

1969

## EC69-220 1968 Dairy Report

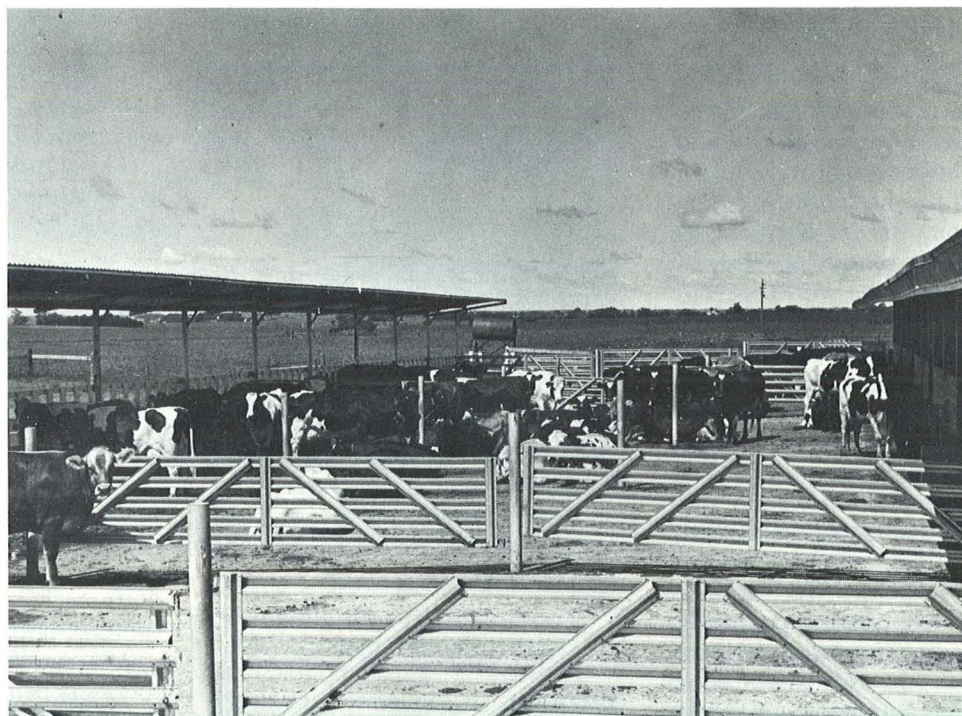
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# 1968 DAIRY REPORT

## CONTENTS

Think Positive About Dairying .....	2
Improving Breeding Efficiency .....	3
Reproduction Diseases in Dairy Cattle .....	4
Complete-Feed Dairy Rations .....	6
Which Silo For Me? .....	7
Milk Quality Is Farmer's Job .....	11
Holstein Cows: Beef Producers .....	13
Dairy Herd Improvement .....	15
Weighing, Sampling, Testing Devices .....	17
High Nitrate Feeds .....	18
Housing System for Calves .....	19

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# Think Positive About Dairying

By Frank H. Baker

Chairman, Dept. of Animal Science

The dairy cow is well established as an efficient converter of feed and forage to human food. Nebraska is establishing itself during this decade as one of the outstanding feed and forage producing areas of our country and the world.

For example, feed grain production in our state today is nearly three times the average annual production of the 1930's (13 to 14 million tons annually compared to 4.7 million tons).

Feed and forage production will continue to expand due to increases in irrigated acres, improved crop varieties, improved fertilization practices and improved harvesting methods. At present we can irrigate about 3 million acres. It has been estimated that our water resources will permit us to irrigate 6 million acres annually without depleting the water resources.

The feed produced on these new acres will ultimately be converted to human food in some manner and at some location in the world. If we think positive about dairying in Nebraska . . . we can say that this conversion will be done in part or to a large extent by dairy cows in Nebraska.

## Twice As Much

Nebraska produces about twice as much milk as is needed by its population. A defeatist might say we can't expand the dairy enterprise under these conditions. May I point out that we produce beef and pork at much higher levels than this and both of these enterprises have grown tremendously during the early and mid 1960's.

If we think positive about dairying in Nebraska . . . we can say that the dairy industry will grow more rapidly than the pork industry and the beef industry in the future.

Nebraska's dairy operations have been largely small and moderate

sized herds (5 to 50 cows). A similar statement could have been made for beef herds and swine operations a few years ago. Today a majority of the beef and swine operations are specialized operations with more volume than in the past.

The production efficiency in these larger, more specialized operations makes them very competitive for the use of productive resources (land, labor and capital). Dairy operations in other areas (West Coast, Great Lakes area, and Northeast) tend to be larger and more specialized than in our area.

If we think positive about Dairying in Nebraska, we will say that many large specialized dairy operations will be developed to make us competitive in other livestock enterprises in our state and other dairy producing areas of the country.

Dairy cows in Nebraska produce 7440 lbs. milk annually compared to a national average of 8820 lbs. In the past 20 years, the average corn yield per acre in Nebraska has increased from 30 bushels per acre to more than 70 bushels per acre. Currently, Nebraska has only 10% of its cows on DHIA; the national average is 23%; some states have as high as 49%. Similarly, only 19% of the Nebraska dairy cows are bred artificially; the national average is 48%.

If we think positive about dairying and utilize the new technology available such as AI, DHIA and improved feeding; we will improve milk yield per cow by 50% to 100% within the next 15 to 20 years.

Dairy production has a specialized labor requirement . . . but we can say the same thing about a beef operation or a swine operation. If we think positive about dairying in Nebraska we will pioneer in many new approaches to remove the drudgery from the dairy business.

## Mead Operation

The University of Nebraska is thinking positive about dairying. The dairy herds in the Experiment Station system are being assembled as a single unit at the Mead Field Laboratory to increase research and management efficiency.

This dairy operation will serve as a training ground for both undergraduate and graduate students pursuing careers in dairy production.

In thinking positive about dairying at the University, we are trying to provide programs to develop people . . . our students . . . and technology . . . our research.

## Objectives

Our departmental objectives are:

1. To assist producers to utilize dairy technology to maximize income opportunities.

2. To assist producers to assume the responsibility for providing a dependable, wholesome supply of milk to consumers at a fair price.

3. To assist youth in developing an understanding of the scientific principles involved in milk production and milk quality.

4. To assist youth, both urban and rural, to develop an appreciation and interest for animal agriculture with emphasis on career opportunities.

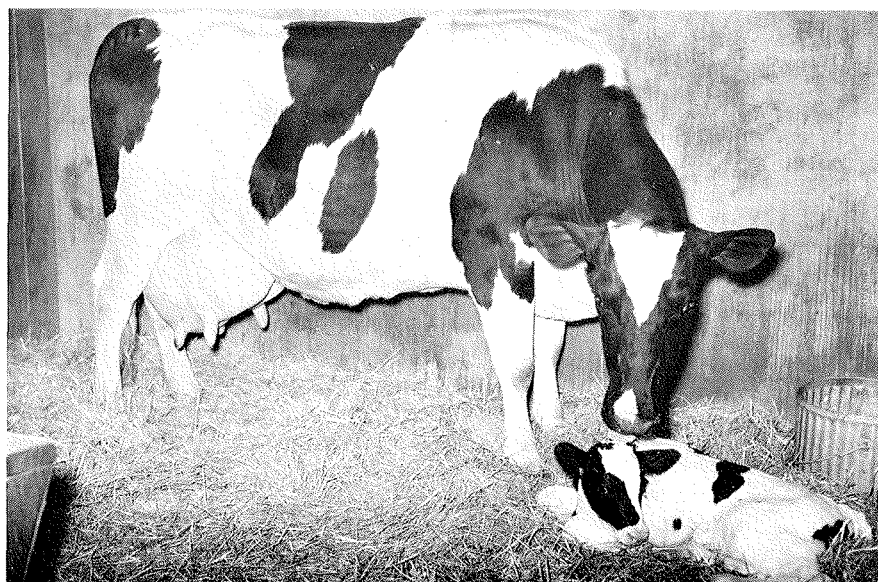
5. To assist in promoting understanding and good will between agriculture's off-farm segments and the producers to facilitate reflection of price and quality information back to the farm.

6. To assist in promoting cooperation within the agricultural industry and in promoting good will between this industry and consumers.

7. To assist consumers in the development of an understanding of milk quality, wholesomeness and nutritive value in relation to the wise purchase of food.

8. To assist consumers in development of an appreciation for the contribution of animal agriculture in providing a nutritious diet and a high standard of living for the American public.





## Improving Breeding Efficiency

Dr. A. B. Schultze

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Department of Animal Science

Every dairy herd has breeding troubles at one time or another. About five percent of the dairy cow population is sterile, and no known treatment or management will overcome this. However, with proper attention to a number of details and practices, breeding efficiency can be increased in most herds.

We can promote the chances for increased breeding efficiency by growing heifers to an adequate size at the age they are to be bred. If heifers are to calve at 24-26 months, Holstein heifers should weigh about 800-850 pounds when bred. Brown Swiss heifers should be about 50 pounds heavier. Jerseys should weigh about 600 pounds and Guernseys 50 pounds more.

The size of the heifer at calving is important because undersize at

calving is associated with increased calving difficulty.

Records kept for the University of Nebraska Holstein herd show that about 1.5 more services per conception were required on the average to get cows in calf following a difficult calving than for those following a normal calving. Sometimes complete sterility can be attributed to calving difficulty.

Many factors reduce breeding efficiency—disease, inadequate feeding, abnormal genitalia conditions, hormonal imbalances, the use of low fertility semen, poor breeding technique where artificial breeding is practiced and lax herd management.

### Use Highly Fertile Semen

One practice that helps minimize low fertility in the cow is the use of semen from high fertility bulls. Results from the use of highly fertile semen compared to medium fertile semen shows that on the average not only will fertilization rate be higher, but less embryonic

Table 2.—Time of breeding compared to fertility.<sup>a</sup>

Time of insemination after calving	Pregnant at 35 days post-breeding
Less than 20 days	50%
20-40 days	50%
40-60 days	55%
Over 60 days	70%

<sup>a</sup> Wisconsin study.

death will occur when cows are bred with semen from highly fertile bulls. Results from a study at Cornell University are shown in Table 1.

The chances for a successful breeding in most cows are about 60-70% when insemination is performed the latter part of the heat period or several hours after the end of heat. Cows bred in early heat have about a 40% chance. The difference is worth the effort required to see that the cow is bred at the proper time.

To accomplish this it is necessary for the dairyman to spend considerable time and effort in the detection of heat. A record of all heat periods should be kept and used to anticipate recurring heat periods. Signs of approaching heat such as restlessness, swollen appearance and redness of the external genitalia should be watched for.

Without close observation, timing of insemination in relation to stage of heat will be less precise. Also, without at least two observation periods each day for heat, more silent heats or heats after a long cycle will be reported. Cows that have been bred may be thought to be with calf because heat, although it occurred, was not observed.

### Don't Breed Too Soon

Fertility of the cow shortly after calving is low even though heat may occur within a few weeks. Table 2, from a Wisconsin study, is representative of other work in this area.

Not only is fertilization rate lower in cows bred under 40 days post-calving compared to those bred 60 days or more following calving, but embryonic death rate is higher. A study at Penn State indicates that

Table 1.—Fertilization rate, percent ova fertilized, live embryo and calves dropped.<sup>a</sup>

Bull fertility	Percent Ova fertilized	Live embryo at 35 days	Calves dropped %
70%+ N. R. Rate	97	86	76
50% N. R. Rate	77	56	46
Difference	20	30	30

<sup>a</sup> Cornell University study.

(continued on next page)

## Breeding Efficiency

(continued from page 3)

cows bred less than 50 days post-calving had a longer calving interval on the average by 26 days than cows bred after 60 days post-calving. This, they state, was because early breeding not only lowered the chance for conception on the first breeding, but also lowered it for the second breeding.

Experimental work has shown that foreign material such as an infection or even a plastic coil will upset uterine and ovarian function. A degenerating embryo in the uterus may also upset genital function. Breeding at times and under conditions where we have the maximum chance for success in inducing pregnancy will minimize chances for embryonic death and its harmful effect on a following breeding.

### Genital Infection

If the vaginal mucus is contaminated with pus and debris, the cow should receive treatment before breeding. Breeding an infected cow may aggravate the condition. By maximizing chances for a conception at each breeding for each cow, the general reproductive efficiency of the herd can be increased. However, certain cows will still be difficult breeders. Abnormalities in structure and function of the reproductive organs prevail in some animals.

**Late Ovulators**—Some cows may ovulate a day or more after heat. Even when bred in the latter part of the heat period, the sperm may die before an egg is shed and the cow is a so-called repeat breeder. Hastening ovulation by administration of hormones has been shown to be possible by Nebraska work but conception rate is low. If such a situation is suspected, breeding later than usual after heat may solve the problem.

**Short Heat Cycles**—There is a poor chance of successful insemination in heat periods with a cycle of less than two weeks. Short estrus cycles or continuous estrus is usually associated with a cystic folli-

cle in the ovary. This condition may often be treated successfully by your veterinarian.

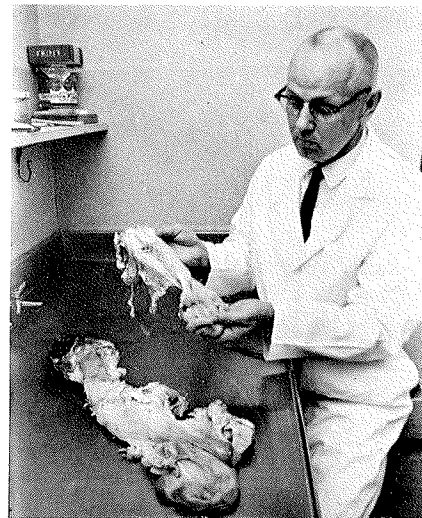
**Abnormally Long Heat Cycles**—These may be due to lax observation by the dairyman, or due to a persistent corpus luteum. If they occur after cows have been bred, they may result from death of an embryo early in pregnancy. Following embryonic death, the cow returns to heat. Embryonic death seems to be a characteristic of some cows and there are treatments that seem to be of some benefit.

**Anestrus**—Cows or heifers may fail to come into heat even though well fed. This condition may be treated successfully in many cases by massage of the ovaries or by administration of suitable gonadotropic hormones.

**Feeding**—Nutrients adequate in amount and kind that are satisfactory for growth and/or milk secretion generally are also sufficient for reproduction. In cows lactating heavily, sometimes the high stimulus for milk secretion appears to use nutrients at the expense of those needed for reproduction.

High milk producers take longer to come into heat following calving than low producers on the average. In a New Zealand study, cows gaining in body weight at the breeding period following calving had a 15% higher conception rate than cows that were losing body weight at this period. "Lead feeding" may obviate some of this difficulty. Some claim that additional Vitamin A given during the breeding period is beneficial.

Veterinarian service is required in many instances to attain high reproductive efficiency. This is especially so when disease or malfunction of the genitalia is present in the herd. Much benefit has been obtained by routine veterinarian examination (monthly visits). Conditions leading to poor reproductive efficiency can be diagnosed early and treated promptly when the chances of successful treatment are greatest. Pregnancy examinations can also be made and cows not pregnant can be treated or, if incurable, sold.



Examining tissue for disease.

## Reproduction Diseases In Dairy Cattle

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Professor and Chairman

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### Vibriosis

Vibriosis is a venereal disease of all breeding animals. The cause is a spiral-shaped organism—*Vibrio fetus*. This disease frequently becomes widespread before it is recognized. Artificial insemination has taken the sting out of this disease in most dairy herds. The addition of antibiotics to AI semen eliminates this infection in such treated semen. The disease is a greater problem in beef herds.

The disease is usually brought into the herd by the purchase of breeding animals. However, it can be introduced into a herd by a wandering animal from a neighboring pasture.

Clinical signs consist of repeated prolonged cycles. Animals return in heat in 30-90 days. Abortions may occur in about 12% of the herd, usually between the 4-7 month of pregnancy. Many of these abortions

are never observed. Examination of the herd reveals a large number of animals to be non-pregnant.

Diagnosis is made by bacteriological examination either by culture or the presence of organisms in cervical mucus or preputial washings from the bull. The infection and its products kill the fetus. The organisms attack the placental membranes and the fetus itself. In most instances no permanent damage to the cow results from this infection.

The disease may be controlled by management—a rest period of 2-3 heat cycles, artificial insemination and the employment of a vaccine.

### Trichomoniasis

This disease is caused by protozoan organisms. The infection proceeds from the vagina, where it is usually deposited by the bull, to the uterus where it results in an inflammation of the uterus and placental membranes that surround the fetus.

Results of this infection range from a very mild purulent reaction to a copious discharge of white to gray pus. The infection becomes chronic and fetus death results in the first third or half of pregnancy.

The fetus may be aborted, mummified, absorbed, or macerated. Retained placental membranes at time of death of fetus is a common finding.

The whitish discharge is a significant observation. Diagnosis depends on demonstrating the protozoan organism either by culture or by direct microscopic examination.

Infected cows should be given a rest for at least 60 days. The best method of preventing the disease is by using semen from a clean bull or AI semen.

Antibiotics are not effective against this disease and there is no vaccine available.

### Bang's Disease

This disease has been greatly reduced in the United States through the national-state brucellosis program. The extensive calfhood vac-

cination and blood testing program and the slaughter of infected cows has dramatically reduced the incidence of this disease.

The greatest danger for reinfection of a herd is from the introduction of pregnant or fresh cows. The safest replacement is a vaccinated calf.

Control measures consist of vaccinating calves between 4-8 months of age and blood testing and isolation of any new additions.

### Leptospirosis

Leptospirosis is an organism that will infect many animals as well as man. It is caused by a spiral shaped organism that is hooked at each end. The organism is highly motile and will live in water for some time. It is sensitive to sunlight, chemicals and antibiotics.

The disease is widespread and found in all states and must be considered when a diagnosis is made. Species reported in cattle are *L. pomona*, *canicola*, *hardjo*.

The incubation period is short, about one week, and the organism is rapidly spread between calves and in older animals. The disease is usually subclinical. Death rate may vary from 5 to 20%.

Clinical signs consist of high temperature, 103-107 for several days, depression and loss of appetite. Diarrhea is usually observed in older animals. Abortions may occur late in pregnancy and a non-inflammatory mastitis, bloody milk, hemoglobin in urine or wineport colored urine, anemia of mucous membranes and extreme weakness frequently accompany this infection.

The blood appears very thin and watery due to destruction of red blood cells. If the infection is local in the mammary gland the milk production usually returns in 10-14 days. Animals that abort show no illness and in most cases breed back without evidence of sterility.

Chronically infected animals shed large numbers of *Leptospira* in the urine, this is a primary source of spread to other animals. The primary route of infection is probably by way of the mouth al-

though the eye is a very susceptible route. Losses in livestock have been estimated at 100 million dollars annually, the main loss being in milk production.

Diagnosis is difficult and depends upon clinical signs, serology, and isolation of the organism. Other diseases causing abortion must be eliminated. Serology frequently is not positive until 14-21 days after infection.

Streptomycin is the drug of choice and should be used immediately after diagnosis. The use of a bacterin has also been of value in early outbreaks.

Control depends upon detecting carrier animals and prevention of exposure to contaminated areas or streams. The vaccination of all susceptible animals is essential in most outbreaks. Vaccination is required each year as the resistance is rather transient or of short duration.

### Other Abortion Causes

Low grade bacterial infection of the uterus caused by such organisms as *E. coli*, *Staphylococcus*, *Streptococcus*, *Corynebacterium*, and *Pseudomonas* can cause abortions. Some of these infections result from dirty technique when delivering a calf or cleaning a cow.

The bacteria *Listeria monocytogenes*—the cause of circling disease or listeriosis—can infect the fetus and cause abortion of a 6-7 month calf. In some outbreaks 50% of the cows abort.

Molds (mycotic infections) occasionally cause abortion of a 6-8 month fetus.

Epizootic abortion is due to a psittacosis-lymphogranulomagroup, and has been found primarily in California and parts of Europe. A characteristic finding in tissues from a fetus are accumulations of lymphocyte nodules.

Unfortunately, many causes of abortion are unknown. Abortion in cattle is an area in which much research still has to be done. If an animal aborts, have the fetus examined by a veterinarian and specimens submitted for laboratory examination.



A complete-feed ration.

# Complete-Feed Dairy Rations

Foster G. Owen

Professor, Animal Nutrition

How can a dairyman be sure he is feeding his cows enough of an economical "balanced" ration to realize their milk producing potential? This is especially difficult when cows are self-fed roughages and provided grain in a milking parlor.

A complete feed may be the answer. A complete feed would contain the roughage along with the grain ration, including any supplemental feeds needed to furnish the required nutrients.

This method of feeding will provide controlled relative amounts of all feed ingredients.

In addition to providing the desired balance of nutrients, such rations greatly simplify the feeding operation. Complete rations can be mechanically handled, permitting maximum automation and reduction in labor requirements. These rations assure an adequate roughage level, diminishing off-feed and other health problems often encountered when feeding high-grain rations along with free-choice roughage. The level of roughage can be adjusted to regulate ration intake.

## Complete Feed

The ingredients which can be included are numerous. Undoubtedly, some ingredients which might not have desired physical quality for use in a conventional grain mixture would be satisfactory when included in a complete feed. Therefore, there is wide flexibility.

Roughages are of special concern. The minimum roughage level should be about 25-35% of the ration, depending upon fiber content.

Crude fiber levels of at least 15-18% are needed. Fiber alone is not sufficient. It must be in a coarse form. Hays should not be chopped less than  $\frac{3}{8}$ " and preferably should be longer. Other roughages which can be used are corn cobs, cottonseed hulls, straw, alfalfa silage and corn silage. The forage should not be ground or pelleted.

Total roughage should not

amount to more than 70% of the total and even less for average or lower quality roughage fed to above average cows. Otherwise intake may limit production.

The estimated net energy (ENE) level should be about 58-68 Therms/100 lb. A protein level of 11.5 to 13.0% is needed. The higher level should be used for high roughage rations or high producing herds (Table 1).

Supplemental calcium and phosphorous is most practicably provided by dicalcium phosphate or bone meal. Levels, ideally, are about 0.4-1.0% of each. The ration should also include 0.5% trace-mineralized salt, 2,400 I.U. of vitamin A (6 mg. carotene) and 3,000 I.U. of vitamin D per pound.

Urea may be included with corn silage rations at 0.6% for high-producing herds or 0.8% for average herds.

## Milk Production

Milk production and feed intake of cows fed complete-feeds has generally been comparable with that of cows fed the roughage and grain rations separately. If cows fed high grain rations do not voluntarily consume enough roughage their milk yields may be improved by complete-feed preparations (Table 2).

Non-pelleted rations of chopped alfalfa hay appear preferable to pelleted or finely ground alfalfa.

Alfalfa hay has also produced somewhat superior performance compared to corn cobs as a roughage. Corn cobs lower digestibility, but seem to be satisfactory in terms of maintaining milk fat test.

Alfalfa is especially practical as a roughage component in this area. Not only because of its availability, but for its nutrient content. Addition of a grain and salt will practically fill the needs for required nutrients. About 50% grain appears ideal from the nutritional standpoint, but there is considerable flexibility.

From 30% to 70% grain with alfalfa has proven satisfactory, but with the lower level additional protein may be needed. At 70% or

Table 1.—Suggested composition of complete feeds for lactating cows.

ENE	58-68 Therm
Crude protein	11.5-13.0%
Crude fiber	15-20%
Calcium	0.4-1.0%
Phosphorus	0.4-1.0%
Trace-mineralized salt	0.5%
Urea	0.6-.8%
Vitamin D	3,000 I.U./lb.
Vitamin A	2,400 I.U./lb.
Hay-equivalent	30%

Table 2.—Performance with complete hay-grain rations.<sup>1</sup>

	FCM	Fat %	Gross TDN/lb. FCM
Free choice hay plus 1 lb. grain/2.5 lb. FCM	37.7	3.80	.64
Free choice Hay & grain	36.6	3.22	.89
Complete feed 30% hay & 70% grain	40.5	3.65	.64

<sup>1</sup> (Southern Illinois).

higher levels of grain, milk yield may be reduced as well as milk fat content.

We have combined alfalfa silage with cracked corn at ensiling time and have also combined ground ear corn and alfalfa silage just before feeding. Both practices appear to provide excellent rations for maintaining milk yield. They also were relished by the cows without excessive weight gain.

However, with high grain feeds over-conditioning may be a problem in late lactation or with cows of low milk potential. Combining the grain ration with corn silage into a complete feed has resulted in milk yields equal to those by cows fed all or part of the grain in the parlor during milking (Table 3).

Although most trials with complete feeds have involved full-feeding, under some conditions limited feeding may be advisable. When only one ration is used, it should have ample high energy for the high-producer, but may tend to fatten cows in late lactation. In such cases restriction of amounts given to individual cows or lots may resolve the problem. When roughage is the most economical, the lower producers could be grouped separately from high-producers and fed a complete feed with higher roughage content.

#### Problems

##### 1. Maintaining milk fat test. Pel-

leted complete feeds offer a means of reducing volume and preventing separation. However, in many cases this has resulted in low fat tests. Fine grinding of roughage itself usually reduces fat test. A  $\frac{3}{8}$  inch screen or even larger is preferred to minimize this problem. In most cases a level of 30% or more of roughage should be included.

2. Health. Many of the problems associated with high grain feeding may also be seen when feeding certain complete feeds. If roughages are too finely ground, diarrhea, poor appetite, or bloat may result. With very high-energy rations stiff joints, rumen paraketosis and liver abscesses have occurred. Pelleted roughage has been especially detrimental to rumen epithelium.

#### Conclusion

Blending of the concentrate and roughage portions of the dairy cow's ration offers several advantages under certain management situations. It provides a method of controlling the ratio of roughage to concentrate, permitting a more adequately balanced ration. The complete ration is readily adapted to automated feeding, simplifying the feeding operation and reducing the labor requirements.

Studies indicate that properly formulated complete feeds can efficiently support high levels of milk yield.

Table 3.—Corn silage complete feed.<sup>1</sup>

	FCM	Fat %	DM intake	
			Silage	Grain
Complete-feed (corn silage & grain)	33.7	3.92	23	10.8
Corn silage (grain fed in parlor)	33.0	4.11	23	9.9

<sup>1</sup> (Illinois).



Bunker silo.

## Which Silo For Me?

P. H. Cole  
Extension Dairyman

F. G. Owen  
Professor, Animal Nutrition

One of the first silos constructed in the United States was built in Maryland in 1876. Interestingly enough, the principles covering silage have not changed much since this early date. Silo structures today still have the primary function of excluding air and water. Beyond this, any other function served by the structure is related to non-storage items such as mechanization or automation.

Today's dairyman needs to calculate rather carefully the initial investment cost and expected annual costs for different sizes and types of silos before he buys if he is going to keep costs low and stay competitive.

In addition to size and type, the dairyman also needs to ask himself this question: "How long will the silo last? And how long will I need it? How long before it will become obsolete? And finally, what other alternatives do I have? Is a silo the best investment I can make?"

#### Types of Silos

A number of factors determine the size and shape that a silo may take. These factors include: the kind and amount of material to be stored, the degree of air tightness expected, and how the silo is to be

(continued on next page)



## Which Silo?

(continued from page 7)

loaded and unloaded. Silos may be classified as follows:

1. Conventional upright silos.
  - a. Concrete stave
  - b. Galvanized steel
  - c. Monolithic concrete
  - d. Tile
2. Gas-tight silos
3. Horizontal silos
  - a. Trench—below ground
  - b. Bunker—above ground
4. Temporary silos
  - a. Vacuum packed
  - b. Stack or pile on ground

### Selecting a Silo

In addition to initial investment costs and annual cost of operation, there are a number of other equally important factors that need to be considered in selecting the proper silo for a particular dairy operation.

**1. Storage losses and their control.** The dry matter and nutrient losses which occur in silage during storage are caused by: (1) the physiological and microbiological activities which transform a green crop into silage in the absence of air, (2) surface spoilage due to heating, molding, and rotting in the presence of air, and (3) seepage caused by the weight of the crop pressing out excess moisture which contains soluble forage nutrients.

**Fermentation losses (invisible).** Experiments indicate that fermentation losses range between 4 and 12 percent. The highest losses occur in high moisture silage. However, too low a moisture content along with poor distribution and packing may also increase loss through heating and molding.

We get our greatest fermentation loss in silage stored in stacks and piles. Fermentation losses in trench and bunker silos are usually

higher than in gas-tight and conventional upright silos. Poor packing and large surface exposure are the most common causes of excessive fermentation losses.

**Top spoilage (visible loss).** U.S. D.A. studies have shown top spoilage losses to range from none in gas-tight silos to 3 to 4 percent in conventional upright silos and from 6 to 10 percent in trench silos and as high as 20 percent in stack silos (Table 1).

**Seepage loss.** Seepage losses will vary with the moisture content, depth of silage, distribution of the silage, and the amount of nutrients in the seepage. Seepage losses as high as 14 percent of the dry matter stored have been reported. Seepage loss can be reduced by wilting forages to 65 to 70 percent moisture or by adding preservatives to absorb the excess moisture (Fig. 1).

Silos may be ranked fairly easily as to storage losses that can be expected. Ranked in order of minimum storage loss they would be: first, the gas-tight silo (4%); next, the conventional upright silo (10%); then the trench or bunker silo (12-15%); and least effective, the stack (30-35%).

It is important to remember that proper management is just as important as the type of silo in reducing storage losses. Even a relatively simply constructed, low cost silo will do a good job of silage preservation if it is properly managed (Fig. 2).

### Covers: The Key to Good Silage

**2. Storage Capacity and Usage.** The size and number of silos that will be needed on a particular farm are normally determined by the number of animals to be fed

Table 1.—Estimate of minimum dry matter losses in forage stored as silage at different moisture levels.<sup>1</sup>

Kind of silo, and moisture content of forage as stored	Dry matter losses					
	Surface spoilage <sup>2</sup>	Fermentation <sup>3</sup>	Seepage	Total silo losses	Field losses	From cutting of crop to feeding
	Percent	Percent	Percent	Percent	Percent	Percent
<b>Conventional tower silos:</b>						
85 percent	3	10	10	23	2	25
80 percent	3	9	7	19	2	21
75 percent	3	8	3	14	2	16
70 percent	4	7	1	12	2	14
65 percent	4	8	0	12	4	16
60 percent	4	9	0	13	6	19
<b>Gas-tight tower silos:</b>						
70 percent	0	7	1	8	2	10
65 percent	0	6	0	6	4	10
60 percent	0	5	0	5	6	11
50 percent	0	4	0	4	10	14
40 percent	0	4	0	4	13	17
<b>Trench silos:</b>						
85 percent	6	11	10	27	2	29
80 percent	6	10	7	23	2	25
75 percent	8	9	3	20	2	22
70 percent	10	10	1	21	2	23
<b>Stack silos:</b>						
85 percent	12	12	10	34	2	36
80 percent	12	11	7	30	2	32
75 percent	16	11	3	30	2	32
70 percent	20	12	1	33	2	35

<sup>1</sup> Conservative estimates for careful filling methods and good drainage based on 6 months of storage. Plastic caps or other good covers will reduce top spoilage. Poor compacting and sealing of the silage and excessive rainfall or melting snow on uncovered trenches and stacks will increase losses.

<sup>2</sup> Includes side and end spoilage in trenches and stacks.

<sup>3</sup> Allowance made for some heating and flake mold at the lower moisture levels.

Table 2.—Minimum silage removal per day to prevent spoilage.<sup>1</sup>

Crop	Weather	
	Cold	Warm
Whole corn silage	2"	4"-6"
Alfalfa-brome	2"	3"-4"
Chopped ear corn	2"	2"
Cracked shelled corn	4"	4"

<sup>1</sup> Example: If you fed corn silage year around and removed it at the rate of 4" a day, it would take 120' of storage space, or two 60' silos.

$$4" \times 360 = \frac{1440}{12} \text{ or } 120'$$

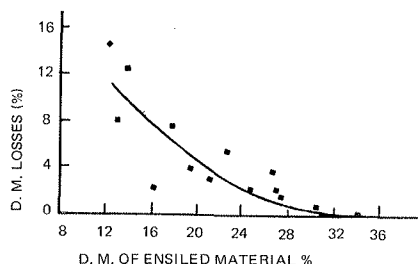


Fig. 1. Dry matter content of ensiled material has more influence on losses by seepage than all other factors combined. University of Georgia.

and the length of the silage feeding period.

On the other hand, on a farm that already has silage storage facilities the capacity of the present structure will determine how large a herd can be fed for how long a period.

In some instances, the size of herd rules out the practicality of any silage storage being economical. For example, Michigan studies have shown that 500 tons is about the break-even point. The annual cost per ton of storage just about doubles as we drop from 600 tons stored to 400 tons of storage.

The reason for the importance of the feeding period and size of herd is that in open silos, either upright or horizontal, there must be a minimum of silage removed per day to prevent spoilage. The amount that needs to be removed per day varies with the crop and season. Table 2 gives these minimums for an upright silo.

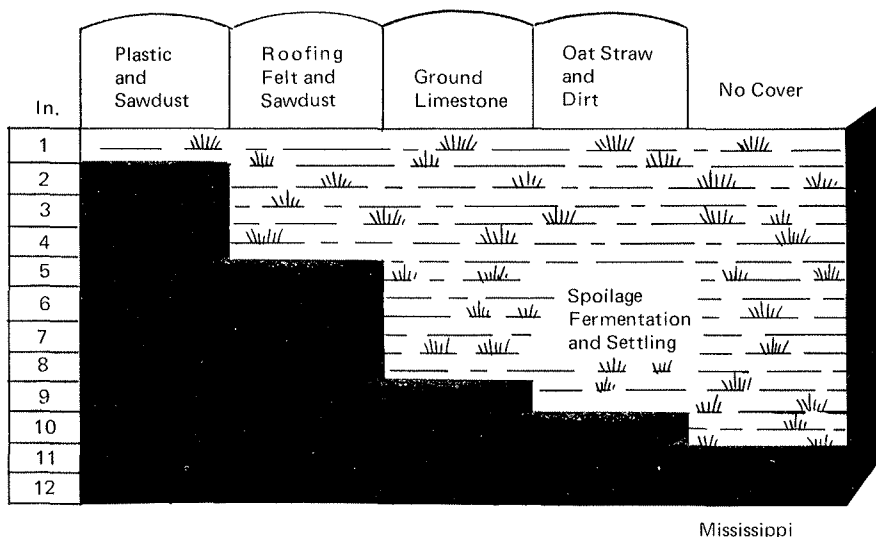


Fig. 2. Summary of findings on silage losses under different covers.

Table 3.—Dimensions and capacities for bunker silos.

Silage depth	Silo bottom width	Silo sectional width	Cross sectional area	Weight of silage <sup>1</sup>	
				4" slice	12" slice
ft.	ft.	ft.-in.	sq. ft.	lbs.	lbs.
6	17	18-6	106.5	1,420	4,260
	21	22-6	130.5	1,740	5,220
	27	28-6	166.5	2,220	6,660
	32	33-6	196.5	2,620	7,860
	36	37-6	220.5	2,940	8,820
8	17	19	144	1,920	5,760
	21	23	176	2,350	7,040
	27	29	224	2,990	8,960
	32	34	264	3,520	10,560
	36	38	296	3,950	11,840
10	16	19	175	2,330	7,000
	20	23	215	2,870	8,600
	27	30	285	3,800	11,400
	32	35	335	4,470	13,400
	36	39	375	5,000	15,000

<sup>1</sup> Silage weight assumed to be 40 pounds per cubic foot.

In calculating the length of trench or bunker silo that is needed, we usually use a removal rate of 6" per day. A minimum of 6" is recommended because most silage unloading equipment works best at this rate (Table 3).

**3. Investment and Cost of Operation.** In attempting to decide which silo is best for his particular operation, the dairyman should take into account both the initial investment cost and the annual cost of operation.

The dairyman needs to ask himself these questions: "How much capital is available? Is this the best way to invest this capital? What interest rate will I have to pay?

What will the total investment be? What will the investment per ton of storage be? What is the rate of depreciation?"

Shown in Table 4 are silage capacity and investments for different sizes of silos and unloaders for storing and unloading different kinds of silage.

If we look at investment per ton of storage (Fig. 3), we note that in general, sealed or gas-tight storage costs about twice as much per ton as silage stored in a concrete tower silo when up to 1,000 tons of silage is stored. Storage costs per ton in a bunker silo are about one-half that of a concrete tower silo when up to 1,000 tons are stored and about one-third of that in a concrete tower silo when 2,000 tons or more are stored.

Two other factors have an important bearing on annual cost of operation. They are: (1) the rate of depreciation used in cost estimates, and (2) the number of times a silo is filled. Figures 4, 5 & 6 give some interesting comparisons when different rates of depreciation and different number of fillings are considered.

On the basis of one complete filling, a 20 year depreciation period and 500 to 1,000 tons of storage capacity (Fig. 4), annual cost per 10 tons of silage were \$10 to \$18

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## Which Silo?

(continued from page 9)

lower for concrete tower silos than for sealed storage silos. The bunker silo does not become competitive with concrete silos until at least 1,000 tons are stored. Sealed storage silos become competitive with concrete tower silos when they are filled two complete times compared with 1½ fillings for the concrete tower silos (Fig. 6).

When the dairyman compares complete silo systems, it is desirable to consider feeding as well as storage costs. For example, annual costs of silage handling equipment add from \$0.32 to \$1.20 per ton. When both storage and feeding costs are included (Fig. 7), the con-

Table 4.—Silo investments including roof and unloader.

Concrete tower	Ton	Per ton	Total
20 x 50	394	\$13.45	\$ 6,800
20 x 60	483	13.04	7,800
24 x 60	697	11.86	10,300
30 x 60	1,087	12.42	15,700
<i>Sealed Storage</i>			
20 x 50	375	30.00	\$13,700
20 x 60	470	27.76	15,500
Others		\$20-\$26	
<i>Bunker</i>			
	1,000	\$5-\$8	\$ 5,000+
	2,000	4- 7	8,000+
	4,000	3- 6	12,000+

crete tower silo system is the lowest in cost for quantities less than 1,000 tons and about equal to the bunker silo when 1,000 tons are stored.

The bunker silo becomes the lowest cost system when 2,000 or more tons of silage are stored annually. These costs are based on one filling.

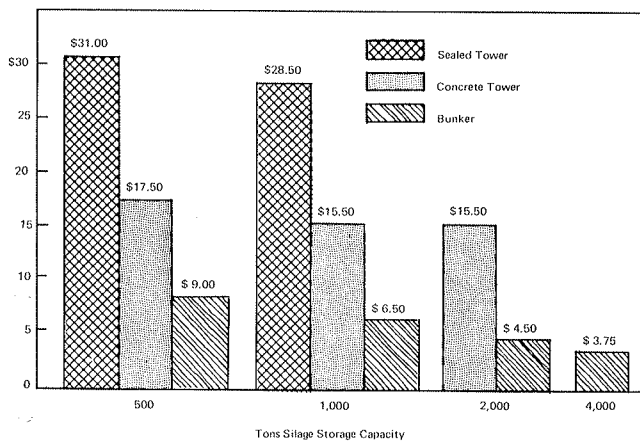


Fig. 3. Comparative investments per ton of storage capacity for sealed and concrete tower and bunker silos. (Includes silos, unloaders for tower silos, scoop for bunker silos of 500-2,000 tons and ensilage loader for 4,000 ton bunker silo). Michigan.

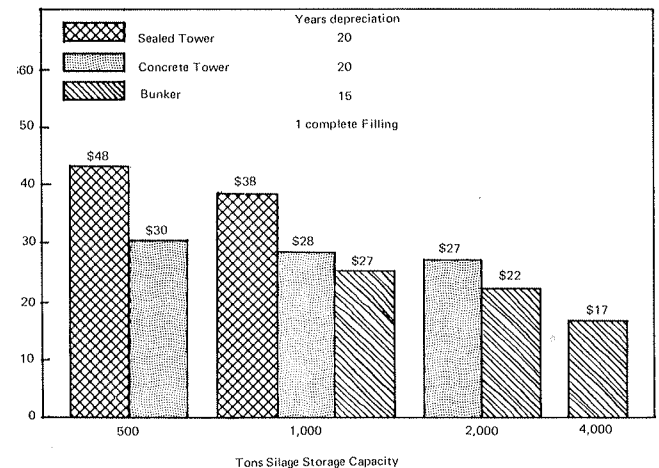


Fig. 4. Annual costs to store 10 tons silage, four tonnages and three types of silages, medium length of depreciation and one filling. Michigan.

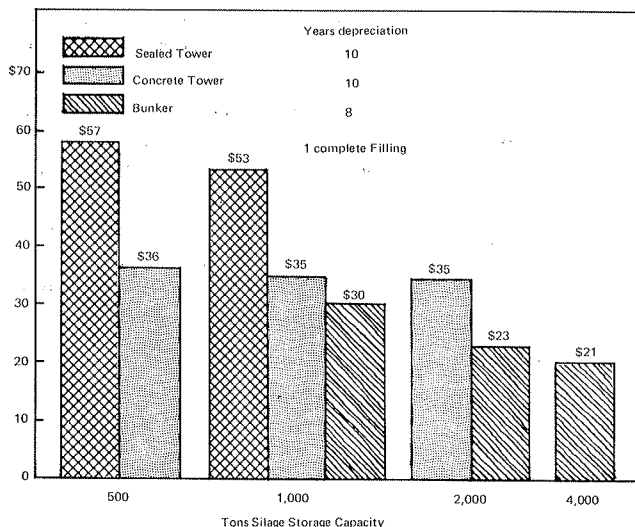


Fig. 5. Annual costs to store 10 tons silage, four tonnages and three types of silos, short depreciation and one filling. Michigan.

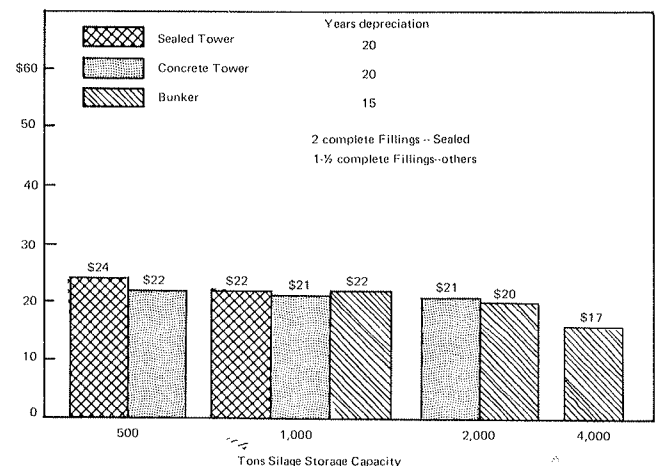


Fig. 6. Annual costs to store 10 tons silage, variable number of fillings, four tonnages, Michigan.

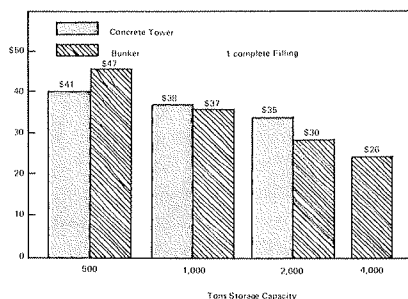


Fig. 7. Annual costs to store and feed 10 tons silage includes silos, unloaders, feed bunks, augers and wagons. Michigan.

### Summary

The question "which silage storage system is best for me?" is not easy to answer. The decision has to be based on the particular needs of an individual farm. Factors such as: kind of crops stored, number of times silos can be refilled, storage losses, size of operation and comparative investments and annual costs all must be taken into consideration.

The following general recommendations can be made:

#### Type of silo to use

##### Bunker or trench

1. Need 2,000-4,000 ton capacity
2. Lower initial investment needed
3. Can only fill once
4. Shorter depreciation period needed

##### Concrete upright

1. Need 1,500 tons or less
2. Limited investment
3. One or more fillings per year

##### Gas-tight silo

1. Need 1,500 tons or less
2. 1½ to 2 fillings per year
3. Can depreciate over 20 years
4. Other capital needs already met

##### No silo

1. Low volume—less than 500 tons
2. Capital can be put to better use elsewhere, i.e., more cows, land
3. Need more flexible program—silage not fed every year

# Milk Quality Is Farmer's Job

R. D. Appleman  
Associate Professor  
Breeding and Management

The dairy farmer has full responsibility for mastitis control and milk quality up to the time the driver pumps the milk into the tank truck. The farmer has help to achieve the quality goals he has established or has had imposed on him by the purchaser of his milk or by existing health regulations.

Several tests have been developed to help the farmer determine if he has a problem, and if so, how severe. The leucocyte level of milk is the primary method used. The main tests used to designate leucocyte levels are (a) direct microscopic count, (b) catalase test, (c) modified Whiteside test, (d) California mastitis test and (e) Wisconsin mastitis test.

### Mastitis Test

The California mastitis test (CMT) is the universally used test on individual cows, and is the standard used in comparisons reported here. The research accuracy of the Nebraska studies were improved by using a syringe set to deliver exactly 2 ml. of both the milk and reagent used.

Enough data have been collected from this long-term study to complete a preliminary analysis of three of the objectives being in-

vestigated. These objectives were to determine how milk leucocyte level is influenced by:

1. Age of cow
2. Stage of lactation
3. Post milking teat-dip

Both Holstein and Brown Swiss cows were included in this portion of the study. The CMT results were recorded at weekly intervals, except for that portion of the report dealing with "stage of lactation" when only monthly data were available. One of five possible ratings were assigned to each sample (Table 1).

### Age of Cow

The average CMT rating obtained during the first 3 months of lactation was used to determine the influence of age of cow (lactation number). Results indicate that the older the cow, the higher the leucocyte content of her milk (Table 2). Milk from cows in their fifth or later lactation had an average CMT score nearly double that observed in milk from first lactation cows. This suggests that the milk leucocyte level expected from mature cows is 3 times that expected from the younger (2 and 3-year old) cows.

These results confirm earlier studies. California researchers found, from a study involving 4,574 cows,

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Table 1.—Classification of CMT scores.

Rating	Suggested meaning	Probable leucocyte level	Probable mean level
1	Negative	0-200,000	100,000
2	Trace	150,000-500,000	300,000
3	Weak positive	400,000-1,500,000	900,000
4	Distinct positive	800,000-5,000,000	2,700,000
5	Strong positive	Generally over 5,000,000	Over 5,000,000

Table 2.—Influence of age of cow on CMT scores.

Lactation number	No. cows	Av. CMT	% Cows scoring CMT-4 or 5
1	15	1.67	0
2	15	1.93	13
3	13	3.19	54
4	6	2.83	17
5 or more	7	3.14	43



## Milk Quality

(continued from page 11)

that the effect of age on CMT score was curvilinear in nature, peaking in the sixth lactation. The magnitude of the influence between the first and fifth or later lactations was about the same as reported here. A similar study in Colorado resulted in substantially the same conclusions.

The reason for this is not known. Older cows obviously have been exposed more often to infection, and their teats and udders also have been injured more frequently, so perhaps their natural defenses are less effective.

### Stage of Lactation

Many dairymen have observed the tendency for cows late in lactation to score positive to the CMT. Only limited data are available at this time from the University of Nebraska herd. Preliminary results, not adjusted for age of cow differences, suggest that a rather distinct increase in average CMT score can be expected as lactation progresses (Table 3).

This problem may be encouraged by over-milking, as it usually requires longer to prepare a cow in late lactation for milking and a shorter time to milk her. This increases the opportunity for tissue damage. In larger herds, by putting more cows into strings according to production level, the milker can give special attention to late lactation cows at milking time, and probably reduce the apparent increase in milk leucocyte level.

Studies underway have shown that some cows will temporarily show a positive reaction if tested within the first three weeks after calving. This is presumed to be the result of the stress of udder congestion before and during parturition.

Table 3.—Influence of stage of lactation on CMT score.

Month of lactation	1-3	4-6	7-9
Number of cows	113	67	22
Av. CMT score	2.63	3.01	3.61

Table 4.—Influence of post-milking teat dip.

	Preliminary period I	Treatment period II	Post-treatment period III
Treatment group (46 cows)			
Av. CMT-Score	2.54	2.90	2.87
% change, period I & II		+14	
% change, period I & III			+13
Control group (34 cows)			
Av. CMT-Score	2.82	3.40	3.29
% change, period I & II		+21	
% change, period I & III			+17

### Post-milking Teat Dip

Dipping the teats in a disinfectant solution immediately after milking is recommended by a number of authorities. It: (1) removes the film of milk which provides nutrients for bacterial multiplication, and (2) kills any organisms which may be deposited on the teat skin during the milking process. It is postulated that the teat sphincter is relaxed and the streak canal more vulnerable to invasion of organisms.

A preliminary short-term study was completed recently at the University of Nebraska. Eighty cows were included in the study, with 46 receiving the post-milking teat dip<sup>1</sup>; the remainder serving as controls. Weekly CMT scores were obtained on each group during the: (a) 4-week preliminary period before teat dipping, (b) 6-week experimental period, and (c) 4-week post-experimental period after teat dipping ended.

The results, shown in Table 4, confirm the influence of stage of lactation discussed earlier. Results also suggest that post-milking teat dip is a practice to be recommended. The average CMT reading for the treated and control groups increased 14 and 21%, respectively, when the experimental period was compared to the preliminary period. Similarly, the percent increase during the post-treatment period was greater in the control group than in the treated group. This

suggests that there may be some carry-over effects from teat-dipping.

A comparison of monthly CMT results in the Washington State University herd before and after use of the same organic iodine teat-dip was initiated was recently reported. Results are possibly confounded by simultaneous changes in milking procedure, treatment programs and culling practices. Nevertheless, the percentage of CMT-positive quarters was reduced nearly 50 percent during a two-year period.

Similarly, USDA research has shown that teat-dipping after milking is completed greatly reduces the microbial population on the teat ends. Missouri researchers, on the other hand, have concluded that disinfecting quarters after milking improved the udder health markedly after two months of treatment. This suggests that a marked effect may be immediate and that positive results may be long-term in nature. Another study, involving long-term exposure to the teat-dip, is underway at the University of Nebraska.

Milkers generally have accepted this procedure much more readily than the dipping of teat cup between cows and there is no (or little) slowing of the milking time.

### Economic Importance

Is there a probable economic advantage for a dairyman producing CMT-positive (4 or 5) bulk milk to make the changes necessary to consistently produce CMT-trace or

<sup>1</sup> The organic iodine detergent-germicide (Bovadine) used in this study was graciously supplied by Lazarus Laboratories, Inc., 42-16 West St., Long Island City, N.Y.

weak positive (2 or 3) milk? According to a California study, a dairyman with 50 milking cows could expect to realize an increased yearly income of \$937 and \$2,654 by lowering his CMT-4 or 5 milk, respectively, to the CMT-3 (Weak positive) level.

This benefit is obtained solely from improved production per cow.

A national abnormal milk program of industry origin was recently started in Nebraska. Effective July 1, 1970, dairymen producing milk for interstate shipment that exceeds 1.5 million leucocytes must take immediate steps to improve their situation or be subject to having their milk withheld from the milk supply.

Corresponding studies on the economic influence of producing CMT-positive milk on annual income is not yet completed at the University of Nebraska.

#### Recommended Action

If a herd has an unusually high bulk milk leucocyte level, it is recommended that the dairyman follow through on one or more of the following courses of action:

1. Start a monthly testing program to determine which cows are producing high leucocyte milk.

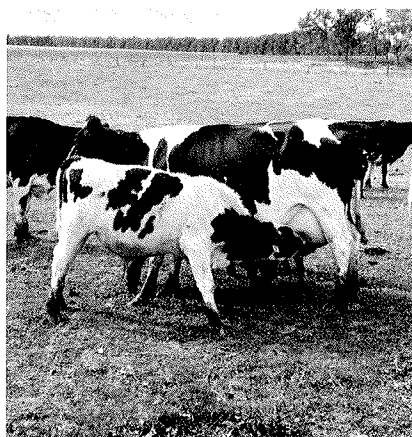
2. Remove from the herd those older cows with below average production potential that are contributing heavily to the high milk leucocyte level.

3. Dry off those cows in the latter stages of lactation that are contributing heavily to the high milk leucocyte level.

(Note: Recommendations 2 and 3 will result only in temporary improvement. If the cause of the problem isn't corrected, other cows will soon take their place.)

4. Have your milking equipment dealer check your equipment and correct any shortcomings.

5. Check on your milking performance, particularly sanitation practices and overmilking. Eliminate overmilking by hanging up the teat-cups when milking is completed and improve your sanitation program by using a post-milking teat dip.



Holstein calves managed as beef cattle.

## Holstein Cows: Beef Producers

Mogens Plum

Professor, Animal Breeding

Lionel Harris

Superintendent, Scotts Bluff Station

Characteristics most often listed as desirable for beef cattle are that they produce calves of good size and with good growth potential, that the cows are good milk producers and that they produce palatable meat, appealing to the consumer.

Since Holstein cattle have good size calves with good growth potential and since "carcasses of properly fed young animals of dairy breeding are surprisingly palatable"<sup>1</sup> the thought occurred that Holstein cattle might be used for beef production if handled as beef cattle.

Many questions need to be answered before large scale operation of Holstein cattle for beef could be undertaken. There was doubt about the amount of milk calves could safely consume, and what would happen to the udders of high producing cows if they were not milked out properly.

#### Experiment Started

A small experiment was started in 1963 at the University of Ne-

<sup>1</sup> Rice, Andrews, Warwick and Legates: Breeding and Improvement of Farm Animals, 6th ed. p. 354.

braska Scotts Bluff Experiment Station to study the potential of Holstein cows as beef cattle. Over a period of five years, 51 calves have nursed their 31 dams. Three sets of twins were born and one calf was crippled and was not weighed. Two calves died shortly after birth of causes that apparently had no connection with the experiment. During four of the years data were collected of the milk consumption of the calves while they were nursing their dams.

This report covers the data on milk consumption of the calves and the relation of milk consumption to their growth. The relationship between the birth weight of the calves and their growth and weaning weight was also studied.

#### Birth Weight, Milk Consumption

Data on milk consumption and gain were available for four of the five years. During this time there were 37 calves raised by 27 different cows. Twenty-five of these cows had previously been in the milking herd at the station and had first lactation records that averaged 13,900 pounds of milk (305 days M.E.). This means that the cows must have averaged well over 45 pounds of milk per day when they calved.

Once a month the calves were separated from their dams. After the cows and calves were separated the cows were milked out and after 12 hours the calves were allowed to nurse the cows. The amount of milk consumed was measured by weighing the calf before it started and after it had finished nursing. The daily consumption of the calves was then estimated by doubling the figure obtained for milk consumption after the 12 hours separation.

When the calves were first born they were not able to consume all the milk produced by the cows, but their consumption of milk averaged 19.7 pounds of milk per day for the first 23 days of their life. The average daily consumption of milk increased as the calves grew and reached an average of

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## Holstein Beef

(continued from page 13)

more than 27 pounds per day when the calves were five months old.

The gain during the first month was 1.6 pounds per day and when the calves reached an age of five months the average daily gain had reached 2.45 pounds. For the first 150 days the calves had an average daily gain of 2.22 pounds. During the first month there was no relation between the consumption of milk and the growth of the calves but from three months on there was a significant correlation between the amount of milk consumed and the gain in weight of the calves. The correlation between the amount of milk consumed during the first 150 days and the gain made by the calves during this period was .55.

### Birth Weight Influences Gain

In growth studies with calves it generally has been found that calves that are large at birth make more rapid gains than smaller calves. This makes large birth weight of calves a desirable character for beef cattle as far as growthiness of calves is concerned. On the other hand, calving difficulties are often encountered when excessively large calves are born. For this reason beef cattle breeders do not emphasize selection for large birth weight.

That larger calves gain more rapidly was also shown by results of the study of Holstein beef cows at the Scottsbluff Experiment Station. After the first month of growth there was a significant correlation between the birth weight of the calves and their rate of growth. The correlation between the birth weight of the calf and the change in weight from birth to 152 days of age was .57.

The regression of growth during the first 152 days on birth weight was  $.0178 \pm .006$ . This means that for each additional pound of birth weight the calves gained an extra 0.0178 pound per day. This adds up to an extra 2.7 pounds gain at five months of age for each extra pound of birth weight. Add-

ing to this the one pound advantage in actual birth weight gives a five months weight advantage of a 90 pound Holstein calf over a 60 pound calf of 111 pounds.

### Dams Previous Production Level

The average mature equivalent 305-day production of the first lactation of the cows in this project was 13,900 pounds of milk, varying from a high of 19,500 pounds to a low of 9,400 pounds. The lowest production of any of these cows during their first lactation was 21 pounds of milk per day.

All cows, therefore, produced more than the calves could consume when they were first born. It is, therefore, not surprising that the average consumption of the milk from birth to 152 days of age or the gain from birth to 152 days of age had no relation to the production of the cows during their first lactation.

Figure 1 is a graphic presentation of the average milk consumption and gain in weight from birth to 152 days of age. Since there is a significant relationship between the gain and birth weight the figures in the graph are adjusted for differences in birth weight of the calves.

Bull calves and heifer calves showed no significant difference in milk consumption and rate of gain until they reached approximately three months. The 37 calves were

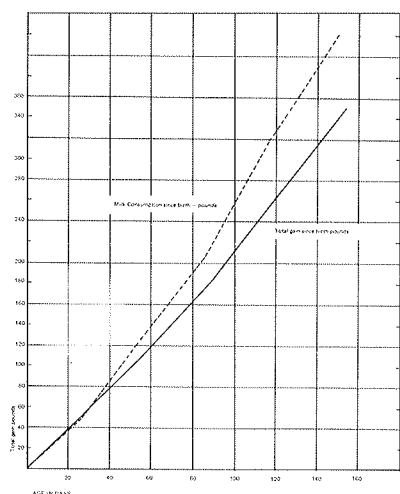


Fig. 1. Milk consumption and gain from birth to 153 days of age of 37 Holstein calves managed as beef cattle.

sired by seven different sires and no differences were found between the offspring of the sires as far as milk consumption or gain of calves was concerned. Likewise, there was no significant difference from one year to another.

### Adjusted 205-Day Weaning Weights

During the five years of the experiment there have been 42 single, live calves born, 17 male and 25 female. The average birth weight has been 102.4 pounds for the males and 93.4 pounds for the heifer calves. Since there was a significant regression of growth on birthweight, the 205-day weaning weights were analyzed with birth weight of the calf as a covariate and were adjusted for regression of weaning weight on birth weight.

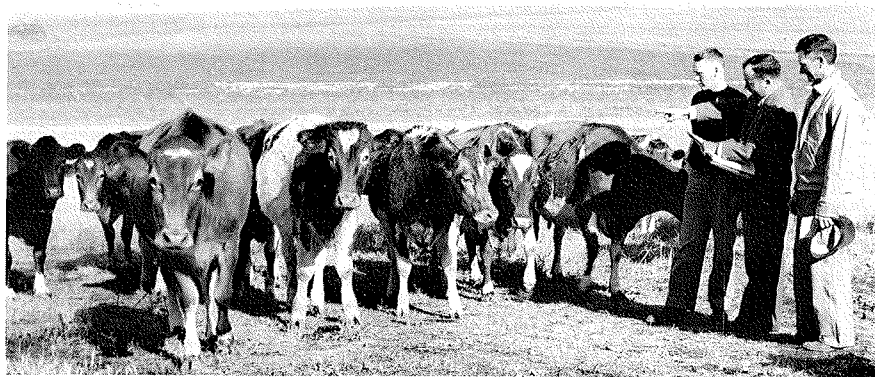
The adjusted 205-day weaning weight was 586 pounds and the adjusted average gain from birth to weaning at an age of 205 days was 2.38 pounds. The regression of weaning weight on birth weight was 3.14 pounds.

This means that for each pound a calf was heavier at birth the 205-day weaning weight increased by 3.14 pounds. Therefore, a 30 pound difference in birth weight would result in a 94 pound difference in 205-day weaning weight. This again points out the advantage of large calves, provided, and this must not be forgotten, that the larger calf does not cause complications at calving time.

### Holsteins Are Rapid Gainers

So far the experiment has pointed out that Holstein cattle managed as beef cattle produce growthy calves that have had a 205-day weaning weight of close to 600 pounds. There have been some indications of mastitis, but so far all cases have cleared up without any treatment and there has been no serious trouble with the udders of the high producing Holstein cows used for the experiment.

Further experimentation to investigate the possibility of raising more than one calf on a cow is in progress.



Records improve management.

## Dairy Herd Improvement

C. W. Nibler

Extension Dairyman

Douglas First

The State and National Dairy Herd Improvement Program is a very effective cooperative project between the United States Department of Agriculture, the Land Grant Universities, the State and National breed associations and the dairymen or dairy farmers.

The first dairy herd improvement association in the United States was organized in Newaygo County, Michigan in 1905. This association had an enrollment of 31 herds and 239 cows. The average cows per herd were 7.7 and the average production of all cows in the association was 5,300 pounds of milk and 215 pounds of butterfat.

In 1967 there were 1,344 dairy herd improvement associations in fifty states and Puerto Rico that employed 2,319 supervisors. Enrolled in the associations were 37,683 herds and 2,098,919 cows. The average number of cows per farm was 55.7 and the average production was 12,307 pounds of milk and 468 pounds of butterfat.

The first Nebraska Dairy Herd Improvement Association was organized in Douglas County in 1910. Enrolled in this association were 21 herds and 425 cows, or an average of 20.2 cows per herd. The supervisor employed by the association was W. C. Andreas. Average production per cow for the first association was 7,095 pounds of milk and 257 pounds of butterfat.

Since 1910 the number of associations and the number of cows on test has gradually increased. Table 1 shows, for 1967, a summary of herds and cows enrolled in Standard, Owner-Sampler and Weigh-A-Day-A-Month record keeping programs.

There has been a slight increase in the number of cows on test in 1968 and monthly production records are maintained presently on 20,000 to 21,000 dairy cows.

Since the first Nebraska Dairy Herd Improvement Association was organized in 1910, good progress has been made in increasing the number of cows on test and increasing milk and butterfat production per cow.

Table 1.—Herds, cows, cows per herd and average production of cows in different production record keeping systems for Nebraska in 1967.

Method	Herds	Cow years	Cows per herd	Milk lbs.	Test butterfat	
					%	lbs.
Standard DHIA	347	15,707	45.3	11,988	3.7	448
Owner-Sampler	71	2,521	35.6	11,717	3.6	420
W-A-D-A-M	24	748	31.0	9,838	3.5	348
Total	442	18,976				

### Only 9 Percent

Although progress has been made, still only nine percent of the cows milked in Nebraska are enrolled in a production testing program. There is a real opportunity to enroll more Nebraska herds and cows in a production record keeping program.

Originally, all DHIA records were manually processed but today the Standard and Owner-Sampler records are electronically computed at central record processing centers.

Records for Nebraska dairymen are processed at the processing center at Iowa State University, Ames, Iowa. At this center, records from about 6,300 herds and 245,000 cows located in nine different states are computed monthly.

Dairy herd improvement association records upon individual cows can be used for the following purposes.

1. To help select and eliminate low producing unprofitable cows from herds.
2. To help with decisions that pertain to feeding and management of the cows.
3. To help establish prices of animals to be purchased or sold.
4. To help keep important dates such as: birthdates, freshening, dry, bred, bought and sold dates.
5. To help make decisions as to which cattle to keep for breeding and herd replacement purposes.
6. To evaluate the milk and butterfat production of daughters of sires for use in the owner's herd or for artificial breeding studs.

### Cash Returns

Milk and butterfat production of cows and herds vary and the cash return from dairy cows is closely related to their production. Table 2 shows groups of cows that produced different amounts of milk and butterfat. The value of their milk or product and the returns above feed cost is shown for each group. These are Nebraska cows of all breeds for the period May 1, 1967 to April 30, 1968.

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## Herd Improvement

(continued from page 15)

One cow, that produced 14,945 pounds of milk and 571 pounds of butterfat, ate \$102 more feed and returned \$293 more income above feed cost than a cow that produced 6827 pounds of milk and 255 pounds of butterfat. In addition, the high producing cow's feed cost per 100 pounds of milk produced was \$.67 less than for the low producing cow.

The dollar value of animals with DHIA records compared to animals without records varies with breeds, within the breeds and from farm to farm. There is a variation between registered and unregistered animals. The number of records on a cow may influence her value because two or more records are more reliable than one record in evaluating the producing ability of a cow.

### Records Pay

The average of all sales of dairy animals over a period of years shows that cows with milk and butterfat production records sell for more than cows without records. The same is true for male and female offspring from cows with or without records.

The value of a dairy herd can increase substantially over a period of years as a result of a DHIA program. Considering other economic conditions equal, dairy herds increase in value as production increases. Another fringe benefit is that the genetic base can be improved, which means the value of heifers gradually is increased.

The Agricultural Research Service of the USDA assemble 305-day mature equivalent milk and butterfat records from all states through the computing centers. These records are used for evaluating cows and bulls and are published regularly for use by the dairy industry.

In 1967, 1,851,274 Standard DHIA lactation records were reported to the USDA for use in statistical summaries, genetic appraisals and research.

The proportion of cows on test having records reported was 88 percent. From Nebraska, 18,529 lactation records were reported to the USDA in 1967. Presently, 100 percent of Nebraska's DHIA records are being reported to the USDA.

DHIA sire summaries were computed on a total of 38,103 bulls in 1967. DHIA cow index evaluations on 7,211 outstanding cows—registered progeny of bulls summarized in 1967—were computed and made available to the dairy industry for consideration as dams of future herd sires. These cows comprise about the highest 2 percent of the breeds.

### Summary

1. The dairy herd improvement program is an effective cooperative project between the United States Department of Agriculture, the Land Grant Universities, the state and national breed associations and the dairymen or dairy farmers.

2. The first DHIA was organized in the United States in Newaygo County, Michigan in 1905 and in Nebraska in Douglas County

in 1910. The average milk and butterfat production per cow for the first DHIA in the United States and Nebraska was 5,300 and 215 and 7,095 and 257 pounds respectively.

3. In 1967, in the United States and Puerto Rico, there were 1,344 DHIA's with an enrollment of 37,683 herds and 2,098,919 cows. The average production was 12,307 pounds of milk and 468 pounds of butterfat. Today in Nebraska about 21,000 cows are enrolled in the production testing program. Last year's Nebraska cows in Standard DHIA averaged 11,988 pounds of milk and 448 pounds of butterfat.

4. Standard and Owner-Sampler records from Nebraska and eight other states are electronically computed at the Iowa Dairy Record Processing Center at Ames, Iowa. Records from 6300 herds and 245,000 cows are computed monthly.

5. DHIA records are helpful to dairymen or dairy farmers.

6. The milk and butterfat production of cows at different levels, with their value of product, feed cost, income over feed cost, and feed cost per cwt. of milk is shown in Table 2.

7. Sales of dairy animals over a period of years shows that cows with milk and butterfat production records sell for more than cows without records. The value of a dairy herd and their offspring can increase substantially over a period of years as a result of a DHIA program.

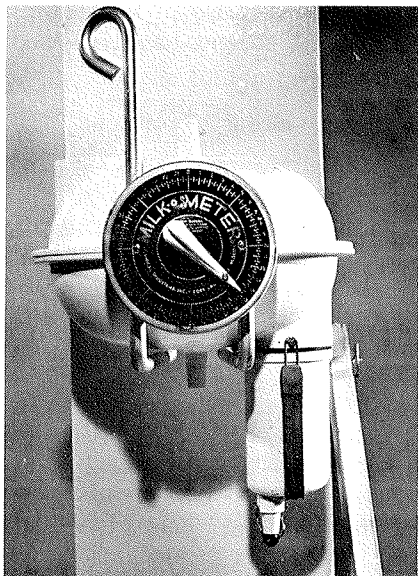
8. In 1967, 1,851,274 Standard DHIA lactation records were reported to the USDA for use in statistical summaries, genetic appraisals and research. From Nebraska, 18,529 lactation records were reported to the USDA in 1967.

9. DHIA sire summaries were computed on 38,103 bulls in 1967. DHIA cow index evaluations were computed on 7,211 outstanding cows, the highest 2 percent of the breeds. This published information was made available to the dairy industry.

Table 2.—Milk and butterfat production, value of product, feed cost, returns above feed cost and feed costs per 100 pounds of milk for cows producing at different levels.

Cow years	% Days in milk	Milk lbs.	% B.F.	B.F. lbs.	Value prod. <sup>1</sup>	Feed cost	Income over F.C.	Feed cost per cwt. milk
261	76	6,827	3.7	255	\$319	\$171	\$148	\$2.50
646	80	8,734	3.7	326	408	187	221	2.14
2479	84	10,281	3.7	380	475	203	272	1.97
4904	85	11,515	3.7	426	533	230	303	2.00
3716	85	12,518	3.7	469	586	239	347	1.91
2770	87	13,944	3.8	523	654	266	388	1.91
824	88	14,945	3.8	571	714	273	441	1.83

<sup>1</sup> Value of one pound butterfat \$1.25 for all groups.



Milk-O-Meter satisfactory.

**R. D. Appleman**  
Assoc. Prof., Breeding and  
Management

**C. W. Nibler**  
Extension Dairyman

The subcommittee on Weighing, Sampling and Testing Devices, consisting of a group of USDA and state experiment station researchers, has tested and checked the accuracy of several different milk metering devices during 1968.

Dr. Robert Appleman is a member of this subcommittee, appointed by the National DHIA Coordinating Group. The latter group is the governing body of the national DHIA program and includes State Research and Extension personnel, USDA, breed association and A. I. personnel, as well as National DHIA (dairy farmer) representatives.

### Weighing Devices

The National DHIA Coordinating Group has accepted the following "stationary-mount weigh jars" for use in the standard DHIA program:

1. DeLaval Receiver Jar No. 8300719-01. When this jar is installed and used in accordance with the instructions, the milk weights

obtained and the sample for butterfat test are well within the prescribed limits of tolerance as specified for Standard DHIA testing.

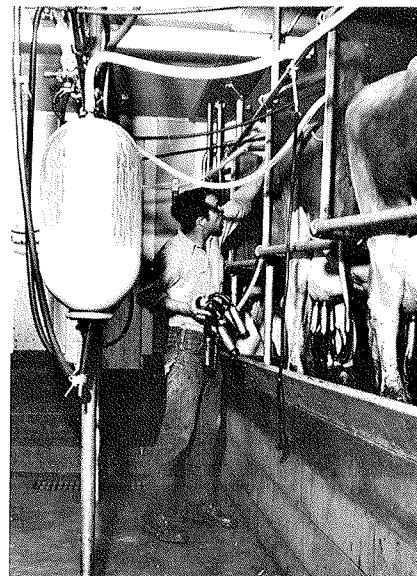
2. The Chore-Boy Roll-O-Measure (No. 11916) was approved for DHIA testing when properly installed and used according to directions. There are a number of present installations that are not secured to the floor or curb to provide a rigid mount. These must be modified before they can be used. Unless the frame is securely fastened in a rigid position, the jar is susceptible to large errors. The sampling device for this jar is the same as used by DeLaval.

3. The Surge Weigh Jar (No. 25177) was approved for DHIA testing when installed and used in accordance with the proper instructions. As is the case for all receiver jars, the accuracy depends on the plumbness of the jar in respect to the calibration scales. The jar must be mounted to a pipe that is plumb and rigid to provide accurate weights.

More recently, the following stationary mounted jar systems have been approved, subject to the same installation procedure described above.

4. Universal Jar No. 7491.
5. Sta-Rite Jar No. DE31-100.
6. Bou-Matic Jar No. 8517802.

## Weighing, Sampling, Testing Devices



DeLaval Jar No. 8300719-01 is satisfactory.

In addition to installing only approved equipment according to the standards specified, DHIA supervisors and dairymen must be sure to allow sufficient air agitation of the milk before sampling. *One second for each 2 pounds of milk is required.*

The other sampling device, approved several years ago, is the Milk-O-Meter. This meter performs satisfactorily in most pipeline barns provided adequate maintenance is provided.

The technical committee has also been conducting tests on several new sampling devices, including the foreign-made Tru-Test and Waikato meters. Tests completed at the University of Nebraska on the Tru-Test meter appear promising. Problems in meter standardization and sampling procedures have delayed their acceptance but the manufacturers hope that the deficiencies can be corrected.

### Testing Devices

The Milko-tester has recently been approved for DHIA on fresh milk and on milk preserved with potassium dichromate. Recent work at the University of Nebraska indicated that Milko-tester results are more precise (less variation in repeated samples) than results obtained by the Babcock method.

# High Nitrate Feeds

**Don J. Kubik**  
Extension Dairy Specialist  
N. E. Station, Concord

There has been much concern about the high nitrate content of roughages, especially in Northeast Nebraska. Some of the concern results from rumors of death losses due to nitrate poisoning.

Nitrate itself is not especially toxic to animals. When nitrates are eaten by ruminants, they are normally broken down to ammonia and then converted by bacteria into bacterial protein. Nitrite, one of these conversion products, is the cause of "nitrate poisoning."

Normally, the conversion of nitrate to ammonia progresses rapidly with no problem even though nitrates appear to be converted to nitrite at a faster rate than nitrite is reduced to ammonia. When feeds containing high levels of nitrate are fed, nitrite toxicity may occur. Nitrate poisoning may also occur when some factor or factors slow the rate of reduction of nitrite to ammonia.



Nitrate studies in the laboratory.

More than 60% of 350 samples tested in August and early September, 1968, showed a nitrate content in excess of 1.5% potassium nitrate equivalent ( $\text{KNO}_3$  %) (Table 1). There have been cases of death reported where rations contained over 1.5%  $\text{KNO}_3$ .

Based on the rule of thumb which says 0.5%  $\text{KNO}_3$  in the total ration is the level at which we should be concerned and 1.5% in the total ration is the level at which death may occur, we could expect much trouble from the roughage in Northeast Nebraska. We have not experienced the trouble expected.

By ensiling time, most forages tested in August and early September had dropped considerably in their nitrate content. A reduction in nitrate content is expected as a crop matures.

It was fortunate that most livestock men were aware and concerned about the nitrate situation and took the necessary precautions to insure favorable results. Most livestock men followed University

of Nebraska Extension Service recommendations and have reported no trouble.

## Harvesting Precautions

Some precautions taken to reduce the nitrate content of the forages were:

1. **Cutting the crop high.** The bulk of the nitrates are contained in the lower one-third of the stalk. In fact, as much as 45% of the total nitrate in a corn plant may be in the lower eight inches of the stalk. Nitrate content of the feed can be greatly reduced by operating the cutter bar high or by not allowing animals to graze too closely.

2. **Letting the crop mature.** As crops mature much of the nitrate in the plant is converted to protein and becomes harmless to cattle. This is especially true when the plant produces seed.

3. **Harvesting high nitrate forages as silage.** Forty to 60% of the nitrate may be reduced during the fermentation process. The range is from about 10% to over 90%.

## Feeding Precautions

In addition to getting a reduction in the crop before feeding, there are a number of things which are being done at feeding time to greatly reduce the danger when feeding high nitrate feeds. These include:

1. **Providing frequent intake of feed.** Animals tolerate considerably more nitrate if the intake is spread over a period of time. Animals perform normally in research where they are given a high daily intake in several feedings daily, while animals died when given the same amount as a drench. Cattle should be fed multiple feedings every day or the material self fed, keeping some feed in front of them at all times. Cattle that are especially hungry should not be fed high nitrate feeds.

2. **Providing adequate minerals, energy, protein and vitamin A.** Animals on a high plane of nutrition are much more tolerant of high nitrate feeds. Animals have the

Table 1.—Nitrate situation, August–September, 1968.

Range $\text{KNO}_3$	Number in range	% of total
0–.49	54	15.4
.5–.99	48	13.7
1.0–1.49	36	10.3
1.5–1.99	36	10.3
2.0–2.49	40	11.4
2.5–2.99	34	9.7
3.0–3.49	35	10.0
3.5–3.99	31	8.9
4.0–4.49	18	5.1
4.5 up	18	5.1



ability to convert nitrates to ammonia which can then be used by the animal for building microbial protein. The conversion of nitrates to ammonia requires the action of enzymes which are dependent on trace minerals. These minerals are copper, iron, magnesium, manganese, and molybdenum.

Energy in the form of starchy feeds is needed for the animal to most effectively convert ammonia to microbial protein. That is why high starchy feeds such as corn are important in a high nitrate ration. In addition, protein and vitamin A are needed in the amount to properly balance the animal's daily ration and insure proper animal function.

3. **Change feeds in the ration slowly.** This permits the animal and the bacteria in the rumen to adjust to high nitrate feeds when they are added to the ration. This will also help prevent digestive disturbances when certain other ingredients are included.

4. **Feed some low nitrate feeds.** Dilute the nitrate content of the ration by mixing low nitrate roughages or grains in with roughages that are high in nitrate. This is also necessary where feeds have not yet been tested and are suspected to be very high in nitrate.

#### Summary

Nitrates have been blamed for more than their share of problems. Nitrates can be a problem but this is not likely in well fed herds.

In the past observations have suggested a total ration containing 1.5%  $\text{KNO}_3$  on a dry basis would be dangerous. With recent work it has been shown that this figure is conservative for animals properly fed a good complete balanced ration. You can expect normal performance on rations containing up to 3.0% ( $\text{KNO}_3$ ) when animals are getting a well balanced ration fed properly.

When grain, trace minerals and vitamins are being fed adequately it is not likely that corn, sorghum and other forages will contain sufficient nitrate to cause problems.



Fig. 1. Indoor wooden pen.

## Housing Systems for Calves

F. G. Owen, Professor  
Animal Nutrition

R. D. Appleman, Associate  
Professor  
Breeding and Management

During the past five years the University has evaluated several types of housing for the young dairy calf. The purpose is to gain more knowledge about how calves can be successfully housed and still minimize disease, labor and costs.

At the Mead Dairy Center we have a simple indoor wooden pen (Fig. 1). It is 4' x 8' and constructed

with exterior plywood. The removable board across the front provides openings for holding pails for water and grain, and also facilitates taking calves in and out. The pen can be constructed quickly with common farm tools, but it is neither as permanent nor as readily cleaned as most metal pens.

The indoor metal pen (Fig. 2) was designed in cooperation with a commercial manufacturer. It is 36" high and 54" square, constructed of 18-gauge all-galvanized interchangeable panels. Modular construction provides flexible arrange-

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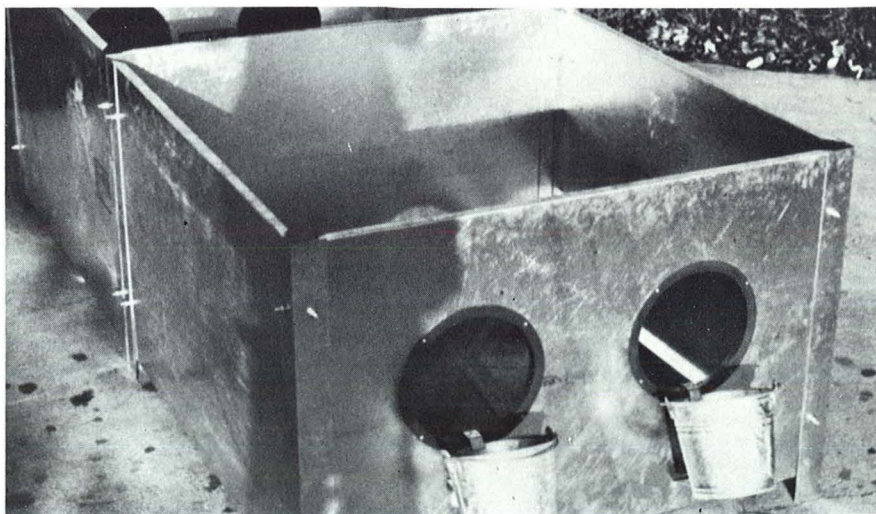


Fig. 2. Indoor metal pen.



## Housing Systems

(continued from page 19)



Fig. 3. Elevated stalls with screen floor.



Fig. 4. Front view of elevated stalls.

ments and the pens can be disassembled readily for cleaning, storage or moving.

Elevated stalls (2' x 4') have been used at the Scottsbluff Station for about 2 years (Figs. 3 & 4). They are positioned 15" off the floor on 2" x 4" legs. Plywood panels separate calves. Elevated pens allow more calves to be raised in confinement. No bedding is required and cleaning is best accomplished with water pressure. An expanded metal screen flooring has proven to be superior to 2" x 2" slatted wooden floors.

Last spring we designed a metal house for starting calves outside (Figs. 5 & 6). These houses or "calf cabanas" are 3' x 4' with a height of 3½' to 4' from back to front. Feed and water buckets are removed easily by raising the hinged roof. Each calf is tethered by a 5' chain attached to a leather collar.

These houses can be moved readily to a new area each time another calf is started; are easily cleaned and disinfected; and allow both the calf and the feed sufficient protection from the elements from April through November. We have no winter time experience as yet, but expect that only minor modifications will be required.

The main disadvantage is that inclement weather is disagreeable to the caretaker.



Fig. 5. Calf cabanas.



Fig. 6. Inside view of calf cabana.