and well known authorities on dairy management.

Roger Snell, Indian Falls, N.Y. (From NYDHIA *Improver*, September-October 1973. 1973 DHIA herd average for 77 cows, 17,801 pounds of milk and 616 pounds of fat).

1. Using DHI records.
2. Heat detection.
3. Handling of dry cows.
4. Veterinary work.
5. Low calf mortality.
6. Mastitis detection.

DHIA Supervisor's Hoard's-Round Table. From Hoards Dairyman, Dec. 10, 1969, "Management Tips From DHIA Supervisors."

1. Milking practices.
2. Mastitis control.
3. Culling.
4. Milking condition of equipment.
5. Sick cow treatment.
6. Using records.
7. Herd health.
8. Regular calving.
9. Breeding—type & production.
10. Physical condition of cows.

Morrison (From Morrison's Feeds and Feeding, 22nd Ed., "Essentials in Feeding Care.")

1. Dry period of proper length.

2. Comfortable surroundings.
3. Regularity in feed & care.
4. Kindness on part of herdsman.

Mekitrick (Hoards Dairyman, Dec. 10, 1972) "What Constitutes Good Herd Management?"

1. Fresh cow care.
2. Raising calves.
3. Using records.
4. Preventative medicine.
5. Milking practices.

Let's look at specific comments by Nebraska dairymen about each of these key management practices. Comments definitely indicate that Breeding and Feeding are of major importance, and at the same time they put a high value on another group of practices commonly lumped together as "management."

Feeding. Quality of feed, particularly in reference to hay, was the factor mentioned most frequently. Palatability of the feed was seen as very important also. Availability of water at all times was mentioned several times.

Visits to the farms confirmed the high value placed on quality hay. Without exception the hay was of excellent quality and in the majority of cases stored and fed under cover.

Breeding. The major emphasis here was on good breeding (genetics). Extensive use of A.I. seemed to be one of the keys. A very high percent of the cows in these 10 herds were A.I. offspring.

Another key practice seemed to

Table 3. Top ten vs all herds—overall efficiency.

Factor	Top ten	All herds
1. Age	4-00	4-02
2. Body weight	1,260	1,260
3. Calving interval	393	390
4. Length of lactation	332	321
5. Length of dry period	61	68
6. % Left herd	24	21
7. Progress EPA	221	+162
8. Progress EATA	64	+41

Based on information taken from DHIA form 203, "Herd Ranking" and "Summary."

be getting the cows bred back on time.

Care and Comfort. Individual attention and attention to small details were the keys here. Put the cows first!

Care and comfort of the animal could easily rank next to feeding in importance.

Herd Health. Provide for routine veterinary checks. Pay special attention to udder health. Check regularly after calving, before breeding and have a pregnancy check.

Milking Practices. Provide good equipment and good technique to include: fast and thorough milking, regular milking, teat dipping and dry cow treatment.

Production Testing & Record Keeping. You need breeding, calving and production records to manage the herd. Don't overlook identification.

Culling. Use records to cull.

Other keys to successful management mentioned include:

1. Well grown out herd replacements.
2. Importance of some type of partnership.
3. Special care in bad weather.
4. Putting it all together.

What the Records Show

The DHIA records indicate that these 10 herds have made significant progress in terms of production (Table 2).

Figures in Table 2 indicate that the top producing herds started out at a considerably higher level of production than the average herd. Even more significant is their rapid rate of progress, particularly in the past five years. Interestingly enough herd size and rate of growth has been very similar in both groups.

Other Measures of Efficiency

DHIA figures in Table 3 point out some further differences in herd efficiency between the top 10 herds and other herds. A number of these differences can be directly attributed to the type of management decisions being made.

Note that cows in the top herds are on the average a little younger

(continued on next page)

(continued from page 3)

but about the same size. The higher culling rate (% left herd) could easily account for the younger age. The size probably reflects a better job of raising heifers (several mentioned the importance of this) and greater use of A.I. The more rapid progress in rate of improvement in EPA (Estimated Producing Ability) and EATA (Estimated Average Transmitting Ability) are also likely results of stricter culling and greater use of top A.I. sires.

The shorter dry period in the top herds is likely due to better breeding management.

Summary

All top managers agreed on the importance of feeding and breeding. They particularly emphasized the importance of an ample supply of high quality forage and the importance of having cows with the inherited ability for high production.

They also stressed the critical importance of management practices such as:

1. Care and comfort of the individual animal.
2. Special attention to animal health and disease prevention.
3. Good milking practices and attention to the condition of milking equipment.
4. Regular use of production records and other herd records.
5. Strict culling of unprofitable animals.

The two real keys to high production appear to be (1) attention to small details and (2) putting it all together.

Like all other herd owners the top herd owners have to decide:

What to do.

When to do it.

How to do it.

The difference between the two groups appears to be in the latter two questions—when to do it—which is timing and how to do it—which is technique.

"Only superior cows with superior management can be expected to give superior production."

Calf Scours: Sign of a Serious

Alex Hogg
Extension Veterinarian

Calf scours is not itself a disease: it is a clinical sign of a disease problem that has several causes. Some known causes of calf scours are bacterial and viral infections, parasitism and nutritional factors. It is suspected that infection with as yet unknown viruses may be an additional cause.

Calf scours causes mild to severe dehydration, acidosis and electrolyte imbalances due to increased losses of water, sodium, potassium and bicarbonate. Simple fluids given by mouth early in the disease is the currently recommended treatment. If the disease is allowed to continue for even a few hours, intravenous fluid treatment becomes necessary.

The most important specific causes of scours in young dairy calves include:

1. *E. coli* scours.
2. Viral scours: Reovirus, Coronavirus, Bovine virus diarrhea; and other viruses.
3. Salmonellosis.
4. *Clostridium perfringens*.
5. Coccidiosis.
6. Nutritional scours.

Although there are wide variations in the age at which calves become infected with scour-producing bacteria, viruses and parasites, Table 1 will help in diagnosing the cause of a particular outbreak of calf scours.

E. Coli Scours (Colibacillosis)

E. coli scours can occur in calves under 10 days of age or following severe stress. Experimentally, it can only be produced in calves during the first day of life. *E. coli* is commonly a secondary infection following diarrhea in which viral agents are the primary cause.

Clinical signs—*E. coli* scours is characterized by diarrhea and progressive dehydration. In peracute cases, death may occur in a few hours without diarrhea. Feces are increased in amount, watery to pasty, yellowish to greenish or light brown and may contain streaks of

blood and excessive mucus. The course varies from 2 to 4 days or longer.

Lesions—Dehydration and absence of body fat are marked. The small intestine is filled with fluid and the large intestine contains fluid to pasty, yellowish feces.

Diagnosis—Depends on an accurate history, clinical signs and culture of internal organs for bacteria.

Treatment—Most important is correction of the acidosis, which is caused by the loss of bicarbonate, and dehydration. This is done by giving fluids by mouth or intravenously. In addition, intestinal and systemic infections should be treated with both oral and injectable antibiotics and sulfonamides.

Control—Calves should be born into a clean, dry environment. All calves should receive 2 quarts of colostrum as soon after birth as possible even if it must be force fed. Early isolation and treatment of scours will help prevent new cases. Whole milk should be fed for at least 10 days before switching to a good quality milk replacer.

Reovirus Calf Scours

Reo-like virus causes scours in calves during the first week after birth. However, when the infection is first introduced into the herd, it can affect calves up to 21 days of age and older.

Clinical Signs—Affected calves are depressed, salivate (slobber) slightly and have a profuse yellow watery diarrhea. They lose their appetite for 24 hours. Mortality ranges between 1 and 50%, de-



Calf with scours showing dehydration and a watery feces.

Disease Problem

pending on the secondary bacteria present and the level of management.

Lesions—The reo-like virus infection alone causes no gross lesion in the small intestine. The only abnormal finding is more fluid intestinal contents. Any reddening or edema (thickening) of the intestine is due to secondary bacterial infection.

Treatment—Treatment should include antibiotics and/or sulfonamides (both orally and by injection) and fluid therapy to combat the secondary bacterial infection and the severe dehydration. Loss of movement in the abomasum (true stomach) limits the absorption of oral antibiotics so injectable treatment is often necessary.

When calves first begin to scour, they will still nurse, therefore, withhold all milk or milk replacer and feed 1 or 2 quarts of simple fluids 4 to 6 times per day. Gradually reintroduce milk when diarrhea has stopped, or in about 24 hours, but continue the fluids for one or two additional days.

Control—A reovirus scour vaccine developed by the University of Nebraska-Lincoln researchers, was released for sale by the USDA on March 1, 1973. This vaccine is called Scour-Vax Reo and is available through veterinarians. The vaccine, which is specific for reovirus only, is given by mouth as soon after birth as possible.

Coronavirus Calf Scours

Coronavirus scours is a second virus identified by NU researchers. This virus usually causes scours in calves between 6 and 21 days of age.

Clinical Signs—The calves are not as depressed as those infected with reovirus and have a moderate watery diarrhea. The fecal material is curdled and contains clear mucus that resembles the white of an egg. There is a moderate loss of appetite and mortality ranges between 3 and 20%. Diarrhea continues for several days.

Table 1. Age relationships of some infectious calf scours.

Cause of scours	Age in days
<i>E. coli</i>	2 and up
Reovirus	1-21 (generally less than 5 days)
Coronavirus	5-21 (generally 5-9 days)
BVD	any age
Salmonella	6-21
<i>Clostridium perfringens</i>	1-21
Coccidiosis	18+

Lesions—Grossly, there is no observable lesion in the intestinal tract. By subgross or microscopic examination, there is a shriveling of the fingerlike projections lining the intestine. Any gross lesion in the intestine results from a secondary bacterial infection.

Treatment—Treatment for coronavirus scours is the same as for reovirus scours.

Control—NU researchers have developed an oral modified live coronavirus vaccine which will be field tested soon. They are also testing a combined killed Reo-Coronavirus vaccine which is given to the cow by injection 2 months and 1 month before calving. Although preliminary results are promising, additional work will be required before these vaccines are released for sale.

Diagnosis of Reovirus and Coronavirus Scours

Facilities for identifying reovirus and coronavirus are available through the diagnostic laboratories located at the NU Veterinary Science Department, or the Veterinary Science Laboratory at the North Platte Station.

The proper collection, preservation, and submission of samples for

identification is important. Follow these steps:

Reovirus:

A. Fecal samples are the specimens of choice.

1. Collect directly from calf.
 - a. A thermometer or gloved finger inserted into the anus helps stimulate defecation.
 - b. Pressure on the abdomen may help.
2. Collect sample in a clean container.
 - a. Small baby food jars work well.
 - b. Plastic cups can be used.
3. Freeze as soon as possible.
 - a. Freezing stops bacterial action.
 - b. Submit to the laboratory frozen.

B. Selection of calves to sample.

1. Choose calves in early stages of diarrhea, those not scouring over two to four hours.
 - a. Cells slough off early.
 - b. May get false negatives if scouring too long.
2. Sample 8 to 10 calves for a herd diagnosis.

Coronavirus:

A. Fecal samples are not adequate for fluorescent antibody examination.

B. A 6-inch section from middle of spiral colon is the specimen of choice.

1. Tie off both ends.
2. Freeze.
3. Submit frozen.

An accurate diagnosis cannot be made unless these steps are followed.

Bovine Virus Diarrhea (BVD)

Experimentally, bovine virus
(continued on next page)

Have you noticed these signs in your young calves?

They could be from using an inferior quality milk replacer if your calves are under 4 weeks old.

- * Poor weight gains.
- * Increased susceptibility to scours.
- * Higher incidence of scours and mortality.
- * Poor response to scour treatment. Most treatments for scours assume that an infectious bacterial enteritis is present. Scours due to nutritional factors will only respond to a change of diet.
- * Diarrhea may be persistent and progress to emaciation and death. Calves will respond to whole milk.

Calf Scours . . .

(continued from page 5)

diarrhea (BVD) has been shown to cause severe diarrhea and death in young calves exposed to the virus.

Clinical Signs—Diarrhea begins from 28 hours to 3 days after exposure to the virus and may persist for as long as 29 days.

Lesions—Ulcers can be found on the tongue, lips and in the mouth of some young calves. These lesions are similar to those found in yearling and adult animals affected with bovine virus diarrhea.

Diagnosis—History, lesions and diagnostic laboratory assistance are required to make a diagnosis.

Treatment—Treatment is similar to that used in reovirus and coronavirus scours.

Control—Bovine virus diarrhea is best controlled by vaccinating all replacement heifers one or two months before breeding. Do not vaccinate pregnant heifers or cows with modified live virus (MLV) BVD vaccine. There has been a history of occasional problems with MLV BVD vaccines. Consult the attending veterinarian before starting a bovine virus diarrhea vaccination program.

Salmonellosis

There are more than 1,000 types of *Salmonella*. All types are potential causes of disease. *Salmonella typhimurium* is a common cause of disease in young calves.

Salmonellae produce a potent toxin within their cells (an "endotoxin") so that animals may appear to be more severely affected following treatment. This is because the endotoxin is released when the bacteria die. Therefore, treatment should be designed to combat endotoxic shock.

Calves are usually 6 to 14 days of age before signs of *Salmonella* infection appear. In contrast, *E. coli* or reovirus infections often occur soon after birth. Coronavirus infection develops more nearly at the time that *Salmonella* does in young calves.

Salmonella infection is more prevalent in dairy calves than in beef calves because:

1. Dairy calves are more closely confined.

2. Dairy calves, notably Holstein bulls, are less resistant.

3. Dairy calves have more exposure to carrier animals (birds, cats, rodents). Milk replacers are made of ingredients which can possibly contain *Salmonella* bacteria and should be checked.

Clinical Signs—Clinical signs associated with *Salmonella* infection include diarrhea, blood and fibrin in fecal material, depression, elevated temperature, straining and sometimes pneumonia. Arthritis may occur. *Salmonellosis* is often associated with other diseases or other stressors.

Lesions—A membrane-like coating of the intestine is strong evidence that the problem is *Sal-*

of *Salmonella*. Affected calves should be isolated and treated after the unaffected calves have been fed.

Treatment—Antibiotic treatment is not generally successful. Antibiotics are most effective when used on calves in the group which have not yet developed clinical signs of *Salmonellosis*.

Fluid therapy and electrolyte replacement plus combating endotoxic shock are more successful than other forms of treatment.

Enterotoxemia

Enterotoxemia, highly fatal to young calves, is caused by toxins produced by *Clostridium perfringens*. Six types of the *Clostridium* bacteria (A,B,C,D,E, and F) produce



Calf scour treatment includes simple fluids given by mouth.

monellosis. An occasional pneumonia or arthritis is also observed. Rarely, small areas of dead tissue can be observed in the intestine.

Diagnosis—A diagnosis of *Salmonellosis* is confirmed when typical lesions are observed on post-mortem examination. It is essential that *Salmonella* bacteria be isolated from either the liver, gall bladder, lymph nodes, intestine or lungs.

Control—Control depends on general sanitation procedures and reducing sparrow, mice, rat and fly populations. Purchased dried milk and meat products should be free

toxins. Type C is the most important in calves while types B and D are of minor importance. Apparently the other 3 types are of no significance.

Clinical Signs—Enterotoxemia usually affects calves 3 weeks of age or less. Since this condition is associated with vigorous calves that are receiving large quantities of milk, it is most common in beef calves but does occur in dairy calves. The disease has a sudden onset: affected calves become listless, stop nursing and display uneasiness, straining or kicking at the

abdomen. Bloody diarrhea may or may not occur. The clinical course of disease varies from 2 to 24 hours. In many cases, calves may die without signs being observed. The temperature remains normal to subnormal.

Lesions—The postmortem lesions are hemorrhagic in character. The main lesions are bloody areas of dead tissue in the small intestine.

Diagnosis—Demonstration of type B, C or D toxin in the small intestinal contents by laboratory methods confirms the diagnosis. A tentative diagnosis can be made by finding a hemorrhagic enteritis in a calf that has suddenly died.

Control—The disease is best controlled by vaccinating the cow with toxoid 8 weeks and 4 weeks before calving. A single booster dose of toxoid should be given annually 4 weeks before calving. Newborn calves from nonimmunized cows can be protected by subcutaneous injections of antitoxin. Daily oral doses of 250 mg of chlortetracycline can also be used concurrently with antitoxin injections as a method of control.

Treatment—The subcutaneous administration of antitoxin and oral chlortetracycline are the only effective treatments.

Coccidiosis

Coccidiosis is caused by microscopic, one-celled parasites of the genus *Eimeria*. Two species, *Eimeria zuernii* and *Eimeria bovis*, are usually associated with clinical infections under field conditions. Coccidiosis is a major disease problem in beef cattle herds. It also affects dairy calves but it is not as big a problem as in beef calves.

Clinical coccidiosis is more likely to occur under conditions of poor sanitation and overcrowding or after the stresses of weaning, shipping, sudden changes of feed or severe weather.

Diagnosis—Clinical coccidiosis is diagnosed by finding in diarrheic feces significant numbers of the parasite. The number of parasites found in the feces varies and the results of fecal examination must be related to clinical signs and in-

testinal lesions (both gross and microscopic).

Clinical Signs—Typical signs of coccidiosis are diarrhea, rough hair coat, loss of appetite and weight, weakness and general emaciation. General weakness may cause the calf to defecate while lying down, thus soiling the tail and hindquarters. In more severe cases the feces may contain blood, mucus and stringy masses of tissue.

Severe straining may be observed in the more advanced stages. Death may occur during the acute period or later from secondary complications, such as pneumonia.

The first signs of coccidiosis caused by *Eimeria bovis* usually occur about 18 days after infection.

Treatment—Sulfonamides remain the drug of choice in the treatment of coccidiosis. By the time clinical signs appear, the portion of the coccidia's life cycle within the host is essentially completed. If treatment is given before signs appear, manifestation of the disease can be largely or entirely prevented. Thus, treatment of exposed but not yet affected calves may be desirable.

Amprolium, a drug that has been highly effective against coccidiosis in poultry has been found effective in controlling and preventing coccidiosis in calves. Amprolium was approved in late 1973 by the FDA for use in calves.

Control—Control the natural intake of infective parasites by young animals with good feeding practices, good management and good sanitation.

Nutritional Scours

Physiology of Digestion in the Calf—Certain parts of the intestinal tract and their respective digestive enzyme activities have particular significance in digestive disturbances that are nutritional in origin.

The following statements may help in understanding why some digestive disturbances arise.

1. The calf can utilize only protein of milk origin from birth to 3 weeks. The young calf is unable to utilize non-milk proteins such as soy flour, fish and meat meals

which are ingredients in some milk replacers.

2. After 3 weeks of age, hydrochloric acid production in the true stomach develops, the enzyme pepsin becomes active and non-milk proteins can be utilized.

3. Lactase (a digestive enzyme) is present in adequate amounts in the newborn calf. The calf, therefore can digest lactose (milk sugar).

4. There is no maltase activity in the preruminant calf so it cannot utilize maltose.

5. The preruminant calf has no sucrase, therefore, sucrose cannot be used. Table sugar (sucrose) should *not* be used in supportive fluids.

6. The preruminant calf cannot utilize starch as there is little pancreatic amylase in the newborn calf.

7. Pancreatic lipase is low at birth but is sufficient by 8 days of age to utilize milk fat and a wide variety of animal and plant fats which may be added to milk replacers.

8. Overfeeding overdistsends the abomasum (true stomach) and too much undigested milk goes down the intestinal tract.

9. It's important that the calf receive a good feeding of colostrum early. The first colostrum removed from the teat contains the highest level of antibodies. The calf should receive colostrum from all four teats.

Oral Electrolyte Solutions

Treatment of calf scours must be directed toward the dehydration, acidosis and electrolyte imbalances caused by the large fluid losses. The usual antibiotic and sulfonamide treatments can be given simultaneously with the treatment for dehydration.

Dehydration can be overcome with simple fluids given by mouth very early in the course of the disease. If severe dehydration is allowed to develop, intravenous fluid treatment by a veterinarian becomes necessary.

The following three formulas for simple oral electrolyte solutions have been recommended:

(continued on next page)

Calf Scours . . .

(continued from page 7)

Formula #1

- 1 heaping teaspoon table salt.
- 1 rounded teaspoon baking soda.
- 1 gallon water.

Withhold all milk, milk replacer, calf pellets, hay or bedding. Let calf suck up to 3 quarts at a time of the above solution, 4 times per day. Injectable vitamins, antibiotics, or fluid therapy can be given simultaneously.

After 24 hours and at least one hour after last offering of salt-soda solution, start feeding not more than 1 quart of milk or milk replacer per offering, morning, noon, evening and night for 3-4 days.

Begin oral antibiotic treatment when milk feeding is resumed.

Formula #2

- 1 teaspoonful of table salt.
- ½ teaspoonful of baking soda.
- 4 ounces dextrose (or 250 cc 50% dextrose solution).
- 2 quarts water.

Feed 2 quarts of this solution 4 to 6 times per day, gradually reintroduce milk or milk replacer after 24 to 36 hours of fluid treatment. Use same quantities of milk recommended in Formula #1 when reintroducing milk.

Quantity depends on severity of scours and degree of dehydration. If the feet feel cold, it is an indication the blood vessels are constricted and blood volume is not back to normal.

Note: Use kitchen measuring spoons, silverware is too inaccurate.

Formula #3

- 1 can beef consommé (grocery store soup section).
- 3 cans warm water.
- 1 heaping tablespoon baking soda.

Feed 1 to 2 quarts at 4 hour intervals. Quantity may be increased if dehydration increases. Feed no milk or replacer for 24 to 36 hours. Gradually reintroduce milk as in Formula #1.



Use the best sires you can get.

1974 Plans: 1978 Dividends

Franklin E. Eldridge
Professor, Animal Science

When a dairyman thinks about his herd's breeding or genetics—the hereditary basis for milk production—his first consideration should be the goals or objectives he really wants to reach.

Setting Realistic Goals

In trying to suggest such goals, let's look at the increase in milk production that has occurred in Dairy Herd Improvement Association herds over the past 10 years. In the United States, the increase has been 2,000 pounds of milk or an average of 200 pounds per year. In Nebraska, the increase has been 1,300 pounds of milk or 130 pounds per year.

To understand this smaller increase, we must recognize that over that period of time in Nebraska, the number of herds on test has about doubled, while the increase nationwide has been about 5 to 10%. When new herds are added to testing programs, they generally come in at a lower level of production.

If we were to take herds which were on test 10 years ago and compare their production then with their production today, we might also find that Nebraska has increased at a rate of 200 pounds per year. So, it appears that a dairyman needs an increase of about 200 pounds milk production per year to keep up with the average. In a

competitive business world staying even is not enough, so dairymen should reach for an annual increase in milk production of more than 200 pounds.

Only part of this increase is genetic. Genetics account for an estimated 50 to 100 pounds per year, the rest of the increase is from improved management and better feeding.

Each herd owner needs to set his own goal relative to his present herd average. For an average of about 13,500 pounds, it seems reasonable to set a goal of 400 pounds per year increase, since this is a reasonable expectation of improvement. For herds that average 16,500, the owner might be satisfied with an increase of 300 pounds of milk per year, since improvement at a level that is already high is more difficult. For herds that average 10,500, which are below the average, one should not be satisfied with less than 500 to 600 pounds per year.

The bright spot of setting these goals is that you *can* do it!

1978 Herd a Result of 1974 Decisions

We've been talking about an increase in milk production on an annual basis. Now, let's think of increasing production on the basis of generations. For example, the decisions you make during 1974 will be reflected in calves born by September, 1975. If heifer calves from

these matings are bred to calve at about 24 months (the ideal age to plan for) then it will be September, 1977, before the last heifers have calved. It then takes 10 months to complete a 305-day record. So, it will be mid-1978 before you have the final data on milk production.

Use Predicted Difference In Sires

The recent USDA-DHIA Sire Summary includes the Predicted Differences for a very large number of bulls from all different breeds. If you wish to look only at some of the top bulls, then the list published in *Hoard's Dairyman* (Sept. 10, 1973) includes the bulls ranked by Predicted Difference in dollars. If you wish to improve the genetic producing ability of your herd using these highest Predicted Difference bulls through artificial insemination will almost guarantee success.

The Predicted Differences in the Sire Summary are differences related to generations rather than annual increases. If, on a herd basis, you expect to increase your herd at the rate of 400 pounds per year, and half of this is the result of genetic differences, then you would like to get 200 pounds per year in genetic improvement. The use of these high predicted sires with an anticipated rate of increase of 200 pounds per year means an increase of 800 pounds over a four-year generation interval. Therefore, if you are planning to improve the producing potential of your herd an average of 200 pounds per year, you cannot afford to use a sire with a Predicted Difference of less than 800 pounds, since it takes at least four years to get the daughter's milk production completed.

Owner Should Choose Sires

The decisions of which bull to use on which cows too often is left up to the AI technician. No one has a greater interest in the income from the herd than the owner. These decisions really should be made by the owner himself, and not delegated to someone else. No one knows those cows as well as the person who owns and manages

them, and matings can best be determined by that person.

Another factor to consider in bull selection is the cost of the semen. Ampules from many of these high Predicted Difference bulls can be obtained for \$10 or less. Because of very high demand, some may cost \$100 per service or more. When prices are that high, the dairyman must consider how valuable that daughter will really be in his herd. Since there are many high Predicted Difference bulls to choose from, it is not necessary that a dairyman pay the very highest prices for semen.

Consider Milk Production Before Type

The major income to 90% or more of dairymen is from milk produced from his herd. Type therefore, should be given secondary consideration except in very high producing purebred herds where type is a factor. In these herds, high type animals may command high enough prices to justify more attention to type. Basically however, those sires entered in the Sire Summary have sufficiently good type. For the majority of cows, high milk production is what the dairyman is seeking and the best way to evaluate milk production is to actually measure it. It has been established by many studies that the correlation between type and production is very

low and in some cases actually negative.

There are two groups of characteristics that have some significance to dairymen: strength of udder and udder attachments, and feet and legs. These two factors have an influence on longevity. Longevity is not really a measure of how long a cow will live, but of the ability of a cow to perform well enough so that she is not removed from the herd by other factors such as low production, low reproductive record, mastitis and so forth. Strength of udder attachments, and strength of feet and legs contribute to the ability of a cow to stay in the herd.

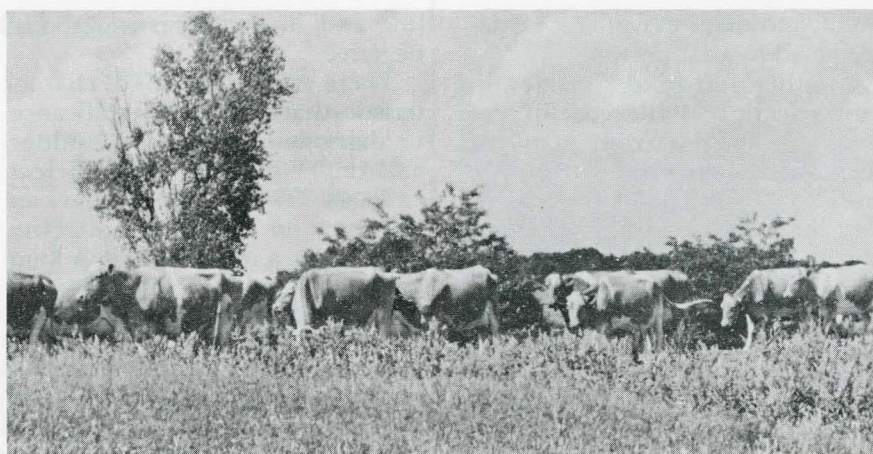
Every dairyman would like to have cows living to 8, 10 or 12 years and continuing to produce at a very high level each year. However, the average age of cows in DHIA herds in Nebraska is 4 years and 2 months. This indicates that most dairymen do not keep many cows up to advanced ages. It is difficult to breed for longevity: the heritability for it is so low that little progress could be made by breeding for it directly. But longevity could possibly be improved by trying to breed only good sound cows, particularly in mammary systems, feet and legs.

Analyzing ages of cows in herds, we find some interesting facts. For example, an average age of 4 years in a herd does not mean that the oldest cows are 6 years old. There are numerous 2-year-olds, since that is the age most cows enter the herd. For every three 2-year-olds, one 10-year-old would bring the average to 4, or for every 8-year-old, two 2-year-olds would produce an average of 4. So it takes several older cows to bring the average even up to 4.

Finally, as we look at costs of handling dairy herds, the cost of breeding for improved production should be considered as a *capital investment* rather than as an *operating cost*. The money you put into producing better cows this year will continue to bring returns for many years. Investments made in 1974 in both time for studying your cows and making decisions, and in costs of breeding, will start making returns in 1978.



"Do I stay?"



Calving interval can influence your herd.

High Cost of Low Reproduction

L. L. Larson
Assistant Professor, Animal Science

Reproductive performance can be measured by:

1. Percent non-return rate.
2. Services per conception.
3. Days open.
4. Calving interval.

Calving interval, from the time a cow produces a calf until she produces another, is one of the more accurate methods. Nearly all factors that decrease reproductive performance will cause a lengthening of the calving interval.

The importance of the calving interval becomes evident when you recognize that the mammary gland is an accessory organ of the reproductive system. The only practical way of stimulating milk secretion is to have the cow produce a calf. At calving, milk secretion is started at a relatively high level, increases for a few weeks and then declines at a rate characteristic of the individual cow. Maximum annual milk production is obtained when the cow produces a calf each 12 months and spends a high percentage of her lifetime producing at the higher

levels. Therefore, longer calving intervals reduce farm income through lower annual milk production and reduced size of calf crop.

The effect of calving interval on production efficiency of cows capable of milking at an economical level for 305 days is given in Table 1. For example, a herd that has a 14-month calving interval and 305-day lactations is producing at 90% efficiency when compared to a 12-month interval. If cows in this herd average 12,000 pounds of milk per year on a 14-month interval, they would produce about 13,333 pounds ($12,000 \div .90$) on a 12-month calving interval. This means you could get 1,333 more pounds of milk per cow annually.

The total annual loss for a 50-cow herd would be 66,650 pounds of milk ($50 \times 1,333$). If milk is worth \$8 per cwt., this means there is a loss of \$5,332.00 in gross milk income.

Fewer calves are born in herds with poor reproductive performance. A 50-cow herd on a 14-month calving has an 86% calf

Table 1. Effect of calving interval on production efficiency.^{a,b}

Efficiency measure	Average calving interval, months			
	12	13	14	15
	% efficiency			
Milk per cow	100	99	90	86
Profit for labor	100	98	81	72
Size of calf crop	100	92	86	80

^aCows dried off at 305 days regardless of how long they must stand dry.

^bConlin, 1967.

Table 2. Embryonic loss during the gestation period of the dairy cow.

Days after insemination	Percent fertility
1	96
30	82
90	70
Calving	62

crop (Table 1), or 43 calves born per year ($50 \times .86$); this means a loss of 7 calves per year. This reduces current profits because there are fewer calves to market for cash and future profits are limited because fewer herd replacements will be available to replace low producing cows in the herd.

The calving interval can be divided into three periods:

1. Recovery period, time period from calving until the cow receives her first service.

Hormones Used to

L. L. Larson
Assistant Professor, Animal Science

Reproductive failures force dairymen to cull some of their better producing cows each year. This has stimulated interest in methods of artificially inducing lactation without the necessity of the cow producing a calf.

How Was Lactation Induced?

Ohio researchers have reported the most successful attempt to date to induce lactations. Nine cows and one heifer which had failed to conceive were used in this study. The treatment consisted of injecting a combination of 17β -estradiol (0.1 mg per kg body weight per day) and progesterone (0.25 mg per kg body weight per day) for 7 days. Half of the daily dose was injected subcutaneously at exactly 12 hour intervals for the 7 days.

Mammary glands of cows that responded to the treatment began to fill with fluid between 9 and 18 days after the start of treatment. Regular twice daily milking was begun when the gland became distended with fluid and the teats were full and turgid. Induced lactations were characterized by a rapid increase in daily yield the first 10 days after milking began.

2. Breeding back period, period from first service until she conceives.

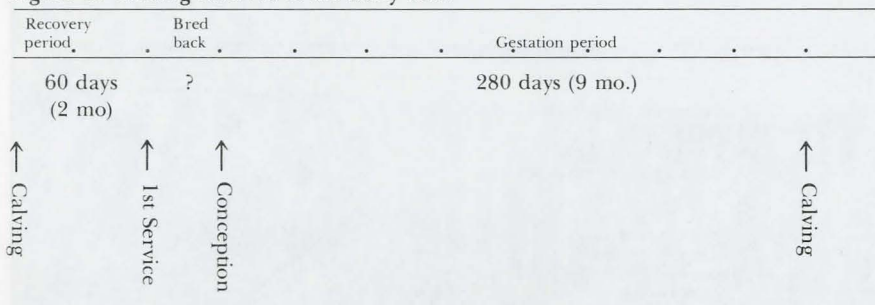
3. Gestation period, period from conception to calving (Fig. 1).

Of these three time periods the gestation period is the longest (9 months) and cannot be altered. Therefore, the calving interval is determined by what happens during the recovery period and the breeding back period.

Shortening the Calving Interval

The two major factors controlling the length of the calving interval are length of interval from calving until the cow receives her first service, and the conception rate. First, let's consider what we can do

Figure 1. Calving interval of the dairy cow.



about the conception rate. Conception rate is influenced by the bull's fertility, the cow's fertility and numerous management factors.

In comparing bulls of high and low fertility it was found that high fertility bulls fertilized 97% of the eggs compared to 77% for the low fertility bulls. Although nearly all the eggs are fertilized when a high fertility bull is used only about 62% will result in the birth of a live calf due to embryonic death during the gestation period (Table 2).

Both the bull and cow contribute to this embryonic loss, but the loss is even greater if low fertility bulls are used. There is little that can be done to prevent this natural loss, but one can select high fertility bulls to keep the loss at a minimum.

Numerous factors can influence a cow's fertility. However, in most herds about 90% of the cows are reproductively normal and only about 10% are problem breeders. While a great deal of concern is devoted to the problem breeders, the 90% that are reproductively normal actually have a much greater effect on the herd's average calving interval.

Therefore, conception rates cannot be readily increased above the normal limits set by mother nature when high fertility bulls are used and recommended management procedures are followed. This was evident in a Kansas study of 40 DHIA herds. The conception rate and services per conception were the same for both the short and long calving interval herds. (Table 3)

What then caused the difference in the length of the calving interval between the short and long interval herds? Cows in the herds with short calving intervals were bred an

average of 28 days sooner after calving than the cows in the long calving interval herds (Table 4). In addition, the interval between repeat services was shorter in the short calving interval herds resulting in the total number of days open being 41 days less in these herds. If a 12-month calving interval is ideal a cow must conceive by 90 days after calving. In this study only 50% of the cows in the long calving interval herds had even received their first service by 90 days compared to 73% of the cows in the short interval herds.

These results emphasize the need for identifying when each cow is ready to be rebred after calving and trying not to miss any heats. To accomplish this will require a good record system and heat detection program.

In conclusion, the most practical method of shortening the calving interval is to use high fertility bulls, shorten the interval from calving to first service and try not to miss any heats.

Table 3. Reproductive performance in herds with short or long calving intervals.

Criteria	Calving interval	
	Short ^a	Long ^b
Conception to 1st service (%)	56	56
Total conception after 2nd serv (%)	80	80
Total conception after 3rd serv (%)	91	90
Services per conception	1.8	1.8

^aShort = 21 herds (calving interval of 360-374 days)

^bLong = 19 herds (calving interval of more than 405 days)

Table 4. Herd breeding efficiency data.

Criteria	Calving interval	
	Short	Long
Calving to 1st service (days)	79	107
1st to 2nd service (days)	36	57
2nd to 3rd service (days)	33	50
Days open	101	142

Induce Lactation

Peak lactation occurred 30 to 50 days after lactation began, and persistency of lactation was approximately normal.

Response Is Variable

Lactation was induced in only 60% (6 of 10 animals) of the animals following the first hormone injection series. Lactation was induced in one more animal following a second treatment series. The six cows with previous lactations produced an average of 82% of the milk and 90% of the fat produced during their best normal lactation.

Limitations of Induced Lactations

The major undesirable features of this procedure are the extreme variability in response of the mammary gland to the treatment and the increased estrous activity of the animals.

This particular treatment procedure may not be sufficient for heifers that have not had a previous lactation. Nor could you expect this procedure to stimulate milk production in a cow during late lactation without first drying her off and giving her a rest period. While some animals might respond to this treatment it must still be considered experimental.

What's Real Cost

Table 1. Theoretical Nebraska Grade-A milk cow herd projected costs & returns 1974, 100 cows.

Item	New (\$)	Depreciated value (\$)
INVESTMENTS		
Land, 5 acres @ \$1,000	\$ 5,000	\$ 5,000
BUILDINGS AND IMPROVEMENTS		
Milk barn	\$10,000	
Cattle shelter and feed storage buildings	15,000	
Bunker silo	3,500	
Fences, feed bunks and water troughs	3,000	
Paving, 5,000 sq. ft.	2,000	
	33,500	16,750
	(20 yr. depreciation = \$1675/yr.)	
EQUIPMENT		
Waste handling	2,500	
Feed wagon, tractor and loader	12,000	
Milking machine	6,000	
Milk tank	6,000	
Misc. dairy equipment	3,000	
	29,500	14,750
	(10 yr. depreciation = \$2950/yr.)	
COWS		
100 cows @ \$700	70,000	52,500
Total	138,000	89,000
INCOME		
12,000 lb milk/cow @ 8.00 cwt.		96,000
Other dairy income:		
45 bull calves @ \$125	5,625	
45 heifer calves @ \$150	6,750	
25 cull cows @ \$480	12,000	
		24,375
Total		120,375
Yearly investment credit @ 7% (based on 5% of new buildings value and 10% of new equipment value)		325
Total Income		\$120,700
EXPENSES		
Labor		
Yourself (\$7,500 + \$7,500 mgt.)	15,000	
Hired man	7,500	
Total		22,500
Feed		
Concentrate		
15 lb/day @ \$120/T	32,850	
Forages-30 lb hay eq./day plus 10% wastage @ \$30/T	18,000	
Total		50,850
Replacement animals		
25 head @ \$650	16,250	
Total		16,250
Other cash costs		
Milk hauling @ \$3.25/cwt.	3,900	
Breeding fees	1,200	
Gas & oil for tractor	450	
Taxes	1,400	
DHIA fees	700	
Utilities	1,000	
Insurance	800	
Veterinary	1,600	
Supplies	1,400	
Repairs	1,400	
Depreciation	4,625	
Total		18,475
Total cash expense		108,075
Interest on depreciated investment @ 8%		7,120
Total real expense		\$115,195
	* * *	
Summary on Nebraska Theoretical Cow Herd (1974)		
		\$
Income		Real Profit
Expenses		120,700
		115,195
Net Profit		\$ 5,505

Don J. Kubik
District Extension Specialist (Dairy)

We could take the average costs of a group of producers and call that the "real cost" of producing milk. We have collected data on such a group in Nebraska and can give their average cost of producing milk. But this is not the best way of analyzing the situation dairymen find themselves in either in Nebraska or in the nation.

This average cost for a group of existing producers doesn't tell the whole story. Why? Because there are producers at all different stages of development—some about to quit or retire, others who would like to expand, and still others who have just started or are trying to get started.

Most producers in this and other cost studies are established producers, having built their facilities at a fraction of today's costs and operating with little or no out of pocket interest or depreciation costs. We need to consider who is going to produce our milk in the years ahead and how that producer can get the capital or financing necessary to set up an economical operation.

Conditions Examined

Although cost studies mentioned above provide real cost data, they apply to only one set of conditions. Let's examine some other situations to see what the real cost of producing milk is. Some of the situations which exist today are:

1. A group of producers with herd averages of 9,000 lb milk per cow per year, a level which is said to be uneconomical.

2. Someone trying to get started in farming who is expecting to make dairying one of his major enterprises.

3. An existing producer with an established herd who wishes to expand or improve his operation.

4. An existing farmer trying to obtain more capital financing to begin a dairy enterprise in his farming operation.

of Producing Milk?

5. An investor or investors looking at the dairy business from the "outside."

Based on Nebraska costs, a theoretical cost and return statement, Table 1, has been prepared. Minor differences in the various cost and return items will be noted when comparing them to figures from other areas, but the figures are reasonable for a 100-cow herd producing 12,000 lb of milk with a modest physical plant in northeast Nebraska during 1973.

A 40-60-cow herd would have slightly higher per cow or per hundred weight costs than this 100-cow herd because some of the basic investments such as the milkhouse, parlor and equipment are about the same for the 40-60-cow herd as they are for the 100-cow herd. Most other costs are on a per cow basis and size of herd doesn't affect them. These items are things such as insurance, breeding, veterinary expenses, etc.

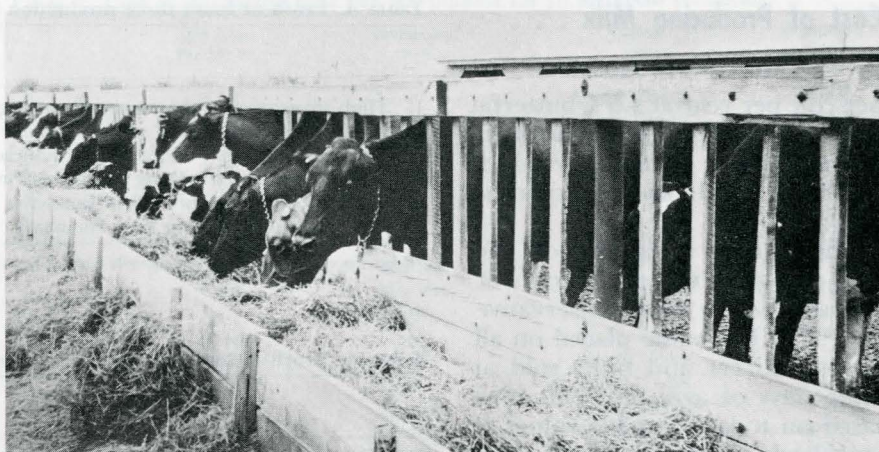
Figures in Table 1 as well as the remainder of this discussion are for the dairy operation only. They do not include the farming operation. The feed is charged into the dairy operation at market value (this will vary from area to area), interest is charged at the going term rate of 8½, and cows are valued on the basis of recent sales of animals representative of the three production levels stated.

Values placed on buildings and equipment are based on recent sales to dairymen. Taxes, interest and depreciation are figured on only the dairy enterprise, not the total farm enterprise. Appendix Tables A through F show these values.

Three Investment Levels

To get an idea of the costs for the various situations, three investment levels for buildings and equipment with two financing plans for each of the three investment levels will be considered.

High. This system costs \$1,400 per cow for buildings and equip-



What does it cost you to produce milk?

ment. This is based on quoted figures for a total confinement unit, including milkhouse, parlor, maternity and calf facilities, free stalls, upright feed storage, automatic feeding, liquid manure handling facilities, all under one roof.

Only a few of these systems exist in Nebraska.

Modest. This system is at \$630 for buildings and equipment per cow. This includes milkhouse, parlor, cold free stalls, bunker silos or concrete upright silos, adequate concrete and bunks designed for feeding with a feed wagon. Manure handling is by conventional means.

Many of our dairymen fit into this classification.

Low. This system is at \$300 per cow which is only a milkhouse and parlor good enough to get by inspection, plus the minimum equipment to operate the feeding and cleanup chores.

Quite a few dairymen, including most dairymen producing manufacturing grade milk, especially on rented farms, fit into this classification. Few Grade A dairies have as low an investment in buildings and equipment as this.

The two financing programs are:

Long term—a program under which the buildings are financed for 20 years and equipment for 10 years. Only an established producer with substantial assets for collateral as security can get this kind of financing for this purpose.

Short term—a program under which buildings are financed for seven years and equipment and cattle for five years. This is the kind of financing which would normally be available to a young man with only a minimum of collateral.

Production Levels

To show more accurately the costs and returns of these different investment and financing situations and their effect on producers, three production levels for each of these situations will be considered.

The first at 9,000 lb of milk per cow per year at 3.5% butterfat represents the average production in the state. The second level, 12,000 lb of milk per cow per year at 3.5% butterfat represents the average Nebraska DHIA herd average. The third level at 15,000 lb of milk

(continued on next page)

Table 2. Profit or loss^a, one production level.

	9,000 lb milk per cow per year
1. High investment - short term financing	\$-23,700
2. High investment - long term financing	- 9,850
3. Modest investment - short term financing	- 8,455
4. Modest investment - long term financing	- 2,395
5. Low investment - short term financing	- 1,878
6. Low investment - long term financing	- 1,050

^aLabor was charged as shown in Appendix tables A through F before the profit or loss was determined.

Cost of Producing Milk . . .

(continued from page 13)

per cow per year at 3.5% butterfat is the level of our better herds in the state. Only a small percent of Nebraska herds are in this category.

The income is figured on the basis of a gross value of \$8 cwt for milk sold which looks conservative for 1974. The value placed on all calves, heifers and bulls sold at three days of age, plus cull cows based on today's market values is considered income.

Labor charges in the illustrations will be for two people, considered reasonable for 100 cows. The labor may very well all come from the family, as is the case with many of our larger herds. The first cost is for a hired person at \$7,500 per year. The second person is a working manager. Three different values are put on him depending on the herd average. For the herd producing 9,000 lb of milk per cow per year, a cost of \$9,000 per year is charged; for the herd producing 12,000 lb of milk per cow per year, \$15,000 is charged; for the herd producing 15,000 lb of milk per cow per year, \$20,000 is assessed for his labor and management. These are not unreasonable costs for herds producing at these levels compared to other management positions.

Feed costs are adjusted for the three production levels based on average intake for the three levels. The feed prices are based on present concentrate prices @ \$120 per ton and roughage prices of \$30 per ton for alfalfa and \$15 per ton for corn silage in northeast Nebraska.

Depreciation and interest charges are made on the basis of the investment level (high, modest

Table 4. Profit or loss^a, three production levels.

	9,000 lb milk per cow per year	12,000 lb milk per cow per year	15,000 lb milk per cow per year
1. High investment - short term financing	\$-23,700	\$-14,000	\$- 2,900
2. High investment - long term financing	- 9,850	- 150	+10,950
3. Modest investment - short term financing	- 8,455	+ 1,245	+12,345
4. Modest investment - long term financing	- 2,395	+ 7,305	+18,405
5. Low investment - short term financing	- 1,878	+ 7,822	+18,922
6. Low investment - long term financing	- 1,050	+10,750	+21,850

^aLabor was charged as shown in Appendix tables A through F before the profit or loss was determined.

Table 5. Profit or loss^a, two production levels.

	9,000 lb milk per cow per year	12,000 lb milk per cow per year
1. High investment - short term financing	\$-23,700	\$-14,000
2. High investment - long term financing	- 9,850	\$- 150
3. Modest investment - short term financing	- 8,455	+ 1,245
4. Modest investment - long term financing	- 2,395	+ 7,305
5. Low investment - short term financing	- 1,878	+ 7,822
6. Low investment - long term financing	- 1,050	+10,750

^aLabor was charged as shown in Appendix tables A through F before the profit or loss was determined.

or low) and the length of the financing program (short or long term) for each situation.

Replacement cost per cow is adjusted for the three herd averages. The rate of culling or turnover is 25% per year.

Appendix tables A through F show exact costs for each situation.

Costs and Returns

With these things in mind, let's look at the costs and returns for the situations described earlier.

Situation 1. The producer with a herd average of about 9,000 lb of milk per cow per year.

As shown in Table 2 none of the producers at this level show a profit where labor is charged at \$9,000 per year. To determine the actual income to the producer, subtract the minus income figures from the \$9,000 labor. This indicates the return to labor and management one could expect for each of six situations.

A producer at this production level can make a return to labor and management if he is in a situation where he has a low investment in buildings and equipment. This might be a rented farm or a purchased farm where no additional value was placed on the improvements above the normal going land value. The other situation might be where only a modest investment was required for remodeling existing facilities and long term financing was available.

Situations of modest investment and short term financing or high investment situations do not produce a return to labor or management unless the investments are all paid for and depreciation and interest are not charged. A few non-profitable situations do exist, however, where enterprise records are not kept on the dairy. Costs are charged to the entire business with no attempt to allocate relevant costs to the dairy operation. Even though the farm may have shown a profit, the producer may have been as well off selling his feed or feeding it to some other livestock rather than putting it through the dairy cows. Unfortunately, without adequate records a producer may never know how good or how bad one enterprise may be.

Under none of the six examples could the producer make normal

Table 3. Profit or loss^a, two production levels.

	9,000 lb milk per cow per year	12,000 lb milk per cow per year
1. High investment - short term financing	\$-23,700	\$-14,000
2. High investment - long term financing	- 9,850	- 150
3. Modest investment - short term financing	- 8,455	+ 1,245
4. Modest investment - long term financing	- 2,395	+ 7,305
5. Low investment - short term financing	- 1,878	7,822
6. Low investment - long term financing	- 1,050	+10,750

^aLabor was charged as shown in Appendix tables A through F before the profit or loss was determined.

payments on purchased cows. It would take \$11-15,000 per year to make loan payments which means he would have to have a substantial equity in the cows in order to stay in business.

Situation 2. Someone trying to get started in the dairy business.

This person, with few assets for collateral to obtain capital financing has to realize that his cow payments are going to be no less than \$11,000 per year. This must come out of labor, income and or profit from the business. This amount must be realized above his return to labor. The other real limitation when getting started is obtaining high production in the first years of business. This prospective producer then must look at the lower production levels and short term capital situations shown in Table 3. The only way he might obtain long term capital would be where the facilities were already a part of a farm he could buy, or has bought on long term financing. Depreciation and interest charges shown in the tables are available to the producer for loan repayments or if he has no financing would be income to the owner.

Table 3 shows that there is no way this young man can get started and make cow payments unless he has good production and very little, if any, investment in buildings and equipment. This situation explains why a creditor has to be careful when making a dairy loan to a young man with little or no assets.

Situation 3. An existing producer with an established herd who would like to expand or improve his operation.

The question here is two-fold. First, how good is the herd, and, second, how much security does he have for his loan?

Looking at Table 4, we can see

Table 7. Cost of producing milk per 100 pounds for 18 different situations.

	Milk Cost Per 100 lb	Investment ^a level	Capital ^b term	Production level (lb/cow/yr.)
1.	6.43	Low	Long Term	15,000
2.	6.62	Low	Short Term	15,000
3.	6.66	Modest	Long Term	15,000
4.	7.06	Modest	Short Term	15,000
5.	7.10	Low	Long Term	12,000
6.	7.15	High	Long Term	15,000
7.	7.35	Low	Short Term	12,000
8.	7.40	Modest	Long Term	12,000
9.	7.90	Modest	Short Term	12,000
10.	8.01	High	Long Term	12,000
11.	8.04	Low	Long Term	9,000
12.	8.07	High	Short Term	15,000
13.	8.36	Low	Short Term	9,000
14.	8.42	Modest	Long Term	9,000
15.	9.09	Modest	Short Term	9,000
16.	9.16	High	Short Term	12,000
17.	9.25	High	Long Term	9,000
18.	10.78	High	Short Term	9,000

^aInvestment level in buildings and equipment per cow

Low=300 Modest=630 High=1,400

^bFinancing terms for loans are:

Long Term—Buildings financed for 20 years, equipment 10 years.

Short Term—Buildings financed for 7 years, equipment 5 years.

Table 8. Returns to labor and management, profit or loss, three production levels.

	9,000 lb	12,000 lb	15,000 lb
1. High investment—short term financing	\$-14,700	\$+ 1,000	\$+17,100
2. High investment—long term financing	- 850	+14,850	+30,950
3. Modest investment—short term financing	+ 545	+16,245	+32,345
4. Modest investment—long term financing	+ 6,605	+22,305	+38,405
5. Low investment—short term financing	+ 7,122	+22,822	+38,922
6. Low investment—long term financing	+ 7,950	+25,750	+41,850

that for a herd producing an average of 15,000 lb of milk per year with no cow payments to make, a dairyman can afford to make any desired improvements. If, however, the herd is at the 12,000 lb level, he can afford only a modest investment. If it is at 9,000 lb milk, he should disperse the cow herd and sell the hay and grain.

Situation 4. A young farmer trying to get started in the dairy enterprise.

This is about the same situation as situation 2 (someone just starting farming), except this man would have some of his financing on a long term basis. He would also have

some of the equipment he needs, but he had better plan on the 9,000 or 12,000 lb milk production levels to budget by.

As shown in Table 5, he should plan to make his investments slowly as the herd develops because he will also have to be making cow payments of \$11,000 to \$13,000 per year.

Situation 5. A non-operating investor or investors looking at the dairy business.

There is a high risk in the dairy business due to a high management requirement as shown by the production levels necessary to support a dairy unit. An investor should be slow to consider any dairy business other than a going one because good managers are hard to find. On the other hand, a good struggling dairyman who needs capital or additional financing and not management would be a very good investment as shown in Table 6. At the higher production

Table 6. Profit or loss^a, three production levels.

	9,000 lb milk per cow per year	12,000 lb milk per cow per year	15,000 lb milk per cow per year
1. High investment - short term financing	\$-23,700	\$-14,000	\$- 2,900
2. High investment - long term financing	- 9,850	- 150	+10,950
3. Modest investment - short term financing	- 8,455	+ 1,245	+12,345
4. Modest investment - long term financing	- 2,395	+ 7,305	+18,405
5. Low investment - short term financing	- 1,878	+ 7,822	+18,922
6. Low investment - long term financing	- 1,050	+10,750	+21,850

^aLabor was charged as shown in Appendix tables A through F before the profit or loss was determined.

(continued on next page)

Appendix Table A. Low investment, long term capital, three production levels.

	9,000 lb	12,000 lb	15,000 lb
Income	\$96,700	\$120,700	\$144,700
Expenses			
Labor	16,500	22,500	27,500
Feed	45,850	50,850	55,850
Replacements	13,750	16,250	18,750
Other cash	13,850	13,850	13,850
	\$89,950	\$103,450	\$115,950
Hidden costs			
Depreciation	2,500	2,500	2,500
Int. Bldg. Equip.	1,200	1,200	1,200
Int. Cows	2,000	2,800	3,200
	5,700	6,500	6,900
	\$95,650	\$109,950	\$122,850
Profit	\$ 1,050	\$ 10,750	\$ 21,850
Loss			

Appendix Table B. Low investment, short term capital, three production levels.

	9,000 lb	12,000 lb	15,000 lb
Income	\$96,700	\$120,700	\$144,700
Expenses			
Labor	16,500	22,500	27,500
Feed	45,850	50,850	55,850
Replacements	13,750	16,250	18,750
Other cash	13,850	13,850	13,850
	\$89,950	\$103,450	\$115,950
Hidden costs			
Depreciation	5,428	5,428	5,428
Int. Bldg. Equip.	1,200	1,200	1,200
Int. Cows	2,000	2,800	3,200
	8,628	9,428	9,828
	\$98,578	\$112,878	\$125,778
Profit		\$ 7,822	\$ 18,922
Loss	\$-1,878		

Appendix Table C. Modest investment, long term capital, three production levels.

	9,000 lb	12,000 lb	15,000 lb
Income	\$96,700	\$120,700	\$144,700
Expenses			
Labor	16,500	22,500	27,500
Feed	45,850	50,850	55,850
Replacements	13,750	16,250	18,750
Other cash	13,850	13,850	13,850
	\$89,950	\$103,450	\$115,950
Hidden costs			
Depreciation	4,625	4,625	4,625
Int. Bldg. Equip.	2,520	2,520	2,520
Int. Cows	2,000	2,800	3,200
	9,145	9,945	10,345
	\$99,095	\$113,395	\$126,295
Profit		\$ 7,305	\$ 18,405
Loss	\$-2,395		

Appendix Table D. Modest investment, short term capital, three production levels.

	9,000 lb	12,000 lb	15,000 lb
Income	\$ 96,700	\$120,700	\$144,700
Expenses			
Labor	16,500	22,500	27,500
Feed	45,850	50,850	55,850
Replacements	13,750	16,250	18,750
Other cash	13,850	13,850	13,850
	\$ 89,950	\$103,450	\$115,950
Hidden costs			
Depreciation	10,685	10,685	10,685
Int. Bldg. Equip.	2,520	2,520	2,520
Int. Cows	2,000	2,800	3,200
	15,205	16,005	16,405
	\$105,155	\$119,455	\$132,355
Profit		\$ 1,245	\$ 12,345
Loss	\$- 8,455		

levels the dairy business is very good. Only a small percent of our Nebraska herds are at this level of production, however. These herds can probably get the financing they need to do what they want to do.

Table 7 shows the cost of producing 100 lb of milk for all of the situations described.

Another way a dairyman might like to look at his situation is how much income to labor and management will there be for each of these situations? To get this figure we add the profit of the business as shown in Tables 2 through 7 to the labor income of the operator in the same tables and we have the profit loss figures as shown in Table 8.

Summary

The real cost of producing milk is a little different for every producer. There are some things that affect cost more than others. Three of these are investment in buildings and equipment, term of repayment for capital or depreciation, and production level.

It is nothing new to see the dif-

Colostrum

Foster G. Owen
Professor of Animal Science

Colostrum is one of our least utilized natural resources. The high nutrient value of colostrum and developments in effective and practical methods of feeding point to the need for its more complete use.

Dairymen know the importance of colostrum for the newborn calf as a protection against disease. New information on how to *maximize* this protective value has resulted in the following recommendations:

1. *As soon as practical* after the calf is born milk about two quarts of colostrum from the dam and feed this to the calf via nipple bottle. Take 1 pint of colostrum from each teat as the best colostrum is in the milk taken first. If time exceeds 6 hours before colostrum feeding or if the amount of colostrum is less than a quart, protection will be reduced.

ference milk production levels make on the cost of producing milk. The dairy business can return a very good living to a good manager but also can be disastrous to a poor one.

Dairymen with 12,000-15,000 lb of milk per cow per year herd production averages can afford most any reasonable building program while making an acceptable family living. The only situation unfavorable at the medium or high production levels is one which combines high investment and short term financing. On the other hand, at the lower 9,000 lb herd-average production the only favorable situation is where investment in buildings and equipment is quite low and long term financing is available.

The dairy industry has a serious problem in that few young people have the opportunity to get into the dairy business.

Some serious thought should be given to working agreements, partnerships, or corporations as a means of getting young people started in the dairy business.

Appendix Table E. High investment, long term capital, three production levels.

	9,000 lb	12,000 lb	15,000 lb
Income	\$ 96,700	\$120,700	\$144,700
Expenses			
Labor	16,500	22,500	27,500
Feed	45,850	50,850	55,850
Replacements	13,750	16,250	18,750
Other cash	13,850	13,850	13,850
	\$ 89,950	\$103,450	\$115,950
Hidden costs			
Depreciation	9,000	9,000	9,000
Int. Bldg. Equip.	5,600	5,600	5,600
Int. Cows	2,000	2,800	3,200
	16,600	17,400	17,800
	\$106,550	\$120,850	\$133,750
Profit			\$ 10,950
Loss	\$- 9,850	\$- 150	

Appendix Table F. High investment, short term capital, three production levels.

	9,000 lb	12,000 lb	15,000 lb
Income	\$ 96,700	\$120,700	\$144,700
Expenses			
Labor	16,500	22,500	27,500
Feed	45,850	50,850	55,850
Replacements	13,750	16,250	18,750
Other cash	13,850	13,850	13,850
	\$ 89,950	\$103,450	\$115,950
Hidden costs			
Depreciation	22,850	22,850	22,850
Int. Bldg. Equip.	5,600	5,600	5,600
Int. Cows	2,000	2,800	3,200
	\$ 30,450	\$ 31,250	\$ 31,650
	\$120,400	\$134,700	\$147,600
Profit			
Loss	\$-23,700	\$-14,000	\$- 2,900

Protects the Newborn Calf Against Disease

2. If possible, remove the calf from the cow and feed it two more quarts of its dam's colostrum during the first day. When disease problems are serious, three feedings of two quarts each should be given during the first 24 hours.

3. If dam's colostrum is not available, feed first-day colostrum from another cow in the same herd. A reserve of this kind of colostrum should be saved in a freezer for calves that are born to dams not having a dry period or whose dams are milked prepartum or die during calving.

4. The newborn calf must receive *first* milked colostrum as its *first* feed.

Colostrum for Extended Feeding

In addition to its value in protecting the calf against disease, colostrum is a highly nutritious food. First-day colostrum is about twice as high in total nutrients and is

especially high in protein, vitamins A and D, and minerals. Its composition shifts abruptly toward that of normal milk during the first 2 to 4 days.

Several experiments have compared colostrum with whole milk and milk replacers as diets for young calves through the entire liquid feeding period. Generally, colostrum has proven superior to all other liquid diets.

In Nebraska experiments using colostrum preserved by freezing, colostrum improved growth rate and reduced scours when compared to normal milk. Colostrum-fed calves averaged 52% greater weight gains at 3 weeks of age. Benefits to gains were mainly for male calves.

Other researchers have also reported advantages for colostrum during the early weeks of feeding and that improvements have been especially impressive for male

calves. Beyond the first day of feeding the special value of colostrum is thought to be due to local disease protective effects within the intestine, as well as to its higher nutrient content.

Although residual benefits of colostrum to growth may be seen for weeks following weaning, it seems unlikely that this, itself, is of any ultimate value. However, increased growth during the first several weeks would indicate a more vigorous and healthy calf.

There have been some reports of increased incidence of diarrhea when feeding colostrum, but the type of diarrhea incurred was not apparently detrimental.

Considering its excellent feeding value, it is obvious that all the colostrum available on dairy farms should be used in calf feeding.

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Colostrum . . .

(continued from page 17)

Preserving Surplus Colostrum

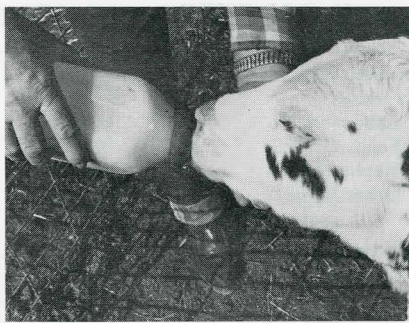
Good dairy cows will produce as much as 150 lb of colostrum during the first 3 days of lactation (enough to feed a calf 7 lb daily for 21 days). Consequently the amount of colostrum available at a given time frequently exceeds the need. This surplus colostrum may be preserved by refrigeration for 5 to 7 days, by pickling for about one month, or by freezing for many months.

Colostrum must be either pickled or frozen for extended feeding. What are the advantages and disadvantages of each storage method?

Pickling does not require a freezer, so storage is inexpensive. However, pickling requires more management to assure that it is not too old, and requires frequent mixing and attention to temperature, especially during very cold or warm weather. The main concern with pickling is assuring a rapid fermentation and avoidance of contamination by possible toxic molds or disease producing bacteria. Although these are not high risk factors, they should not be ignored.

Freezing of colostrum offers the advantage of long-term storage with practically no deterioration in quality. There are no losses due to spoilage. It also essentially avoids the risk of fungal toxins and pathogen contamination. The main disadvantages are the requirement of a freezer and the necessity to plan ahead for thawing. The low cost of freezer ownership, maintenance and operation makes the cost of freezing colostrum minimal on a per calf basis even for a small dairy herd.

Freezing Colostrum. As soon after milking as possible the colostrum not currently needed is put into containers for freezing. Containers holding amounts needed for daily feeding of a calf are usually most practical. We have used both metal and plastic containers. Gallon plastic jugs have been most satisfactory.



See that the calf receives colostrum as soon after birth as possible.

The filled containers should be placed directly into the freezer.

"Pickling" Colostrum. Preserving colostrum by natural lactic fermentation has received wide publicity. Although little experimental data are available on its value and use, many dairymen have used the method or are interested in its use.

1. *Start with good quality colostrum.* Do not use "mastitis milk" or milk from cows which have been dry-treated for mastitis within 10 days of calving.

2. *Use containers for storing the colostrum that will not react with the acid and that can be kept closed tightly.* Some metal containers may react with the acid. A 10- or 20-gallon plastic garbage container is often used. A good tight lid may keep out contaminants, but it is better to use a plastic liner.

Liners reduce clean-up and make possible an excellent tight seal by tying the bag with the metal "twisters" each time colostrum is added or removed. This will help prevent contamination with molds and airborne bacteria. When considerable colostrum is available three or more cans may be useful: one for feeding, one or more full and ready to feed, and one being filled.

3. *Promote rapid fermentation by adding a cup of previously fermented milk when a new batch is begun, and keep at 50-60°F.* This will stimulate rapid development of lactic bacteria which will produce the lactic acid to preserve the food value. Any delay in establishing the acidity provides greater opportunity for development of destructive and possible toxin producing organisms. Keep the product in a cool place during warm weather, pref-

erably in the calf or cow barn rather than in the milk room where it may be too warm.

4. *Colostrum may be combined from several cows which calve within a few days of each other.* However, it is desirable to start a new can if more than a week has passed since pickling began. Stir after each addition.

5. *Keep pickled colostrum no longer than one month.* Acidity continues to build up and protein will begin to break down after long periods of storage.

6. *Before each feeding check for mold; and stir.* Certain molds may be dangerous to calves. Therefore, moldy colostrum should not be fed. If it is used, use it cautiously for feeding older individuals. The colostrum should be stirred before each use to mix fat and non-fat solids.

Feeding Colostrum

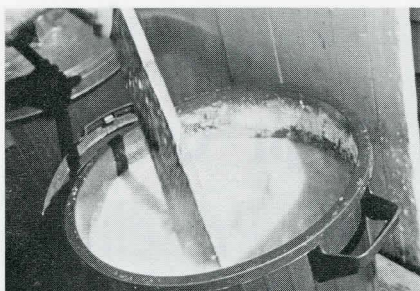
Fresh colostrum or colostrum preserved by freezing or pickling can be fed the same way.

Dilution—pro and con. Colostrum contains about 16% solids, so it may be diluted with one part of water to three parts of colostrum to approximate whole milk. However, dilution is not necessary nor of any known benefit. Some dairymen like to add water on a 1:1 basis. If this is done, the level of feeding should be about 10% of birth weight, whereas about 8% of body weight is sufficient for straight colostrum or the 1:3 dilution.

We suggest that you do not dilute the colostrum since this requires a higher level of feeding to provide equivalent levels of nutrients. Feeding the greater volumes required to provide the needed nutrients may result in more diarrhea.



Colostrum can be safely stored for months in a freezer.



Colostrum can be preserved for a short time as a fermented liquid.

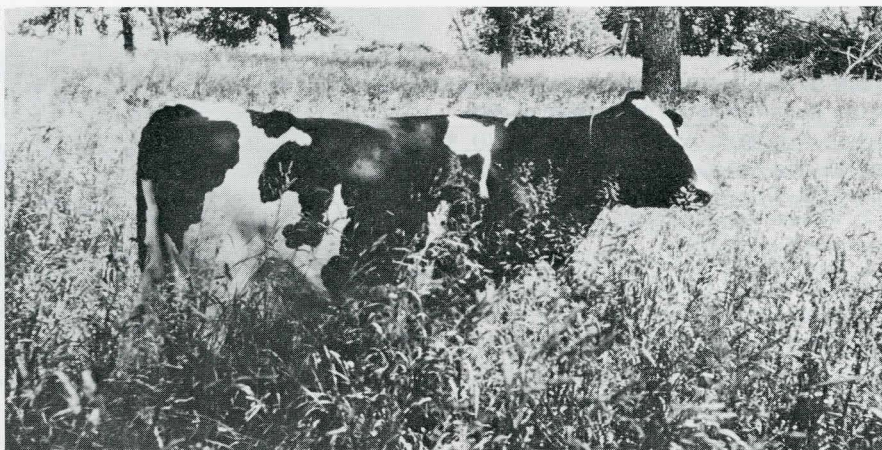
Temperature. Colostrum may be fed warm or cold. However, some believe pickled colostrum should be room temperature rather than cold to obtain better mixing of the fat. It would be most practical to feed pickled colostrum at storage temperature.

By removing gallon plastic jugs of colostrum from the freezer the day before feeding, it is nearly thawed when needed. If not completely thawed, put the jugs in warm water until fully liquid. Gains and health of calves were no different whether the colostrum was warmed to body temperature or fed cold.

Method of feeding. Feeding may be by open pail, nipple pail or nipple bottle. When using restricted levels of feeding, as is normally done when raising replacement calves, health and performance are equally good using these different feeding methods. A nipple may be helpful the first day in getting the colostrum into the calf without delay. Thereafter, the open pail is easier to clean.

When offering pickled colostrum the first time the calf sometimes balks. The calf should not be forced, but permitted to become adjusted over the next several feedings. After initial adjustment there is no apparent problem in shifting between milk and the pickled product.

Frequency of feeding. Several tests have shown that colostrum will perform as well when fed on a once-a-day program as on a twice daily frequency. At Nebraska, we have used 7 lb of colostrum once daily for our Holstein calves with excellent results. The calves are usually started on this program the second day of life.



Top production comes from good cows and good pasture.

Use DHI Records for Culling

P. H. Cole
Extension Dairyman

Guidelines for culling and selection are the same whether a herd is being production tested or not. However, herds on production testing can expect to make more gain from selection because of the accuracy and completeness of the information available on each cow. Genetic process in dairy cows is a slow process at best. Thus, dairymen should make the best possible use of their opportunity for selection by using the data on each cow in their herd obtained through production testing.

One of the immediate uses of the DHI records is in culling. Every herd has some cows that are losing money for their owners. Records point out these cows and answer such questions as:

1. Which cows are losing money right now?
2. How does each cow compare with other cows in the herd?
3. When is the most profitable time to sell a particular cow?
4. Which cows aren't worth saving for another calf?
5. Which cows are good enough to consider saving their bull calves?
6. Is culling for production possible or do the cows cull themselves for other reasons?
7. What is the turnover rate?
8. How much progress has been made through culling?

What Is Available Today?

Dairymen whose herds are enrolled in DHIA and are having their records calculated at the Computing Center at Iowa State University in Ames, Iowa, receive two important aids to culling and selection on a regular basis.

Individual Cow Report—The dairyman receives this report each month. As a guide to culling and selection the following information is given for each individual cow:

1. Daily milk and fat production, plus butterfat percentage.
2. Daily income over feed cost.
3. Days dry.
4. Age.
5. Lactation to date.
6. Income over feed cost to date.
7. Persistency.
8. 305 2X ME.
9. Difference from herdmates.
10. Due date.

A recent survey of top producing herds in Nebraska clearly indicates that dairymen consider their DHI records an important tool in culling. Dairymen also indicated a strong preference for certain production information (see Table 1).

Herd Ranking and Summary—The dairyman receives this report annually. It provides a good guide to the effectiveness of his past years culling program.

The "Estimated Producing Abil-

(continued on next page)

Use DHI Records . . .

(continued from page 19)

Table 1. Survey results showing ranking of items in order of importance when culling and indication of importance of each.

ITEM	RANK	IMPORTANCE			
<i>Test Day Data Section</i>					
1. Milk, % and fat	1	Very 32	Some 5	Little 0	
2. Income over feed cost	7	Very 11	Some 15	Little 9	
<i>Lactation To Date Section</i>					
3. Days dry	9	Very 6	Some 18	Little 12	
4. Age	10	Very 4	Some 23	Little 8	
5. Lactation to date	2	Very 29	Some 7	Little 1	
6. Income over feed cost	5	Very 16	Some 15	Little 3	
7. Persistancy	8	Very 11	Some 17	Little 8	
8. 305 2X ME	3	Very 22	Some 10	Little 5	
9. Difference from herdmates	6	Very 12	Some 17	Little 8	
10. Due date	4	Very 19	Some 13	Little 4	

ity" (EPA) and the "Estimated Average Transmitting Ability" (EATA) provided for each cow in the herd provides a sound basis for the selection of individual animals to use in the herd breeding program.

State averages for progress in selecting for EPA and EATA provide the dairyman with another standard by which to measure the progress his herd has made.

Low Cow List—This listing will soon be added to the current "Herd Management Options" (cow to breed, cows to dry, cows to calve and cows to pregnancy check) that are currently available. The "Low Cow List" will include:

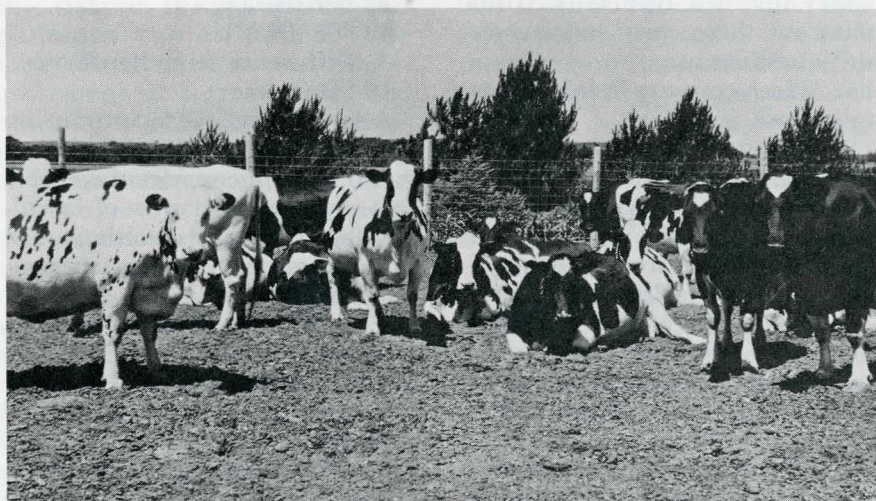
1. 305 - 2X - ME milk for the current lactation.
2. Difference from herd mates for milk on the current lactation.
3. Daily income over feed cost for the current test day.

4. Daily milk pounds for the current test day.

Culling Guide—This listing is still in the process of development. It will be added to the other "Herd Management Options" but probably at an extra cost. The "Culling Guide" will include:

1. Daily profit. Daily profit is defined as income over feed costs minus other cost. The "other costs" item will have to be furnished by the dairyman.
2. Profit til due. This is defined as (daily profit) \times (days til dry) minus (daily dry cow cost \times 60).
3. Difference from herd mates.
4. Total \$ difference.

These four tools—Individual Cow Report, Herd Ranking and Summary, Low Cow List and Culling Guide—provide the dairyman whose herd is enrolled in DHI several effective ways to use records to improve his herd.



We've been using A.I. sires for 30 years.

Beating the High Cost Of Protein In Rations

Foster G. Owen
Professor of Animal Science

Most everything a dairyman buys costs more today than a few years ago, but feed costs have jumped far more than their "fair share." According to the USDA, dairy rations (16% protein) cost farmers 46% more in November 1973 than in November 1972.

This increase in costs has been caused by increases in essentially all feed ingredients. High protein ingredients have contributed considerably to this increase.

Most dairymen will need to adjust their rations or their profits will be substantially reduced. Fortunately, the dairy cow will adapt well to most ration changes, therefore dairymen can alter ration composition without adversely affecting milk yield.

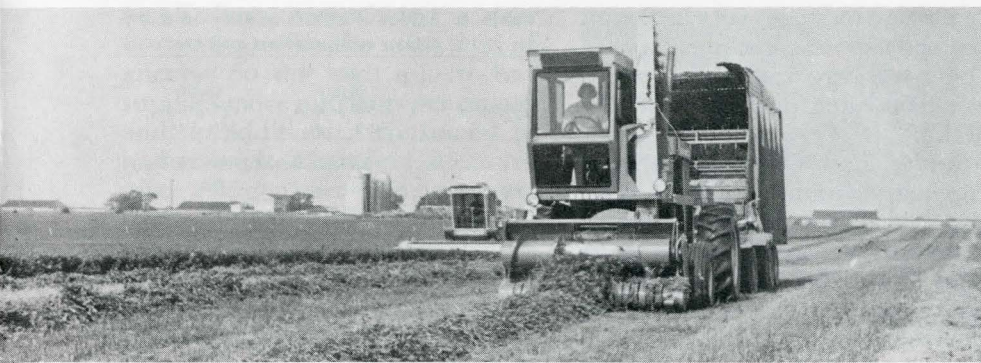
Here are some things the dairyman can do to reduce the cost of providing protein in his dairy ration, while maintaining normal milk production.

Avoid Wasting Protein

Feeding excess protein beyond what the cow needs to produce milk is literally money down the drain. Nitrogen from excess protein passes out of the cow's body through the urine. The remainder of the protein molecule is available for use as energy. Today, protein is much too expensive to use for energy.

Our objective in balancing the cow's ration for protein is to provide an adequate amount to meet her needs for economic milk production, but to limit the protein to this level.

How much protein does the cow need? The National Research



Feed more high quality legumes—such as alfalfa.

full fed as the only forage. Add 2 points for all grain rations fed to cows producing over 60 lb of milk daily. Also add 2 points when corn or sorghum silage constitutes the entire roughage ration or when hay supplemental to these silages is limited to 3-8 lb or less.

Here are some examples:

Example 1. Alfalfa hay is used as the total roughage. Forage test reveals a protein content of 14% and 85% dry matter. What protein level should the grain contain?

Adjust to a 90% dry base. $90/85 \times 14.0 = 14.8\%$ protein

$27.0 \text{ minus } 14.8 = 12.2\%$ protein needed in the grain ration

$12.2\% + 2.0 = 14.2\%$ protein needed for cows above 60 lb milk.

Example 2. Alfalfa hay (10 lb/day) and silage (45 lb/day) are both fed. Analysis:

Hay = 15% protein (as fed) 90% DM.

Silage = 3% protein (as fed) 30% DM.

Adjust to 90% DM:

For hay, $(90/90 \times 15.0\%) = 15.0$

For silage, $(90/30 \times 3.0\%) = 9.0$.

(continued on next page)

Council gives the protein requirement as a percent of the dry matter of the total feed ration as follows: 14% for cows producing less than 45 lb of milk daily, 15% for cows producing 45-66 lb and 16% for cows producing more than 66 lb daily.

Data in Table 1 show that high producing dairy cows will respond to protein levels beyond 14 percent. The response is similar per unit of protein in these experiments over the various ranges tested between 12 and $17\frac{1}{2}\%$.

Before shifting to higher levels of protein it is important to determine whether the anticipated response will be profitable. It appears that between 12 and 16% protein, the response is about 4 lb of milk per pound of additional protein fed. We computed the monetary response with corn at \$70 per ton, milk at 6¢, 7¢, 8¢, and 9¢ a pound, and with soybean meal at various prices from \$160 to \$350 per ton.

Table 2 data show that when soybean meal reaches \$300 per ton the response in milk, priced at 7¢ a pound, is not enough to justify the added cost. But at \$250 there is a positive economic response. So the break-even price for soybean meal is about \$270 per ton. With milk at 8¢ a pound, the break-even price is \$300 per ton, but when milk reaches 9¢ a pound, a positive response is obtained up to \$300, or a break-even price of about \$330 per ton.

Thus far we have been discussing the protein level for the total ration or "complete ration." But for most who feed their grain and roughage separately, the important question about ration protein

is "what level of protein should the grain ration contain?" To answer this question use the following procedure:

1. Send a sample of your forages to a laboratory to have it tested for protein content.

2. If the values are not expressed on an air dry basis convert them to air dry, or a 90% dry matter base.

3. Subtract the protein content of the roughage (90% dry matter base) from 27. This will then give you the percent of protein needed in the grain ration (90% dry matter base).

4. Adjust this value by subtracting 2 points if hay or haylage of high quality (above 18% protein) is

Table 1. Response of dairy cows to ration protein levels.

Experiment			
I. Michigan (1971)			
Protein, %	12.0	14.0	
Milk, lb ^a	15,480	17,364	
II. Utah (1973)			
Protein, %	13.2	14.4	15.5
Milk, lb ^a	14,480	15,270	16,115
III. Utah (1973)			
Protein, %	13.9	15.8	
Milk, lb ^a	14,530	15,980	
IV. Kentucky (1973)			
Protein, %	13.5	15.5	17.5
Milk, lb/day	49.5	52.8	57.9

^aLactation yields.

Table 2. Economics of increasing the ration protein level with different prices for soybean meal and milk.

Price of SBM/ton	Cost/lb protein ^a	Price of milk/lb			
		6¢	7¢	8¢	9¢
(Return above cost of additional pound of protein ^b)					
\$100	4¢	+20¢	+24¢	+28¢	+32¢
150	11	+13	+17	+21	+25
200	18	+ 6	+10	+14	+18
250	25	- 1	+ 3	+ 7	+11
300	32	- 8	- 4	0	+ 4
350	39	-15	-11	- 7	- 3
400	46	-22	-18	-14	-10

^aCost of increasing the ration protein by 1 lb by replacing corn (3.5¢/lb) with soybean meal.

^bAssumes a response of 4 lb milk per lb of protein fed between 12 and 16% of ration dry matter.

Beating High Costs . . .

(continued from page 21)

Calculate roughage percentages:

First convert silage to 90% dry base —

$30/90 \times 45 \text{ lb} = 15 \text{ lb silage (90\% dry base)}$

15 lb silage $15/25 = .60$
of ration is silage

10 lb hay $10/25 = .40$
of ration is hay

25 lb total

Calculate combined roughage protein:

Silage = $.60 \times 9\% \text{ protein} = 5.4$

Hay = $.40 \times 15\% \text{ protein} = 6.0$

% protein in
combined roughage 11.4

Grain ration protein:

$27.0 - 11.4 = 15.4\% \text{ protein}$
needed in grain ration

$15.4 + 2 = 17.4\% \text{ for high producers}$

Use High Protein Forages

Alfalfa is the predominant hay crop forage used in dairy rations in Nebraska. The procedure applies to other high protein forages as well.

Production and use of more high quality alfalfa offers an exceptional opportunity to reduce ration protein cost. As the price of soybean meal increases, the value of alfalfa to the ration increases. An increase in soybean meal prices from \$100 to \$200 per ton increases the calculated value of alfalfa hay from \$46 to \$69, a 50% increase. This \$69 value for alfalfa is about double the current price of \$35. These calculations are based on corn at \$2.20 a bushel and hay containing 16% protein. The theoretical value of

corn silage increases very little with this shift in soybean meal price. The advantage for alfalfa would even be greater for a higher quality alfalfa.

Since a major competitive roughage in dairy rations is corn silage, let's consider the effect of replacing part, or all of the corn silage, with alfalfa. Table 3 shows four rations formulated to meet the needs of a cow producing 50 lb of milk (3½% fat) and weighing about 1450 lb. This table shows the changes in the amounts of corn grain and soybean meal needed to feed with rations containing high, medium or low levels of corn silage and with the corn silage completely replaced with hay. Replacing the corn silage completely with hay reduces the amount of soybean meal needed to about 35% of that for the high silage ration. The calculations for this illustration are based on average quality (16% protein) alfalfa hay.

Table 3 also illustrates the effect of reducing the level of corn silage on the cost of each ration. Reducing the corn silage level from 55 lb per day to 10 lb reduces the cost per cow daily by 33¢. Completely eliminating the silage further reduces the cost, making the savings 40¢ daily. On a ton basis, savings were \$11 for reducing the silage to 40 lb daily, \$15 for reducing to 10 lb daily and eliminating the silage saved \$19 per ton of total ration compared to feeding at the 55 lb daily rate of silage. These savings are based on the approximate price relationships during December 1973 for Nebraska feedstuffs.

Such savings would not be realized if the alfalfa were of low quality or if high wastage was in-

Table 4. Effect of alfalfa quality on dairy ration composition and cost.

Ingredient	Low quality (13% protein 45% TDN)	High quality (19% protein 55% TSN)
	(Composition of rations, %) ^a	
Hay	40	60
Corn grain	48	40
SBM	12	0
Cost/cwt ^b	\$3.82	\$2.36

^aBoth rations contain on a dry basis 65% TDN and 15% protein which are adequate for 60 lb (3.5% fat) of milk daily.

^bBased on ton prices of: \$32 hay, \$70 corn grain and \$250 SBM. The same price is used for low and high quality hay because the cost of production is similar and there is usually little or no price differential for hay quality in Nebraska.

involved in feeding of this hay. In addition, any shift in prices from those used in the example may also alter the amount of saving accruing to the use of high protein forages.

Use High Quality Alfalfa

Forage quality today has a significance magnified beyond anything we've known in past years.

In the past when roughage prices were much lower than grain prices, forage quality was important because high quality forages could supply a much higher proportion of the cow's energy needs than low quality forages and thereby reduce the amount of grain ration needed. But today high quality of forage is of primary significance for its protein value. Until this past year, many dairymen felt that they could cover up for low quality forage by feeding larger quantities of grain. But at the present price of grain rations, dairymen must stop and take another look.

What is "high quality" alfalfa? Generally, alfalfa of high quality will contain 18% protein or more and 27% fiber or less and is highly digestible. It will also be very palatable.

Table 4 contains two rations, one made using low quality alfalfa, the other with high quality alfalfa. Each ration is supplemented with sufficient corn and soybean meal to provide, in both cases, rations with 15% protein and 65% TDN.

Only 40% of the low quality alfalfa can be used in the ration and provide a sufficiently high level of energy whereas 60% of high qual-

Table 3. Effect of replacing corn silage with alfalfa hay on ration composition and cost.

Rations for a 1450-lb cow producing 50 lb/milk/day				
Corn silage, lb	55	40	10	0
Alfalfa hay, lb ^a	5	10	20	23
Corn, lb	14.8	15.9	18.4	18.7
SBM, lb	6.2	5.1	2.9	2.3
Cost/day ^b	\$ 1.71	\$ 1.48	\$ 1.38	\$ 1.31
Cost/ton ^c	\$78	\$67	\$63	\$59

^a16% protein.

^bSilage at \$12, hay \$32, corn \$70 and SBM \$250 per ton.

^cAir dry basis.

ity alfalfa can be included in a ration and provide the same level of energy. So the high quality hay supplies more nutrients per pound and, in addition, is consumed in higher levels. Therefore, it can replace a larger part of the grain ration. Both of these rations are computed to support 60 lb of 3.5% fat-containing milk daily. The major difference in the ration with the low- and high-quality alfalfas is that 12% soybean meal is required in the low quality hay ration—no soybean meal is needed with the high quality hay.

Using a price of \$250 per ton of soybean meal, the savings using the high quality alfalfa is phenomenal. In 100 lb of ration, although 32¢ per cwt more alfalfa hay is required, there is a 28¢ savings in corn and a \$1.50 savings in soybean meal. As illustrated in Table 4, by feeding the high quality hay, soybean meal is not needed in the ration. Thus, \$1.50 worth of soybean meal and 28¢ worth of corn are both replaced by only 32¢ worth of hay. The total savings is \$1.46 per cwt or \$29.20 per ton.

At present, shifting to higher qualities of alfalfa appears to offer the greatest potential of any single factor for improving the feed cost situation for dairymen.

To obtain high quality alfalfa, greater attention should be given to cutting forage in an immature state, removing the hay from the field before it has been weather damaged, and storing the forage in a manner to protect its quality.

Two of the most practical ways to improve alfalfa quality are (1) harvesting the first cutting earlier and (2) making the crop into wilted silage.



Test your forage.

Consider "Other" Grain Ingredients

In Nebraska it is conventional to use corn and soybean meal as basic grain ration ingredients. Dozens of other ingredients have been successfully used in dairy grain mixtures. We are fortunate in Nebraska to have a number of alternative grain ration ingredients available, including sorghum grain, barley, oats, wheat, rye, wheat bran and beet pulp.

The make-up of the grain ration can be shifted radically without any noticeable effects on the performance of the cow (certain shifts do necessitate a period of adjustment). Consequently, we have considerable flexibility in the kind of ingredients we include in the ration. The astute dairyman will be alert to the possibility for reducing ration costs by making shifts in the grain ration formula as prices change.

Table 5 shows potential for cost reduction by substituting oats, sorghum or rye for part or all of the corn in the concentrate ration. Compared to corn and soybean meal at about current prices, a reduction in ration price of \$11 per ton was made by including 50% oats or 35% rye or by completely

replacing the corn with sorghum grain. All of these rations contain 16% protein.

Shifting from soybean meal to other high protein meals may also reduce ration costs. In our area linseed meal is generally available and sometimes cottonseed meal can be purchased.

Including urea also offers an opportunity for savings under some conditions. Grain ration costs can be reduced by \$5 to \$15 per ton by including urea at recommended levels. The amount of savings will depend on the level of urea used and especially to the comparative costs of urea relative to natural protein sources.

We suggest you consider urea for rations to be fed heifers, dry cows and cows producing less than 45 lb of milk daily. Research indicates that cows producing at higher levels of milk do not respond to urea additions.

To obtain most effective use of urea, it is essential that urea be mixed thoroughly into the ration and that animals be given a period of two to three weeks to fully adapt to its use. If urea is used for cows in the latter part of lactation it may be desirable to maintain at least a low level in the ration of high producers to avoid the adaptation problem. It is recommended that urea in the total ration be limited to about .8% of the total dry matter or about 1½% of the grain ration. If palatability is reduced, 5 or 10% molasses may be added to help correct the problem.

Summary

Dairymen are compelled to react to the recent upsurge in feed prices—especially high protein ingredients. They should check and see if they can safely reduce the level of ration protein.

High protein forages, such as alfalfa, should be substituted for low protein forages such as corn silage where practical. Special emphasis on quality of alfalfa will produce high returns.

Use of alternative grain ration ingredients—urea, oats, sorghum grain, rye and by-product feed-stuffs offer further means of potentially reducing feed costs.

Table 5. Use of alternative grain ration ingredients for formulating 16% protein rations.

Ingredient	(Price/cwt)	Rations					
		1	2	3	4	5	6
					(%)		
Corn	\$3.86	79.5	34.1	...	48.4	51.8	35.5
SBM	12.50	20.5	15.9	17.1	16.6	13.2	14.4
Oats	3.50	...	50.0 ^a	...	...	...	...
Sorghum	3.51	...	...	82.9	...	...	...
Rye	3.17	...	...	...	35.0 ^a	...	...
Wheat bran	6.10	...	...	...	...	35.0 ^a	...
Wheat	6.66	...	...	...	...	...	50.0 ^a
Ration price/cwt		\$5.63	\$5.06	\$5.04	\$5.05	\$5.70	\$6.51

^aLevels set as desirable upper limits.

Dairy Research in Progress

Chromosomes Count

The chromosomes of dairy cattle are carriers of genes which control hereditary differences among individuals. Normally, cattle have 60 chromosomes in each body cell. A few cattle in Nebraska have been found with only 59 chromosomes because two of the usual 60 have been joined and are transmitted together. This departure from the usual pattern has been reported to cause a very slight decrease in fertility, but in another case was associated with desirable characteristics. Dairy cattle are now being screened to see how frequently these modifications occur. *Dr. Franklin Eldridge.*

Estrus Detection

Estrus detection continues to be one of the major factors limiting reproductive efficiency. The possibility of detecting estrus by measuring changes in the electrical resistance of the vaginal mucus is being examined. Preliminary results indicate that the change in electrical resistance is related to the stage of the estrous cycle. Additional work is needed to determine if this could be a practical method for determining the proper time of insemination for some cows. *L. L. Larson.*

Conception Rates

Conception rates following treatment to increase the cow's own production of progesterone, the hormone essential for the maintenance of pregnancy, were examined. The study involved the University herd and four private herds. Conception rates of treated cows were not improved over the control animals in any of the herds. *L. L. Larson.*

Calf Raising Program

A Nebraska developed calf raising program is being compared with a conventional calf raising plan. The Nebraska program consists of feeding Holstein calves 7 lb of cold colostrum once daily to 3 weeks of age when they are weaned.

The conventional plan consists of twice daily feeding of 3.5 lb of normal warm milk (after one day of colostrum feeding) to 6 weeks of age.

Although calves on the conventional program gained somewhat more by 6 weeks of age, at 6 months body weights did not differ significantly and there was no evidence of other difference in performance or health. Most of these heifers have now freshened. Lactation and reproductive performance will be compared at the end of the first lactation to learn whether the Nebraska program has any long term effects. *F. G. Owen.*

Calf Starter Rations

Molasses and a buffering agent (sodium bicarbonate) were tested for their value in the starter ration for early weaned calves. Neither of these were beneficial to starter consumption or weight gains. *F. G. Owen.*

Computer Formulated Rations

Ration specifications and feedstuff analyses are continually being updated and modified as new information is obtained. A new publication of this data was published this year. A study was also made of the comparative economics of corn silage and alfalfa hay. *F. G. Owen.*

DEHY in Corn Silage Rations

Dehydrated alfalfa is being evaluated as a partial replacement

for corn silage in a complete mixed ration containing no additional roughage. Preliminary data indicate no benefit from including the DEHY at 10% of the total dry matter fed. Full feeding these rations continuously for successive lactations has produced subnormal performance and health. *F. G. Owen*

Silage Additives

A bacterial-fungal product and a proprietary product containing propionic acid were evaluated as preservatives in direct-cut alfalfa silage. Neither of these additives affected intake, milk yield or feed efficiency.

Protein and dry matter preservation were not affected by the acid additive in an above ground stack of milk stage corn silage. Neither did this product benefit lactation performance when added to corn silage harvested at either the milk stage or dent stage. *F. G. Owen*

Ration Fiber Requirement

Evidence indicates that fiber is required for normal function of the digestive system, normal milk fat content, high efficiency of feed conversion to milk and maintenance of long term health of the milk cow. The amount and form of fiber needed to satisfy the requirements of the cow are not known. Therefore a series of experiments is planned to study the importance of the fiber content of rations for lactating cows.

Any feedstuffs used to increase fiber content in rations of high producing cows must also furnish a high level of usable energy. The first experiment will evaluate levels of soybean hulls as a source of fiber. This ingredient appears to meet the above requirements. *F. G. Owen.*