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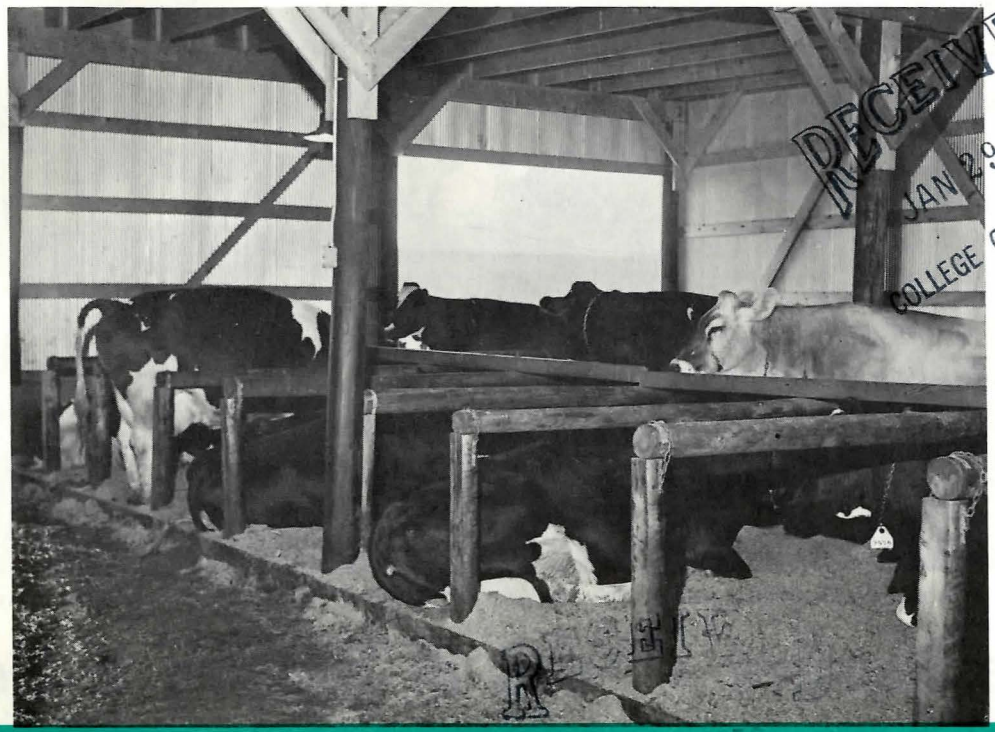

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1969 DAIRY REPORT

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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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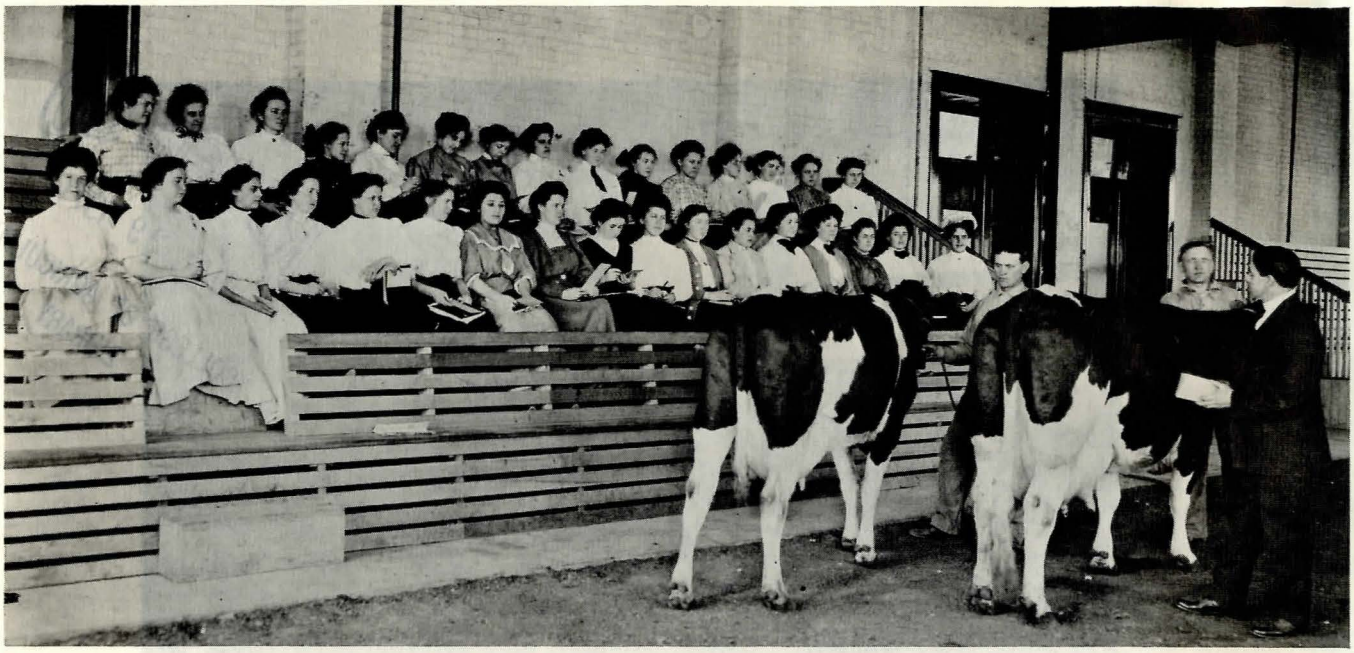
NEBRASKA



A dairy cattle judging class of 1909. Professor A. L. Haecker, in the foreground, was the instructor.

One Hundred + Years of Dairying in Nebraska

By C. W. Nibler
Extension Dairyman

The first milk cows in Nebraska were located at Fort Atkinson, now called Fort Calhoun, north of Omaha. This army post was established to protect fur traders and was occupied in the 1820's by about 600 men, women and children.

Between 1820 and 1826 soldiers at Fort Atkinson raised good crops of corn, turnips, potatoes and maintained large herds of cattle and hogs. The post was improved and became the center of white activity on the Missouri.

In June, 1827, Fort Atkinson was abandoned because members of the War Department claimed the Fort was too much oriented to farming and was not effective in the protection of the fur trade.

Milk For Children

Between 1830 and 1840 many immigrant trains crossed Nebraska and each group had a few milk cows.

Cows accompanying the pioneers were milked to supplement the diet of the travelers, particularly the diet of children. When settlers established their homes on the prairies, many of them kept a few milk cows.

The 1860 census shows that 641 farmers in Clay, Gage, Johnson, Nemaha and Pawnee Counties owned 4,541 cattle, an average of about seven. The average farmer milked two to three cows.

Milk production per cow was low and most of the milk was produced in the spring and summer. With the exception of cheese and stored butter, the supply of dairy foods was limited to the brief milking season.

14,000 in 1867

There were 14,000 milk cows on Nebraska farms in 1867 with an average value per head of $25.60. The number of milk cows gradually increased to the all-time high of 820,000 cows in 1934, valued at $26 per head.

As both milk cow numbers and production per cow increased and towns grew larger, marketing facilities for dairy products were developed. In the late 1860's a cheese factory was built by Dexter F. Woods at Palmyra. The cheese was sold through small country stores and to pioneers crossing the state.

The production of cheese increased and in 1929–30 there were 28 cheese factories in Nebraska. After that the number of cheese factories diminished until recently when Nebraska once again has become an important cheese producing state.

Ice Cream Rare

Ice cream was made upon rare occasions in Nebraska homes after conditions became settled. Between 1870 and 1880 village butchers and saloonkeepers established themselves. They needed ice which was gathered during the winter and stored in icehouses and caves. On the Fourth of July, at weddings and at anniversaries pioneers would make and serve ice cream, the ultimate in a tasty delicacy.

The making of butter was originally a home industry in Nebraska, but the Giddings factory of Table Rock made butter as early as 1874.

Nebraska was the original home of many nationally known dairy processing plants now known as food companies. The Beatrice Foods Company was founded at Beatrice, Fairmont Foods was founded at Fairmont in 1884 and the Harding Cream Company es-

tablished its first creamery in Nebraska.

The production of butter, cheese and ice cream increased as more dairy processing plants were established.

Research Needed

The early history of dairying in Nebraska showed the need for research and for trained personnel to assist the industry. This need was met by establishment of the University of Nebraska and the College of Agriculture. The University was officially established by law February 15, 1869. The College of Agriculture was a part of the Industrial College and was established on 320 acres in 1874.

The University of Nebraska Dairy Husbandry Department was started in June, 1884, when Professor H. H. Wing gave lectures and instruction in dairy farming. Professor Wing served the University for four years.

Professor A. J. Haecker came to the University in September, 1896, as Assistant Instructor in Agriculture and in Dairying. He started the dairy herd at the College with 10 Jersey heifers. The first dairy building was constructed in the fall of 1896 and the first instruction given in a dairy shortcourse, started the first of January in 1897.

Holsteins were added to the dairy herd in 1897. In 1913, purebred Holsteins were added to the livestock at the North Platte Substation and to the Scottsbluff Substation at Mitchell in 1914. At about the same time there was a Holstein herd at the Valentine Substation (later discontinued).

Dairy Herd Moved

The dairy herd was moved from the East Campus at Lincoln to the University Field Laboratory at Mead in February 1966. In 1968 the dairy animals from North Platte were moved to Mead and in 1969 all dairy animals from the Scottsbluff Station were transferred to the Mead location. Brown Swiss and Holsteins are used for experimental purposes.

The dairy herd has been used and will continue to be used for research studies. The following research has contributed to general dairy knowledge:

1. Normal growth of dairy animals of all breeds.
2. Nutritional value of many feeds including irrigated and nonirrigated pastures, sugar beet byproducts, silages made from cereals and sorghums and other feeds.
3. Feeding and management of dairy calves.
4. Artificial breeding of dairy animals—particularly studies on ovulation.
5. Different aspects of inheritance and effectiveness of selection.
6. Dairy cattle for beef production.
7. Dairy cattle diseases—particularly Brucellosis and Mastitis.

Research of Note

Research of special note includes growth studies, application of artificial insemination in breeding dairy animals, feeding one complete ration to producing dairy cows, feeding calves milk once daily and using dairy animals as producers of beef.

Growth studies, under the guidance of Professor H. P. Davis, included the weights and measurements of many different parts of dairy animals from birth to maturity for the different breeds.

Research bulletins showing results of the growth studies are used throughout the world as recognized growth standards.

Nebraska dairy scientists in the 1930's demonstrated the application of artificial insemination to dairy animals. The research on time of ovulation, conducted by Professors George Trimberger and Davis, is still considered basic information by the A.I. Industry. The University of Nebraska's dairy herd was one of the first herds in the country used to demonstrate the production of dairy calves from semen shipped long distance.

Many Dairy Science graduates at Nebraska have been or are dairy farm owners and operators, managers of dairy enterprises, teachers and research workers.

Great Contribution

The Dairy Husbandry Department and now the Animal Science Department and the Food Science and Technology Department have contributed a great deal in research, teaching and extension to Nebraska's vibrant and changing Dairy Industry. For example:

In 1910, in Douglas County, the first Nebraska dairy herd improvement association (called "cow testing association" at that time) was organized with 21 herds and 425 cows. The average production was 7,095 pounds of milk and 257 pounds of butterfat. Today it is 12,000 and 450 pounds respectively.

Dairy herd improvement associations have contributed to the improvement of dairy cows in Nebraska by encouraging better breeding, feeding, and management practices.

The first artificial breeding association west of the Mississippi River was organized and started breeding cows in Douglas County in April, 1941. The bulls owned by the association were housed on the Fair Grounds at Elkhorn.

Later the Nebraska Dairy Breeders Association served Nebraska but now it is a part of Midwest Breeders Cooperative and no bull studs are located in the state.

Industry Has Changed

Nebraska's Dairy Industry has changed tremendously in over 100 years. Although fewer cows are milked and fewer farms maintain dairy herds than during the depression years many factors have contributed to increased income.

Milk production per cow has increased to 7,900 pounds, improved markets and marketing facilities are available for fluid milk and mechanization has replaced much of the manual work.

In 1968, producers received 65.5 million dollars from the sale of milk and cream. In addition, the income from the sale of dairy animals and the value of milk used on the farm produced an income of 94 million dollars, an all-time record.

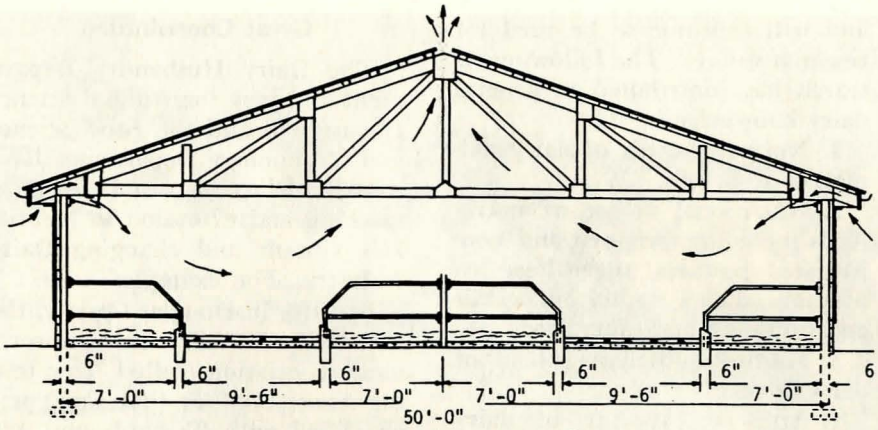


Figure 1. Cross-section of free-stall area.

Free Stall Design, Management

By Don J. Kubik
Area Extension Specialist (Dairy)

Good cows are more valuable today than ever before. It is important to take the very best care of them. Free stalls offer the opportunity to greatly reduce injuries and mastitis.

Bedding is becoming scarce and high priced. Free stalls offer the opportunity to save 50–75% on bedding costs.

Labor is hard to find and keep. Free stalls offer the opportunity to keep cows much cleaner than any other type of housing, which greatly reduces washing time and improves milk quality.

Adding these advantages together we can expect a savings of $20 per cow per year from free stall housing.

The Building

The building which covers the free stalls is just that—a cover. We are not far enough north to consider a closed warm insulated barn. We should use the semi-enclosed cold barn.

We need to provide for adequate natural ventilation. A continuous ridge vent opening or the equivalent, with the area under the eaves left open, will do the job. With this arrangement we get natural ventilation. The warm air from the cows rises, pulling air in from under the eaves (Figure 1) and taking the moisture with it out through the ridge ventilator. It is best to provide a baffle on this opening to alter the inlet depending upon temperature and humidity conditions.

A free stall barn with inadequate ventilation may develop such a condensation problem that it will actually rain in the building. Seek advice on cold barn ventilation before building. The size and shape of the building determine the amount of inlet and outlet. Fans do not do a good job of ventilation in a cold structure.

Tht real ventilation problems occur when temperatures drop below zero. At low temperatures the air holds very little moisture. The doors and the baffles under the eaves can be closed long enough to heat the barn for manure removal, if freeze down occurs. Another way of opening up a building for air inlet and cross ventilation is to provide panels in the side wall (Figure 2) which either raise up or fold down.

Another building must is to either pour the footing for the building at least 12″ higher than the curb behind the cows or 2′ above grade level (Figure 2), or to put plank on the inside of the barn wall. This protects the outer wall from being pushed off by pressure from cows pushing bedding forward with their feet.

When building be sure the doors are high enough for easy access by large tractors.

The type of building should be determined solely on the basis of cost. We are in a time of change in building costs. The relative advantage is changing between types of buildings. Put up the building which is least expensive.

The Design

In laying out the free stall barn do not overlook cow management and manure handling.

As herds become larger (over 40 cows) we need to make provisions for dividing the herd for feeding purposes. The best design for larger herds and one which makes dividing the herd easy is to go to multiple short rows (Figure 3).

Only small herds should consider single row barns (Figure 4).

The Stalls and Alley

The free stall alley should be a minimum of 9′ wide—10′ is better. Some 8′ alleys have been used, but they should only be considered when remodeling old buildings where a wider one is impossible.

The alley should be flat from curb to curb and slope no more than 4% in the direction the manure is to be pulled or pushed. Stall dividers can be of wood or steel. If steel, be sure you use heavy weight high tensile strength steel. If building with wood, use heavy posts dug well into the ground.

Dividers should be two inch material and bolted. Light weight stall dividers are a constant main-

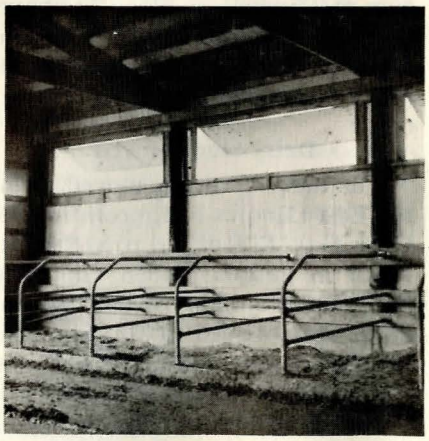


Figure 2. Another way of opening up a building is to provide panels in the side wall.

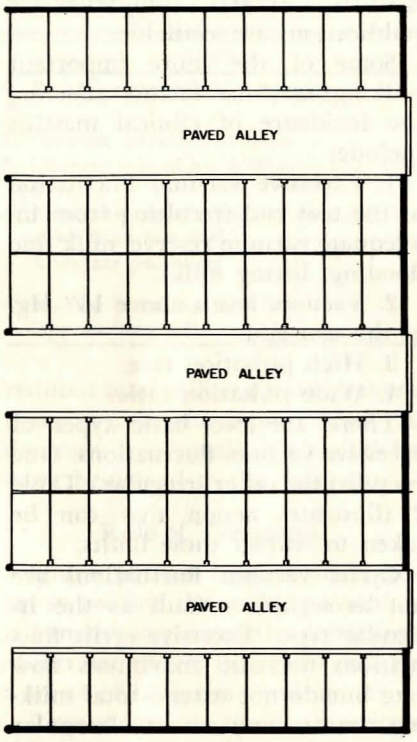


Figure 3. Multiple short rows.

tenance problem. Cows will exert tremendous pressure trying to turn around, etc., in the stalls.

The size of stall depends on the breed of cattle and the size of cows in the herd. For normal Holstein herds stalls 44–48″ wide and 7′ long are adequate.

A wither board used as a trainer, which can be adjusted forward and backward until a desirable length can be obtained, is a common practice now. This is necessary when stalls are made too long. The length of the stall is measured from the back of the curb to the side of the building or center divider. Stall width is considered from center of one divider to the center of the next—not the distance between dividers.

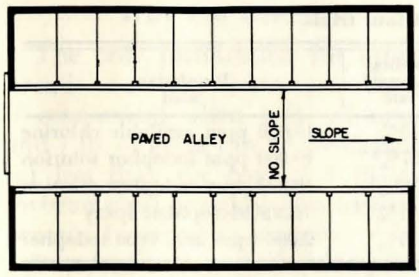


Figure 4. Only small herds should consider single row barns.

On the cover of this report is a picture of our free stall barn at the Mead Field Laboratory. This is a relatively new stall design. These stalls are 6′4″ from the stall divider to the rear of the curb, and the dividers are 32″ higher than the top of the curb.

Many different styles of dividers are available and being tried. This one is a simple construction. We are not certain that a lower rail is necessary. We do know that problems occur when only a low rail 20–24″ above the bedding is used. Cows turn around in these stalls and will also step over this type of divider.

Manure Disposal

Last winter again proved that we need to be prepared to remove manure on a regular basis. This may mean twice a day cleaning in order to prevent freeze down.

In addition to regular cleaning, some provision for emergency storage away from the normal cow and machinery route is recommended. For example, where a dock is used to load the spreader a separate holding area for manure, outside of the lot to comply with Grade A inspection, should be provided. The manure should not be pushed off the dock with the idea of getting it tomorrow.

One of the most popular manure handling systems is the use of a snow scoop and a bumper at the end of the alley to push the manure against for loading. This system seems more desirable than the scraper in that it has more capacity and with a hydraulic loader, it can be turned down and the weight from the front end of the tractor exerted on the blade which aids in breaking loose the manure where freeze down occurs.

If a dock (Figure 5) is used to load manure onto a spreader, you should not have any incline on the dock as it is difficult to get up it with a rubber tired tractor in the winter. Also provide drainage away from the lower or spreader side of the dock to keep it dry.

Long pulls of over 40′ with manure should be avoided either by the design of the barn or with multiple loading points. Another consideration is removing the manure without getting the tractor and spreader off concrete. Curbs should be put on sides of holding pens and alleys where manure is to be pushed or pulled.

General Management Suggestions

1. Clean free stall barn daily. When the temperature drops below zero, clean twice daily to prevent freeze down.
2. Rake manure that is dropped into stalls into the alleyway twice daily. Normally less than 10% of the stalls will have manure in them.
3. Keep well bedded. Normally, adding bedding three times per year is adequate after the bedding gets firmed up.
4. Do not feed in stalls unless absolutely necessary in extreme weather.
5. Separate cows in heat.
6. If adequate shade is not available, allow cows free access during hot summer weather.

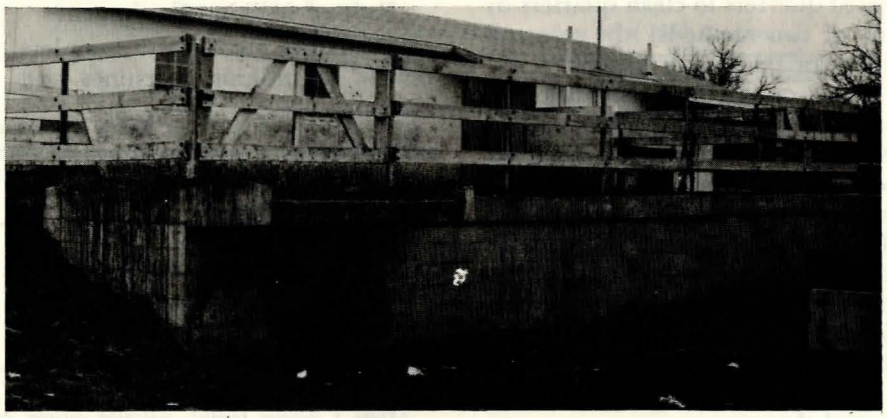


Figure 5. Do not allow an incline on your dock.

Udder Health Can Be Maintained

By R. D. Appleman
Assoc. Prof., Dairy Breeding and Management

Too many dairymen will not admit they have a mastitis problem. The very nature of the disease —an occasional treatment combined with a rare "outbreak"—causes many herd owners to conclude that their present practices cannot be improved.

If you are an average dairyman, and milk 50 cows, you treat only 1 cow each 10 days. But this amounts to 6% of your herd each month, and 72% of the herd each year. Can you, Mr. Average Dairyman, continue to live with a condition that affects nearly three-fourths of your herd?

The prevention of clinical mastitis involves three basic considerations—milking technique and hygiene, milking equipment function, and treatment of intramammary infection.

Milking Technique and Hygiene

Bacteria cause 98% of all cases of mastitis. *Streptococcus agalactiae* and *Staphylococcus aureus* are the two most common types of infection. Both are transmitted from cow to cow during the milking process. If these bacteria made no contact with the teat end, few new intramammary infections would result.

It has been assumed that these organisms were transferred from infected quarters to clean quarters by one of two methods: the teat cup liners, or the milker himself.

Based on the first assumption, it has been almost universally recommended that the teat cup assembly be disinfected between cows. The value of this practice is questionable. Evidence seems to indicate that the practice serves only to impress upon the dairyman the infectious nature of the disease; it affects the organisms much less.

Recent experiments have demonstrated that:

1. New infections rarely occur at the time of milking.
2. Microorganisms present on the teat end between milkings are the most important source of new infections.
3. Dipping all teats in an effective disinfectant solution after every milking is the most important hygienic procedure in preventing new infections.

Results of recent research are almost totally favorable to the practice of dipping teats after milking is completed.

Results of the four experiments summarized in Table 1 indicate that this simple practice will reduce the new infection rate in problem herds by one-half. Additional trials at the University of Nebraska support this conclusion.

Washing the udder and teats before application of the milking machine serves at least two useful purposes: (a) it cleans the cow of extraneous foreign material that might otherwise enter the milk supply, and (b) it stimulates the cow for proper milk letdown.

But, the old and once-accepted practice of washing the udder and teats with a common cloth from a bucket of diluted, ineffective disinfectant solution readily transfers microorganisms from cow to cow. A much more desirable practice is to use individual paper towels and warm, free-flowing water to scrub the udder and teats.

Role of Milking Equipment

Space does not allow a complete review of milking machines and mastitis. Several comprehensive publications are available.

Some of the more important milking machine factors affecting the incidence of clinical mastitis include:

1. Excessive vacuum fluctuation at the teat end (resulting from inadequate vacuum reserve, milk line flooding, lifting milk).
2. Vacuum levels above 13″ Hg. at the teat end.
3. High pulsation rate.
4. Wide pulsation ratio.

There are two basic types of excessive vacuum fluctuations. One is cyclic; the other irregular. Table 2 illustrates action that can be taken to correct these faults.

Cyclic vacuum fluctuations are not as serious a fault as the irregular type. Excessive cyclic fluctuations decrease maximum flow rate but do not extend total milking time to any extent. Irregular vacuum fluctuations, on the other hand, should not exceed 2″ Hg. Any variation greater than 2″ may result in increased infection rates.

There is sufficient research evidence for one to conclude that a milking vacuum over 13″ Hg. at the teat end, especially when combined with high pulsation ratios and/or wide pulsation ratios, results in increased udder disease.

The objectives of periodic liner pulsation are to massage the teat tissue, which promotes better blood and lymph circulation, and to counteract the pain created by continuous application of vacuum to the teat end.

Even though fast pulsation and a wider pulsation ratio result in high maximum milking rates, a combination of the many changes in pulsator performance has not

Table 1. Summary of four trials.

Location of trial	Length of trial	No. cows	Beginning infection rate	Ending infection rate	Disinfectant used
N.Y.	21 mos.	1700	40%	10%	40,000 ppm available chlorine
Wash.	9 mos.	800	52%	27%[a]	10,000 ppm iodophor solution
Wis.	13 mos.	188	41%	19%[b]	10,000 ppm iodophor solution
Mo.	6 mos.	147	23%	11%[c]	Hexachlorophene spray
Mo.	6 mos.	147	27%	15%[c]	2,000 ppm acid type iodophor

[a] Control cows remained above 40%.
[b] Only 1 side treated, cow served as own control, and remained constant.
[c] Only 1 quarter treated, matching quarter on other side served as control, and infection rate remained constant.

Table 2. Steps to be taken to correct two basic types of excessive vacuum fluctuation.

Cyclic	Irregular
1. Enlarge claw chamber capacity.	1. Enlarge vacuum pump capacity (but then have adequate size controller).
2. Decrease elevation of milk.	2. Eliminate air leaks.
3. Increase rate of air admission near teat end.	3. Clean sticky or replace worn-out vacuum controller.
4. Eliminate air admission into milk line away from teat end.	4. Have milk enter top half of the milk line.
5. Alternate pulsation.	5. Have proper slope to milk line. (1½" per 10')
6. Narrow pulsation ratio. (approaching 1:1)	

reduced total milking time by more than 10% in the typical herd. A decrease in over-milking would be more beneficial to the dairyman.

Role of Treatment

Unless proven hygiene measures are in use and the milking machine is functioning correctly, treatment of intramammary infections may be a waste of both time and money.

Treatment of these infections should be limited almost exclusively to the dry period. Treatment during the dry period should serve two important purposes: (1) eradication of existing infections, and (2) decrease the incidence of new infections during the dry period. Treatment of acute mastitis, of course, must take place when it occurs.

Table 3 outlines an effective dry cow treatment program recommended by the University of Nebraska Department of Veterinary Science. Preliminary results of milk leucocyte levels following subsequent freshening suggests that effective dry cow treatment reduces intramammary infection by about 50%.

The number of new intramammary infections will drop, and the quality of the milk produced will be improved if these three practices are followed:

1. Proper hygiene, to include teat dipping after milking.
2. Proper functioning equipment.
3. Effective dry cow treatment program.

Table 3. Recommended dry cow treatment program.

Before Treatment
1. Have veterinarian check condition of cow herd, collect milk samples from the most infected cows, determine what bacteria are present, and determine what medication will provide control.
2. Have serviceman check the milking equipment, and make any necessary modifications.
3. Review and modernize your milking procedures.
During Treatment
1. Treat all quarters with appropriate medication after the last milking.
2. Milk once daily for 5 days (discard milk).
3. Re-treat all quarters and quit milking.
4. Check condition of udder daily for 5 days then release cows to the "dry-cow" pasture.

Urea for Lactating Cows

By Foster G. Owen
Professor, Animal Nutrition

Urea is a synthetic compound which is broken down in the cow's paunch to ammonia and carbon dioxide. The ammonia is then used by the rumen microorganisms for the synthesis of their own body proteins. These organisms are then digested and absorbed by the cow and used in the production of milk and the maintenance of vital body processes.

Why Use Urea?

The only justification for using urea is to reduce ration cost. Urea is economical when 1 lb. of urea and 7 lb. of grain can be purchased for less than the cost of 7 lb. of soybean meal or equivalent natural protein from other sources.

Based on current prices an equivalent level of protein and energy can be obtained for 40% to 50% less from urea plus grain compared to the oil meals.

Level of Urea

Feeding too much urea may cause toxicity, or even death. However, present recommendations allow a wide safety margin against such possibilities. Recommendations a few years ago indicated that the dairy cow could obtain 33% of her protein-equivalent from non-protein sources such as urea. However, recent studies with high producing cows indicate that this level may result in depression of milk yields.

Today we recognize that the amount of urea a cow is fed should be related to her body weight. Table 1 shows recommended levels

Table 1. Maximum levels of urea in the ration of a 1250 lb. cow.

Roughage	Recommended urea level in grain ration
Sorghum silage (no urea added)	1.0% (20 lb/ton)
Corn silage (no urea added)	1.0% (20 lb/ton)
Grass hays	1.5% (30 lb/ton)
Corn silage (10 lb. urea/ton) Fed free-choice with the following amounts of hay or equivalent:	
0	0%
5	.3% (6 lb/ton)
10	.5% (10 lb/ton)
15	.8% (16 lb/ton)
20	1.1% (22 lb/ton)
25	1.5% (30 lb/ton)

Urea for Cows

(continued from page 7)

for different types of roughage. The data show that higher levels of urea can be used with dry roughages than with silages. This is because a highly fermented forage contains considerable amounts of non-protein nitrogen. Consequently, the amount of additional non-protein nitrogen that the animal can handle is reduced.

While feeding silage as the principal or sole roughage, a safe daily level is .27 lb/1000 lb. body weight. For the average Holstein, this is about ⅓ lb. daily.

Adding Urea to Grain

Palatability is often a problem when urea is included at 2% or more of the grain ration. This is why we suggest that not more than 1.5% urea be included in the grain ration.

For high-producing herds where grain levels often exceed 30 pounds, a maximum of 1% is recommended. With these levels in the grain ration, none should be included in the silage. However, it is often recommended to include urea in the silage at the time it is ensiled.

Feeding Urea Silage

A major advantage of adding urea at the time of ensiling is in simplifying the supplementation of all-corn or sorghum silage based rations with protein. To illustrate, dry cows or very low producers need no additional energy beyond that contained in the silage, but they do need extra protein. Whatever amount of protein supplement fed will contain unnecessary energy.

On the other hand, cows in full production of 50–70 lb. of milk daily will receive adequate amounts of protein with a ration containing about 18% protein. Adding the recommended level of 10 lb. of urea per ton of corn silage will raise the protein content of the silage from about 8½% to 12½%. This eliminates the need for supplemental protein needed in the ration of low producers or dry cows, and reduces the protein needed in the ration of high producers to about 14%. Feeding urea via the silage also minimizes the possibility of excess consumption.

For best results, urea should be added to silage of 32–38% dry matter. At higher moisture, excessive urea loss occurs due to runoff. Whereas, with lower moisture, high urea losses may occur from excessive ammonia volitalization, and loss into the atmosphere.

It is especially important to assure that there is no urea in the grain ration used to supplement silage which contains the recommended 10 lb. per ton of urea.

A recently completed experiment at Nebraska showed that urea could be added at 1% of the grain ration or at the 10 lb. per ton rate to the silage without depression in milk yields. However, when these levels of urea were included in both the silage and grain, milk yields were reduced by 3.5 lb. daily when compared to the control ration in which soybean meal supplied the supplemental protein.

Adequate supplemental calcium, phosphorus and trace minerals are especially important with urea containing rations.

Feed Handling Made Easier

By Philip H. Cole
Extension Dairyman

What is an effective feed handling operation?

How efficient is *your* feed handling operation?

Handling operations, in general, do not contribute to increasing income to the farm, and may actually add costs of ownership and operation to the enterprise. However, if properly adapted, they should reduce overall present costs of operation (Figure 1).

For most dairy farms the best overall feed handling system will be the one which has the lowest cost combination for fixed cost of ownership and annual operating costs for machinery, structures and labor while providing the desired goals.

Three Phases

The feed handling process on any particular farm may be broken down into harvesting, storage, and feeding.

One of the keys to efficient feed handling is the proper blending together of these three phases. If the harvesting, storage, and feeding operations are going to fit together, all three must be considered at the time the overall plan is designed.

The proper location of storage facilities is very important. Storage needs to be located where it is conveniently loaded and unloaded, and yet does not interfere with other farm operations. The type of storage available will also determine to a large degree the type of harvesting operation that should be developed.

On many Nebraska dairy farms one of the most pressing feed handling problems is the location of new storage and feeding facilities. Many buildings and facilities are already in place on the farm and the location of new or additional facilities is not easy to determine. In many situations it would be better to develop a new overall plan and locate new storage and feeding facilities where they best fit regardless of the location of existing facilities.

Principles of Materials Handling

The development of an efficient feed handling system is dependent on the proper application of several principles:

1. *Eliminate unnecessary operations*: Make sure there is a good reason for doing an operation. Don't do it just because it has always been done before.

2. *Reduce the number of times and distance a feed is moved*: Hay, grain, and silage should be stored as close as possible to area of use.

3. *Handle feeds in bulk*: Use

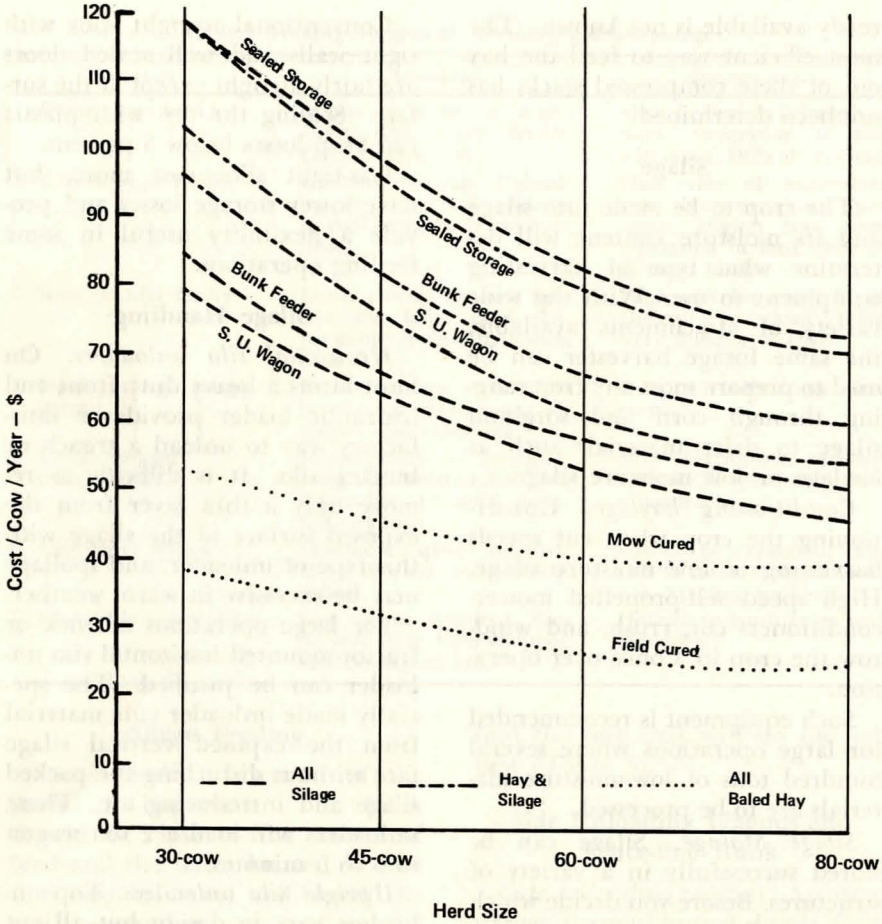


Figure 1. Annual ownership cost per cow for various forage handling and feeding systems.

mechanical equipment to handle large amounts.

4. *Use hands efficiently*: The human hand is a very versatile tool, but not a very powerful one. Use it to push buttons and control equipment, not to shovel grain and fork hay.

5. *Use self-feeding and gravity*: Let cows come to the feed. Arrange storage so feed can be dropped into feeder. Remember even gravity flow and self-feeding have some cost.

6. *Make flow continuous without interruptions for hand operation*: Arrange storage and feeding facilities so that work can be performed in a sequence. Eliminate backtracking.

7. *Mechanize major operations*: Use silo unloaders, mechanical feeders, and augers to handle the largest weight and volume of materials. Start by mechanizing the least desirable and heaviest chores. Silage should be high on the list.

8. *Develop a system and plan for expansion*: Develop a plan that coordinates harvesting, storage, and feeding operations. Plan for expansion. A little thought now may save many dollars in the future.

Handling Specific Feeds

Hay—Most of the hay crop used on dairy farms in Nebraska is either baled or chopped. In the western part of the state some hay is stacked long.

In recent years, because of the need for labor reduction, baling has been replaced by the wilted grass silage system on a good number of farms. However, in the last year or two new labor saving methods of handling baled hay have been developed which may keep baled hay competitive with hay crop silage (Table 1).

Baling—Many variations exist for harvesting and handling the hay crop in the form of bales:

Heat cured hay. Results in greater nutrient retention and less loss than any other baled hay-making method.

Wagon batch system. Hay is dried in the same wagons which bring hay from the field. The daily harvesting capacity of this system is limited by the number of wagons available.

Random handled—mow dried. The key components of this system are the bale thrower, mow conveyor and natural air drier. Labor requirements are no greater than for grass silage, but the work may be more strenuous.

Random handled—field cured. This is the least costly method of putting up hay. However, the risk of weather damage is greater than for any other system.

Chopping—Hay crop harvesting systems which make use of the forage harvester as the basic harvesting machine have two definite advantages over baling.

1. The harvested product usually can be fed mechanically, or it can be adapted to self-feeding directly from storage.

2. Double use can be made of the harvesting machine, feeding equipment, and storage facilities.

Storage—A pole-type storage structure makes satisfactory storage for baled or chopped hay in most parts of Nebraska. The proper location of hay storage is important, particularly if the hay is to be self-fed.

In eastern Nebraska any dairyman making baled or chopped hay should consider artificial drying. The installation of a hay drier will reduce both the number of days spent in harvesting and the severity of rain damage.

Table 1. Summary comparison of harvesting machines.

	Field capacity @60% field efficiency	Average pto horsepower	Average wagon capacities (ton of dm./load)
Baling	3.6 ton dm./hr.	8–10 hp.	2 ton/load
Chopping	1.75 ton dm./hr.	15–20 hp.	1.25 ton/load

—New York

Feed Handling . . .

(continued from page 9)

The feeding of baled hay, whether random piled or stacked, is a hand operation. Labor for baled hay can be reduced by: reducing the distance bales have to be moved, and decreasing the amount of hay fed and substituting forages that can be fed mechanically.

Hay-crop silage. Another method of harvesting, storing, and feeding the hay crop is in the form of haylage or low moisture silage. It has several advantages: 1. Single harvesting and handling system. 2. Single storage and feeding system. 3. Complete mechanization with less investment. 4. Reduced curing time and weather risk. 5. Increased nutrient content over field cured hay.

The most critical disadvantage of handling the hay crop as haylage is that an air-tight upright silo is required.

Wafering or cubing. Cubing makes possible low cost mechanized handling and feeding, reduced storage space requirements, and results in less feeding waste. However, cubing or wafering has not become a common practice outside of the southwest because: 1. Hay must be dried to a moisture content lower than is required for making field cured baled hay. This further increases field losses and the threat of rain damage. 2. The present cost of wafering machines far exceeds the cost of other hay making equipment.

Loose hay stacking. Within the past year new equipment has come on the market which completely mechanizes the building of a "compressed" stack. How this equipment will compare in cost and capacity with other handling equipment already available is not known. The most efficient way to feed the hay out of these compressed stacks has not been determined.

Silage

The crop to be made into silage and its moisture content will determine what type of harvesting equipment to use. With the wide variety of attachments available, the same forage harvester can be used to prepare most any crop ranging through corn and sorghum silage to drier materials such as haylage or low moisture silage.

Conditioning haylage. Conditioning the crop when cut speeds harvesting of low moisture silage. High speed self-propelled mower-conditioners cut, crush, and windrow the crop in a once over operation.

Such equipment is recommended for large operations where several hundred tons of low-moisture materials are to be processed.

Silage Storage. Silage can be stored successfully in a variety of structures. Before you decide which type best fits your needs consider the features of each.

Upright silos, both gas-tight and conventional, fit best in a system using a mechanical bunk. Horizontal silos—including stack, bunker, and trench—work best with a wagon feeding system.

Stack silos are suitable for temporary or emergency use. They have been fairly successful when filled with corn silage in the late fall and fed out before warm weather comes in the spring.

Horizontal silos have the lowest investment cost per ton of storage, but also have the highest storage losses. However, with proper management losses can be kept within reason.

Conventional upright silos with tight walls and well sealed doors are fairly airtight except at the surface. Sealing the top with plastic can keep losses below 5 percent.

Gas-tight silos cost more, but have lower storage losses and provide a flexibility useful in some feeding operations.

Silage Handling

Horizontal silo unloaders. On most farms a heavy duty front end hydraulic loader provides a satisfactory way to unload a trench or bunker silo. It is difficult to remove only a thin layer from the exposed surface of the silage with this type of unloader, and spoilage may be excessive in warm weather.

For large operations a truck or tractor-mounted horizontal silo unloader can be justified. The specially made unloader cuts material from the exposed vertical silage face without disturbing the packed silage and introducing air. These unloaders will load a 2 ton wagon in 3 to 5 minutes.

Upright silo unloaders. Top unloaders vary in design but all cut the silage loose, convey it to the center of the silo, and discharge it from the silo.

Bottom unloaders must be more rugged than top unloaders to withstand the increased pressure from feed stored above.

Unloading rates vary depending on the type of material, moisture content and length of cut. Average unloading rates are about 1 ton per hour for each horsepower of the unloader for unfrozen corn silage. Grass silage unloading will average about ⅔ ton per hour per horsepower.

Selection of top unloaders for tower silos (Table 2) involves such decisions as:

1. Cable suspension versus surface riding.
2. One auger versus two augers.
3. Discharge through a hole in the silage stack versus through the silo chute.
4. Drive accomplished by wheel contact with silage surface, or through a drive-ring type and size of motor.

Table 2. Estimated cost of removing hay silage from a tower silo.

Silage unloaded		By hand labor		By mechanical unloader			
Total tons	Per day tons	Hours per day	Cost per ton	Investment	Total labor costs	Total power and equipment costs	Total costs per ton
200	1.1	0.37	$0.68	$1,250	$26	$217	$1.22
400	2.2	0.87	0.80	1,350	33	249	.70
600	3.3	1.28	0.78	1,450	40	282	.54
800	4.4	1.66	0.76	1,550	48	315	.45

Table 3. Feeding equipment, advantages, disadvantages.

Equipment	Advantages	Disadvantages
1. Open auger feeder	Minimum wear to auger. Least cost auger feeder. Fully mechanized.	Slow to feed full length of bunk. Separation of feed will occur. Difficult to clean.
2. Closed auger feeder	Uniform feeding. Unloading on either side. Adapts to stall barn. Fully mechanized.	High rate of wear—short life. Noisier than open auger. Higher cost. Some separation of feed. Difficult to clean bunk.
3. Semi-circular feeder	Lower power required. Low cost for large herd. Expandable. Even distribution of feed.	High cost for small herds. Difficult to clean bunk. Very difficult to cover.
4. Oscillating trough feeder	Relative low cost. Can handle hay. Low power required. Easy cleaning.	Does not distribute feed evenly.
5. Gutter cleaner Chain feeder	Homemade or bought. Long life. Relative low cost. Adaptable to stall barn. Self-cleaning.	Slow distribution of feed. Difficult to synchronize with unloader.
6. Lazy susan feeder	Minimum space required 15 to 18″/cow. Fully mechanized.	Cannot be expanded. Difficult to cover. Difficult to fill silo. Freezing problem.
7. Reversible belt feeder	Low power required. Can be very long. Feed chopped hay. No separation.	Difficult to synchronize with unloader.

Silage Feeding

Bunk feeder. Location of the feeder is important. The bunk should be close to the source of feed and the barn; located so that it is easy to clean; and should be easily expanded.

In the northern part of the state it may be best to locate the bunk feeder in the free stall area. In colder areas it should be covered.

Covered bunks may be desirable if feed is to be in the bunk for extended periods. A narrow roof 5′6″ above the apron will provide protection for the bunk and give minimum shade. A wide roof high enough to clear cleaning equipment provides shelter for feed and cattle, and summer shade. A wide roof may cause additional snow drifting, and may prevent thawing unless oriented about N–S or NNE–SSW. Some dairymen object to cows resting on the paved apron and so provide no shade over the bunk.

A step next to the bunk will help keep the bunk clean by preventing the cows from standing along the bunk or backing up to it. Steps also protect a bunk from cleaning equipment.

There are many pieces of equipment on the market that will do a satisfactory job. It is important to find the one that will do the job best (Table 3).

Side Unloading Wagons and Fence-line Bunk

Side unloading wagons. An alternative to mechanized bunk feeding is offered by side unloading wagons. Where silage is stored in a trench or a bunker, the side unloading wagon is a natural feeding device; and where silage is stored in a tower silo, it offers economic advantages (Table 4).

Forage wagons are available which serve both for filling the silo and for feeding. For tower silos, discharge from the front left (or right) will be adequate for both filling and feeding. For filling a horizontal silo, discharge from the rear is also desirable.

Side unloading boxes may be obtained for trucks, or they may be purchased as self-propelled units. This type of equipment would probably be limited to large operations.

Fence-line bunks. Side unloading wagons in combination with fence-line feeding reduces the initial investment of a feeding system, and total feeding time need not be any greater than for a mechanical feeding system.

In fence-line feeding systems cattle are fed from one side. This system of feeding can be used with any size operation and can easily be expanded. Driveways take considerable space, and should be surfaced for all weather use. Twice as much bunk space (but not twice as much cost) is required as compared with bunks where cattle are fed on both sides.

Complete Feeds

Complete-feed silage. A comparatively new system of feeding that appears to have some practical and economic advantages for mechanized group feeding is the use of a complete feed silage ration.

In most operations the silage and grain are stored separately and combined at time of feeding. Separate storage provides for maximum flexibility of operations.

Some new dairy housing setups have no grain feeding mechanism in the parlor. All concentrates are fed in the silage. This change in feeding methods tends to eliminate hay feeding entirely and will likely reduce investments.

Which Feeding Program?

Few dairymen will ever have the opportunity to compare two or more complete harvesting and feeding systems for the purpose of selecting the one which will provide the highest possible return.

Cornell University has made a study of the labor and costs associ-

Table 4. Estimated costs per ton for distributing silage.

Tons distributed		By wagon and scoop	Self-unloading wagon	Mechanical bunk
Total	Per day			
220	1.2	$1.16	$1.41	$1.32
440	2.4	.94	.88	.83
660	3.6	.97	.69	.71
880	4.8	.91	.60	.65

Labor is charged at $2.00 per hour. —Missouri

Feed Handling . . .

(continued from page 11)

ated with the various components which make up the many possible forage handling systems. The systems they compared were:

Feeding Program "A" (Baled Hay + Corn Silage + Summer Grass Silage)

Mechanical Bunk Feeder—Conventional Silo

Side Unloading Wagon—Conventional Silo

Mechanical Bunk Feeder—Sealed Storage

Feeding Program "B" (Hay Crop Silage + Corn Silage)

Mechanical Bunk Feeder—Conventional Silo

Side-Unloading Wagon—Conventional Silo

Mechanical Bunk Feeder—Sealed Storage

Feeding Program "C" (Random Piled Baled Hay)

Random Piled Field-Cured Hay

Random Piled Artificially Mow-Cured Hay

A number of inferences can be drawn:

1. If your present roughage program does not include corn silage, and you milk 40–45 cows or less, you will want to study all aspects of the change before going to a silage feeding program because annual costs will increase by $1,000 or more.

2. The most costly systems are those which combine both hay and silage into one feeding program. Hence, where a corn crop is grown for silage, there is a definite cost advantage in handling the entire hay-crop in silage form as well.

3. If a dairyman operates a sealed storage program, the cost per cow per year is high, and is affected very little whether the remainder of the hay crop is handled as bales or as silage. That is, a mixed silage-hay program with one sealed silo costs about the same as an all silage program with two sealed silos.

4. Regardless of herd size, the difference in annual ownership costs of an all oxygen-free storage program with a mechanical bunk feeder and an all mow-cured baled hay program (in a pole structure) is about $2200 per year.

5. As herds get large (near 80 cows) the difference between an all silage program (with conventional silos and feeding with side-unloading wagons) and an artificially-cured all-baled-hay program is less than $5 per cow.

Summary

Handling of dairy feed materials is necessarily a diverse process on most dairy farms. To objectively evaluate your feed handling system here are some guidelines to follow:

* Recognize that a handling or storage problem exists—few systems are ideal.

* Be willing to accept change when change will result in improvement—develop an objective outlook.

* Plan an orderly sequence of operations—relate machine capacities to each other to eliminate bottlenecks in the overall process.

* Select versatile equipment—perform more than one task with the same machine.

* Let livestock help—self feed, or feed mechanically in a central feeding area— eliminate manual transport of feed to individual animals.

* Examine your existing facilities —analyze your present building arrangement to see if it allows effective performance of chores and feed handling.

* Mechanize major operations—but do not "over mechanize."

Nutrients for Dairy Animals

By C. W. Nibler
Extension Dairyman

A dairy cow requires nutrients for body maintenance, growth, reproduction and milk production. Nutrients consumed in excess of these requirements are stored as body reserves. During the dairy animal's life, nutrient requirements vary because of the following factors:

1. Size of animal. Larger cows have a higher requirement than smaller cows. For example, the estimated net energy requirements for body maintenance for a 1,000 pound cow is 6.3 Therms and for a 1,600 pound cow, 9.6 Therms.

2. Age of animal. Younger animals grow at a faster rate than older animals. The requirements for growth for a two-year-old dairy animal are higher than for the three-year-old because the younger animal is growing faster.

3. Reproduction requirements are greatest the last few months of the gestation period. In addition,

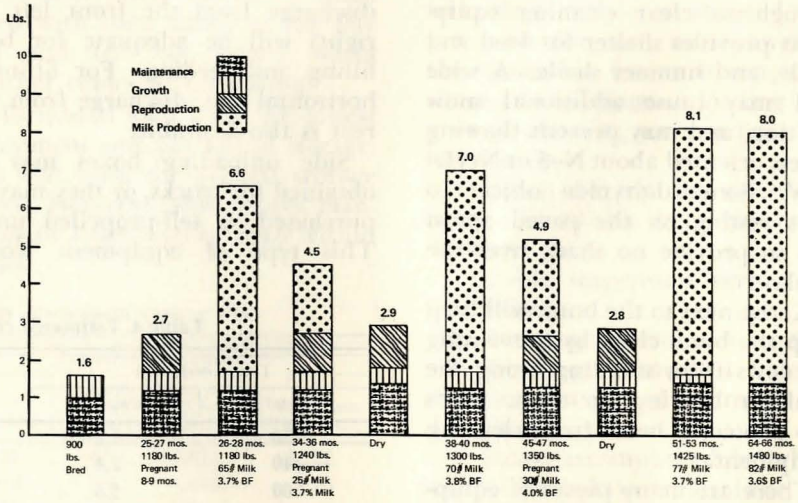


Figure 1. Protein requirements for Holstein from date of first conception until maximum production at maturity (16 to 66 months of age).

the requirements are higher for larger animals than for smaller animals. For example, during the last two to three months of the gestation period the requirement for growth of the fetus in a 1,200 pound cow in terms of estimated net energy is 5.1 Therms and for a 1,600 pound cow, 6.0 Therms.

4. Production requirements are related to milk production and percent of butterfat in the milk. For example, a cow producing 50 pounds of 3.5 percent milk requires enough feed, for milk production only, to furnish 19 Therms and for the same amount of milk testing 5.5 percent, the cow needs feed to furnish 23 Therms.

The National Research Council indicates higher requirements for each pound of milk from high producing cows than from low producing cows. For example, a cow producing 80 pounds of 4.0 percent of milk has a requirement of .40 Therms per pound of milk compared to .32 Therms for a cow producing 40 pounds of 4.0 percent milk.

Body Reserves

In addition to the requirements for maintenance, growth, reproduction and milk production, a dairy animal needs nutrients for body reserves. High producing cows soon after calving generally are unable to eat enough feed to meet all their requirements and it is at this critical period that body reserves are needed. Therefore, body reserves should be accumulated when requirements are low to be available when requirements are high. This is the basic reason for feeding dry cows properly.

Figure 1 shows protein requirements for a Holstein heifer from the time she is bred for her first calf until she reaches maturity and is producing at her maximum. The requirement varies from 1.6 to 8.1 pounds of total protein daily.

Figure 2 shows the estimated net energy requirements in Therms for the same animal. The requirement varies from 8.6 Therms (8,600 calories) to 40.2 Therms (40,200 calories). About 21 pounds of average alfalfa hay would supply 8.6 Therms, but to supply 40 Therms in addition to 21 pounds of hay, about 40 pounds of good corn silage and 36 pounds of high energy grain must be consumed.

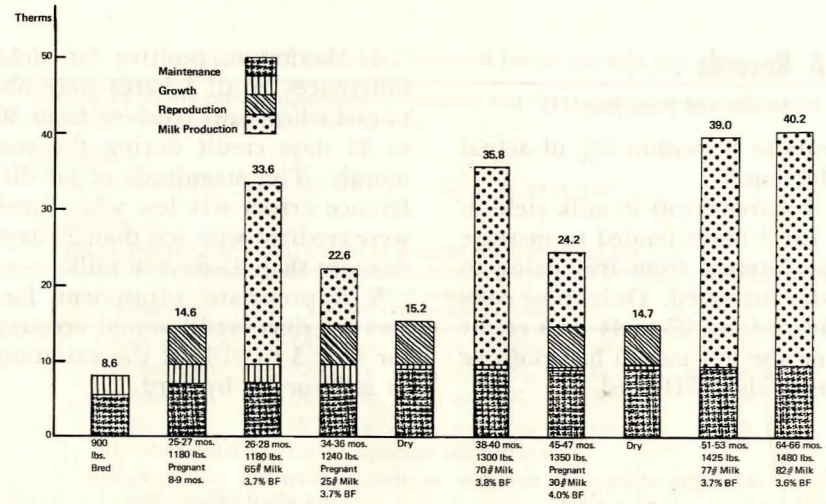


Figure 2. Energy requirements for Holstein from date of first conception until maximum production at maturity (16 to 66 months of age).

Feeding Not Complicated

When one understands the nutrient requirements of dairy animals, feeding need not be complicated. The dairy animal can use a wide variety of forages, grains, by-products from industrial processes (wheat bran, oil meals, beet pulp, etc.) and manufactured products (urea).

Nutritionally, growth and milk production is greatly influenced by the consumption of feeds that furnish energy. Protein, mineral and vitamins are important, but if a good balanced ration is provided and dairy animals consume enough to meet energy requirements plus ten percent for reserve practically all requirements will be met.

Many feeding guides are available that show the amount of grain to feed cows producing different amounts and eating various quality of forages. One good guide is E.C. 67–215 "Grain Feeding Guide For Dairy Cows," available at your county Extension agent's office.

Accuracy of DHIA Records

By R. D. Appleman
Assoc. Prof., Dairy Breeding and Management
T. E. Brubaker
Graduate Student, Animal Science

Previously published research has suggested that much of the error in DHIA calculated records (error being defined as difference from actual production) is the result of giving the cow too much or too little credit during the early stage of her lactation, depending on when she was first tested in relation to when she freshened.

To determine the influence of days from freshening to first test on 90-day production, about 60 standard monthly DHIA records in each of three herds were compared to actual production determined from milk weights and fat tests obtained weekly. The three herds involved were the University of Nebraska, Beatrice State Home and Kansas State University.[1]

Preliminary conclusions, based on data shown in Figure 1, are:

1. Definite herd differences are apparent.

2. The DHIA estimate of 90-day production of both milk and fat

[1] The authors acknowledge the cooperation of Mr. Oscar Meyer, Mgr. of the Beatrice State Home herd; Mr. and Mrs. Paul Coon, Gage County DHIA Supervisors; and Mr. George Woolsey, Clay County Agent, for their help in collection of data.

DHIA Records . . .

(continued from page 13)

appears to be within 6% of actual production.

3. Positive errors in milk yield in 2 of the 3 herds tended to increase as the interval from freshening to test day increased. Only those cows receiving from 27 to 44 days credit during the test month had positive errors in the KSU herd.

4. Maximum, positive fat yield differences in all 3 herds were obtained when cows received from 30 to 35 days credit during the test month. The magnitude of fat difference errors was less when cows were credited with less than 30 days or more than 35 days in milk.

5. Appropriate adjustment factors for days credit would account for only 3 to 21% of the variation in milk or fat by herd.

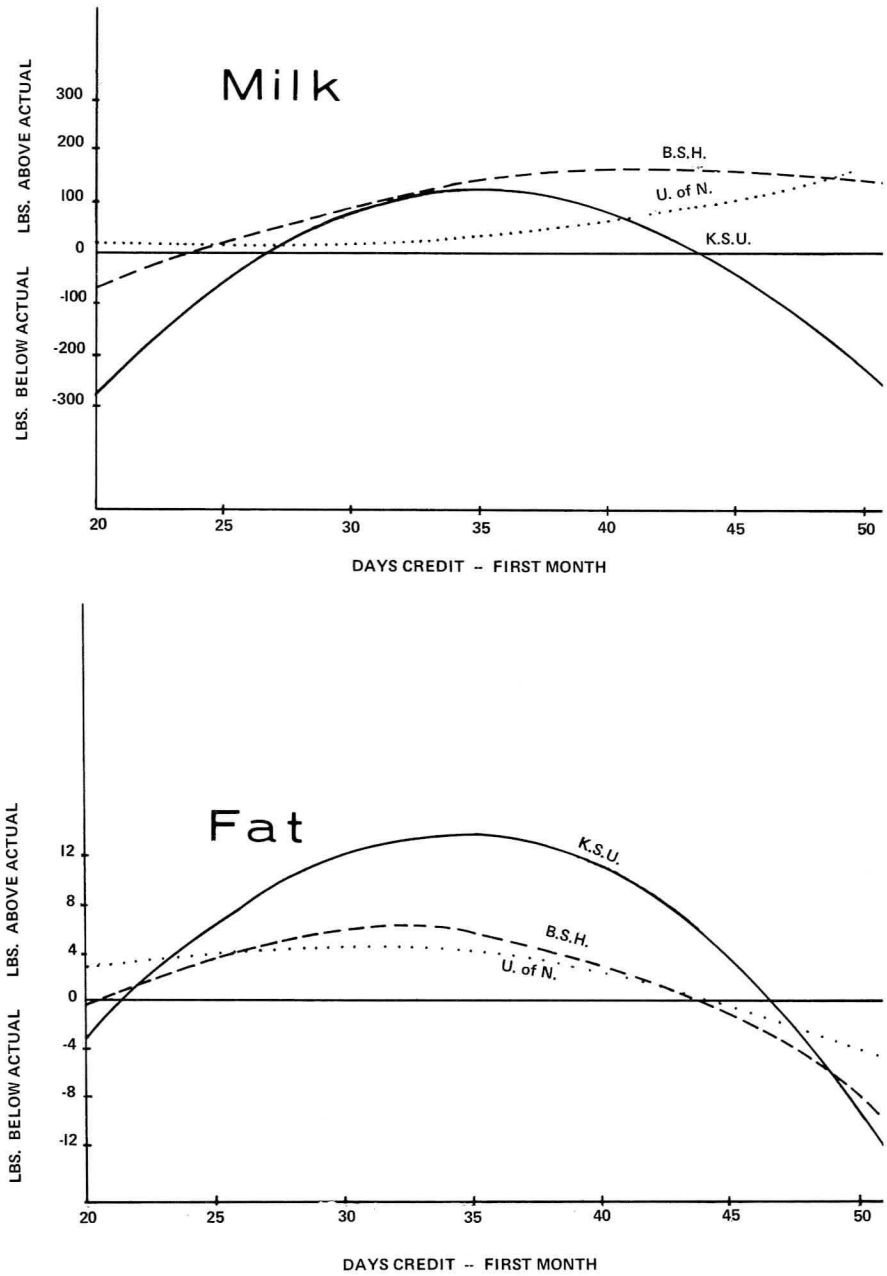


Figure 1. These charts show results of comparison of about 60 standard monthly DHIA records in each of three herds to actual production determined from milk weights and fat tests obtained weekly.

Computer Formulated

By Foster G. Owen
Professor, Dairy Nutrition

Electronic computers have been used for many purposes, from selecting a mate to guiding a missile in space.

The dairyman has benefitted from computer calculated bull proofs and DHIA data.

Computer formulated rations would appear to be the next breakthrough in application of "electronic brains" to dairy problems.

Since feed costs account for 50–60% of the total cost of producing milk even a small percentage reduction in feed cost could amount to a sizeable increase in profits to the dairyman.

For example, a good dairyman may feed 5,000 lbs. of grain ration per cow yearly. At a cost of $70 per ton he would spend $175 per year for this feed. A reduction of $10 per ton in feed cost would reduce his costs by $25 per cow, or $1,250 for a 50 cow herd.

From recent computer results we found that grain ration ingredient costs could be reduced more than $20 per ton below the cost of rations containing principally corn and soybean meal. The machine formulated rations contain all the known nutrient requirements in the amounts needed. Consequently, we think the computer can be a very important, if not an essential, piece of equipment for calculating dairy rations.

Why Use the Computer?

Many dairymen know how to use feed composition data and compute the amounts of different feed ingredients to produce a sound "balanced" grain ration. Some also do some "pencil-pushing" to keep down the cost of the ration.

Many times we find it difficult and time-consuming to get the

Least-Cost Rations

proper nutrient make-up while avoiding excesses. To select the feedstuffs to provide all these needed nutrients at the lowest possible cost is a mathematical problem just humanly impossible.

Here's where the electronic computer is required. The computer can give us exactly the amount of nutrients we ask for and will assure us that they will be provided from the feedstuffs to result in the lowest cost ration.

We can also prescribe that the computer limit the amounts of certain feeds or groups of feeds if we desire. In fact, we can set up just about any specifications we want and get exactly what we ask for.

Ration Formulation

To obtain least-cost rations we must first assemble the following information and feed it into the computer.

1. A list of feeds and the analysis of each for the various nutrients or qualities we wish to be accounted for in the ration formulations.
2. The price of each feedstuff.
3. The ration restrictions or specifications. These include amounts of required nutrients, specific feed ingredients or groups of ingredients. The amounts may be stated as a specific quantity, but when possible minimums or maximums are used to allow all possible flexibility.

The mathematical principle utilized in producing these rations involves the simultaneous solution of a series of equations. This is illustrated in Table 1.

Table 1. Principle of least-cost ration formulation.

Solving of simultaneous equations to provide nutrients, within restricted limits, from feeds, within restricted limits, at lowest cost.

Example:

X_1 = lb. corn X_2 = lb. SBOM X_3 = lb. urea, etc.

Equations:

($\leq$ = less than or equal to; $\geq$ = greater than or equal to)

Component	Percent of component x quality for each available feedstuff	Restriction (cwt.)
Crude protein	$= .085X_1 + .46X_2 + 2.82X_3, + \text{etc.}$	$\geq$ 12.5 lb.
Net energy	$= 80X_1 + 75X_2 + 0X_3, + \text{etc.}$	$\geq$ 63.0 Mcal.
Calcium	$= .02X_1 + .20X_2 + 0X_3, + \text{etc.}$	$\geq$ 0.4 lb.
Calcium	$= .02X_1 + .20X_2 + 0X_3, + \text{etc.}$	$\leq$ 1.0 lb.
(all other nutrients and component restrictions)		
(other ration restrictions, such as amounts of certain unpalatable feeds, bulky feeds, etc.)		
Cost $= C_1X_1 + C_2X_2 + C_3X_3, + \text{etc.} =$ Minimum		

The mathematical principle utilized in producing these rations involves the simultaneous solution of a series of equations. This is illustrated in Table 1.

Computer Feed Program

Over the past four years we have assembled detailed compositional data on over 300 different feedstuffs, and have established ration specifications, or restrictions, for a number of types of rations.

In Table 2 are restrictions we have recently used in formulation of Complete Feed Dairy Rations. This type ration is designed to contain the entire ration needs without any supplemental feeds.

In addition to the specific nutrient specifications, Table 2 shows that at least 30% roughage is required, but not more than 5% molasses. The ration must also contain less than 33%, in total, from

Table 2. Complete-feed restrictions.

	Per cwt.
Ene, Mcal.	$\geq$ 63
Crude protein, %	$\geq$ 12.5
Calcium, %	$\geq$ .4 $\leq$ 1.0
Phosphorus, %	$\geq$ .4 $\leq$ 1.0
Salt (TM),[a] %	= .5
Urea (281%), %	$\leq$ .75
Vitamin A, I.U.	$\geq$ 240,000
Vitamin D, I.U.	$\geq$ 400,000
Hay equivalent, lb.	$\geq$ 30.0
Molasses	$\leq$ 5.0
Low-palat, GP.	$\leq$ 33.0
Animal Pdts., GP.	$\leq$ 10.0

[a] Must contain: Iodine, Iron, Cobalt, Copper, Zinc, Magnesium and Manganese.

Table 3. Complete feed—Dairy.

	Per cwt.	Range	Price
Chopped alfalfa hay, lb.	44.4	\$1.19 – \$1.35	(\$1.35)
Hominy feed, lb.	49.7	\$1.63 – \$2.25	(\$2.09)
Urea, lb.	.36	\$2.25 – \$6.12	(\$3.05)
Dical, lb.	.115	\$ .49 – \$4.13	(\$4.06)
Molasses, lb.	5.00	∞ – \$1.71	(\$1.59)
Salt, TM, lb.	.50	...	(\$ .89)
Vitamin D, I.U.	356,000	...	...
Vitamin A, I.U.	81,720	...	...

Table 4. Computer formulated 16% grain rations.

Ingredient	Lowest cost ration	Lowest cost ration with 50% corn	Lowest cost ration with 50% milo
Wheat midds, lb.	33.00	33.00	33.00
Wheat bran, lb.	31.61	9.31	9.66
Hominy feed, lb.	14.47	...	...
Beet pulp, lb.	8.39	...	...
Molasses, lb.	9.59	...	...
Calcium carbonate, lb.	.76	.83	.84
Urea	1.00	1.00	1.00
Soybean oil meal	.40	...	...
Salt, TM, lb.	.76	.76	.76
Vitamin D, I.U.	356,000	356,000	356,000
Vitamin A, I.U.	217,920	217,920	217,920
Corn	...	50.00	...
Milo	...	...	50.00
Cottonseed meal	...	5.08	4.71

Computer Rations

(continued from page 15)

a list of low palatability feeds, including such feedstuffs as brewer's grains, distiller's grains and rye grain.

We also provided the computer with a set of the current prices. Table 3 shows the resulting ration. In addition to the ration, we also obtain the price ranges for each feedstuff. These ranges show the limit of price change which can occur for a particular ingredient in order for this specific ration to remain lowest cost.

We also have specifications for grain rations of 10, 13, 16 and 20% crude protein. Our last computer runs, made last spring, resulted in rations quite high in by-product feeds (Table 4).

Since many of our farmers produce corn and milo and these grains are widely available in Nebraska, we formulated additional rations for the same specifications, except that we required a minimum of 50% corn or 50% milo. We found that the price of a 16% protein ration was increased by 12.3% with the corn and by 11.2% with the milo compared to the lowest cost ration. For the 20% protein ration, the price was increased by 23.2% when the 50% level of corn was required, and by 11.2% when 50% milo was required.

Conclusion

This report has been prepared to focus attention on the potential for reducing feed cost through use of computer formulated rations. In addition, it is intended to explain the principles of this method of formulating rations and to present results of experimentation with this technique for producing dairy rations.

The rations presented in this report are not intended for use, but are merely for illustrative purposes. However, in the near future, we plan to make available, through publications, the results of our research. It is expected that these results will be used extensively by all interested in this method of ration formulation.

Ventilation is important in the new law.

Milk Law and What it Means

By T. A. Evans
Extension Economist
(Food Marketing)

The 1969 Nebraska Legislature adopted a set of sanitation standards for the production and processing of "manufacturing grade" milk. This is milk used in the "manufacture" of such products as cheese, butter, nonfat dry milk and ice cream.

This new law will not affect those who already have adequate facilities and are producing a satisfactory product. Some will undoubtedly find it necessary to make changes or adaptations of present facilities. For a few it may even mean construction of new facilities.

Requirements

The new law requires that "a milkhouse or milkroom conveniently located and properly constructed, lighted and ventilated shall be provided for handling and cooling milk in cans or in farm bulk tanks. *It shall not be used for any other purpose.*" It should be noted that milking equipment need not be washed and/or stored in the milkhouse or milkroom but "adequate facilities . . . shall be provided either in the milkhouse or milkroom or in a nearby enclosed facility."

A requirement probably already basically met by most producers is that "a milking barn or milking parlor of adequate size and arrangement shall be provided to permit normal sanitary milking operations. It shall be well lighted and ventilated, and the floors and gutters in the milking area shall be constructed of concrete or other impervious material. The facility shall be kept clean, the manure removed daily and no swine, fowl or other animals shall be permitted in any part of the milking area."

The third major point insofar as producers are concerned is the cooling requirement. The law states that "milk in cans shall be cooled immediately after milking to sixty degrees Fahrenheit or lower unless delivered to the plant within two hours after milking . . . Milk in farm bulk tanks shall be cooled

Rapid cooling a must.

Remove manure daily.

Avoid contamination.

to forty degrees Fahrenheit or lower within two hours after milking and maintained at fifty degrees Fahrenheit or lower until transferred to the transport tank." This requirement should not cause too much difficulty since most milk producers already have mechanical cooling equipment.

"Acceptable" Milk

The law also sets up standards for sediment content and bacterial count for this grade of milk. "Acceptable" manufacturing grade milk must not contain more than *3 million* bacteria per ml. This is very lenient when compared with the *100 thousand* standard set for Grade A producers.

The law states that "the flavor and odor of acceptable raw milk shall be fresh and sweet. The milk shall be free from objectionable feed and other off-flavors and off-odors that would adversely affect the finished product . . ."

The law also sets up a procedure for producers transferring from one plant to another. Either the producer himself or the previous buyer must furnish the new buyer with the producer's quality record for the past 90 days.

Herd health requirements, condition in which milking facilities and equipment are to be maintained and certain procedures to be used in producing milk are also briefly spelled out in the law. None of these requirements are excessively rigid and are consistent with practices being presently carried out by most milk producers.

License Required

A license is required to produce and market manufacturing grade milk. There is no charge for this license and it does not need to be renewed each year. It can, however, be suspended "upon evidence of violation by the holder of any of the terms of this act, or for interference with the director (Director of Agriculture or his duly authorized agent) in the performance of his duties. The director may revoke a license for serious or repeated violations."

This law will be enforced by the State Department of Agriculture. This does not necessarily mean, however, that state inspectors will be visiting each and every farm that produces manufacturing grade milk. While this is not spelled out in the law, it is probable that routine farm inspections will be made by a fieldman from the plant to which the producer is selling his milk and only spot checks will be made by a state inspector to determine degree of compliance with the law.

The law will go into effect about January 1, 1970. Six months after the effective date every producer of manufacturing grade milk must have obtained a license from the State Department of Agriculture. The department may, however, extend the time for compliance with herd health, facility and procedural requirements for a period not to exceed 24 months from the effective date.

Your State DHI Association

By Philip H. Cole
Extension Dairyman

The Nebraska Dairy Herd Improvement Association was officially organized March 7, 1966. The state was divided into three districts (Figure 1) and five directors were elected from the three districts. Directors elected were as follows: Wayne Fry and Ted Martin, District I; Paul Grabouski and Howard Defrain, District II; and Mason Newkirk, District III.

The purpose of the newly formed organization was to promote the improvement of dairy cattle in the state of Nebraska by:

1. Coordinating the work of local Dairy Herd Improvement Association in Nebraska and improving services to members.

2. Cooperating with the American Dairy Science Association; the Agricultural Research Service; the Purebred Dairy Cattle Association; the Cooperative Extension Service, University of Nebraska College of Agriculture and Home Economics; and the Department of Animal Science in the conduct of dairy record keeping programs.

3. Cooperating in the establishment of policies and rules for the conduct of dairy record keeping programs in Nebraska in keeping with the uniform rules and regulations of the American Dairy Science Association and the Purebred Dairy Cattle Association.

4. Maintaining a high standard of integrity in the Dairy Herd Improvement records as a protection to the dairymen who use these records in any phase of their dairy herd improvement program.

5. Extending and improving the Dairy Herd Improvement Program in Nebraska in order that more cows may be tested, and that records may be continuous, accurate and dependable.

Your State DHIA

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6. Cooperating with breed organizations, health authorities, youth organizations, educational institutions and other groups in activities of mutual interest.

5¢ Per Cow

Membership in the state association is made up of county and multiple county DHI associations. Each local association is assessed 5¢ per cow as its membership fee in the state association.

In April of 1968 the Nebraska DHIA was represented at the annual meeting of the National DHIA by Mr. Paul Grabouski. On the recommendation of Mr. Grabouski, and the strong encouragement of Mr. Craig Bean, President of the National DHIA, the state association affiliated with the national association in April 1969.

The first annual meeting of the Nebraska DHIA was held in York on December 4, 1968. At that meeting the association was challenged to accept responsibility for the following activities:

1. To develop greater uniformity in the conduct and acceptability of the Nebraska program.
2. To promote an opportunity for the membership to more effectively exchange information.
3. To make recommendations to the North Central Regional DHIA Subgroup and to National DHIA, Inc.
4. To consider and recommend research projects (both state and national).
5. To develop promotional and educational programs in DHIA.
6. To assist and advise in the business and organizational activities of the local DHIA's.
7. To name a representative to the National DHIA, Inc.

Since the December meeting, the state association has been incorporated, added more local associations to its membership and sent an official representative to the national association meeting in Denver, Colorado and is presently serving as a member of the board of directors of the National Association.

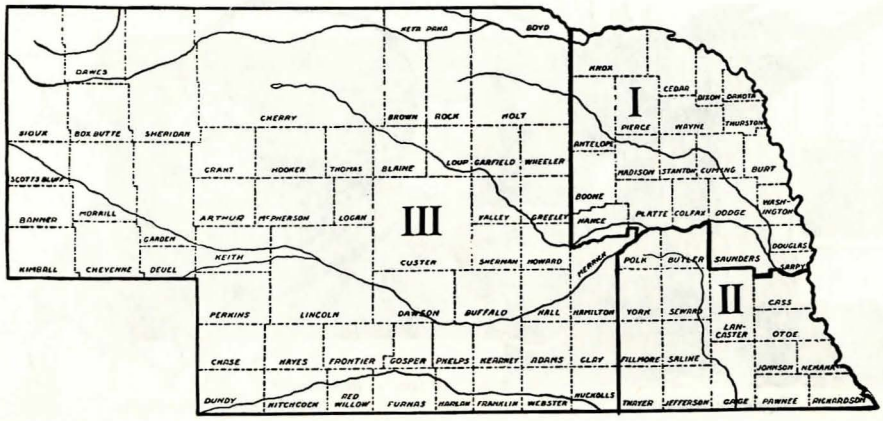

Figure 1. Nebraska DHIA Districts.

Important Job

The team that consists of DHIA members, supervisors, directors of local, state, and national DHIA has an important job to do. The importance of this job becomes quite apparent when we consider:

1. People have confidence in DHIA records and purchase animals on the basis of these records.
2. DHIA records are used in sire evaluations.
3. The purebred breed associations more and more are going to rely on DHIA records.
4. The DHIA member is paying the bill and reserves complete and accurate records on his cows and herd.

An important function of the state DHIA in the future will be management of the finances of the state DHIA program. This job is presently being handled by the Nebraska Inter-Breed Dairy Council, but it appears now that sometime in the future this function will become a responsibility of the state DHI group.

New Milk Metering Device

By Robert D. Appleman
Assoc. Prof., Dairy Breeding and Management

University of Nebraska researchers have been testing the accuracy of metering devices to provide dairymen with an economical and accurate method of determining each cow's milk weight.

The absence of such devices is one of the primary reasons only 10% of the Nebraska cow population is on test. A New Zealand meter, called the "Tru-Test," has been the one studied recently.

These results, along with those obtained at the New York, Illinois, North Carolina, and Pennsylvania experiment stations, are being evaluated. If the meter is sufficiently accurate, final approval for its use in the DHIA program will be granted by the National DHIA Coordinating Group.

The Tru-Test meter has been checked for accuracy at the University of Nebraska on three different occasions. Each successive test involved a model that was easier to use, malfunctioned less frequently, or was more accurate.

Results of the Nebraska trials are shown in Table 1. The original meters, tested in January, 1968, were difficult to use and slowed up the milking routine. On the average, the meters appeared relatively accurate, but were not approved because meter number 6 credited the cow with too much milk five times as frequently as the cow was short-changed.

The March, 1969, trials involved meters that were easier to operate, but the accuracy was still unacceptable.

In the most recent trials, both meters tested appear to have met the

required standards. Meter accuracy, expressed as a percentage of true scale weight, averaged 99.5 and 100.0%, respectively. This means that, on the average, the difference between meter weights and tank measurements should not exceed 10 pounds per 1,000 pounds of milk produced.

With individual cow milk weights, obtained on cows producing 25 pounds per milking, about 50% of the obtained weights are accurate to within ½ pound of the actual yield. Two-thirds of the samples are within 0.8 pound of actual yield, with the remaining one-third equally divided between too high and too low.

The fat test obtained from the meter and from a bucket averaged 4.04 and 4.08%, respectively, in the Nebraska trials. Forty-nine of the 50 meter samples tested were within one-tenth percentage point of the test obtained from the bucket sample.

If similar recent tests, conducted at other state universities, provide equally good results, it seems probable that the Nebraska dairyman will soon have a fast, economical, and relatively accurate metering device available for use on test-day.

Table 1. Summary of Nebraska "Tru-Test" meter trials.

Date	Meter No.	No. cows tested	Meter accuracy (% of scale wt.)	% of measurements in error by ½ lb. or more[a]	
				High	Low
1/68	5	50	99.7	8.0	12.0
	6	50	101.1	32.0	6.0 [b]
3/69	53	46	100.5	37.1	5.6 [b]
	57	54	101.8	23.9	10.9 [b]
8/69	33	52	100.0	26.9	23.1
	36	52	99.5	19.2	23.0

[a] Based on 25 lb. milk flow per milking.
[b] Insufficient accuracy to warrant approval.

Progress Reports

Complete feeds before and after calving, consisting of alfalfa silage and sorghum grain (plus minerals), have been evaluated. Two different rations, containing 44% or 61% grain on a dry weight basis were full-fed for 3 to 4 weeks before freshening and the first 12 weeks after calving. The high-grain ration did not improve either milk yield or composition when fed either during the dry period or in early lactation. The 44% grain ration was distinctly superior to the high-grain feed in terms of efficiency of energy use.

Teat "Streak Canal" anatomy of 105 cows was determined from X-rays of the teat end. The streak canals become longer and wider with advancing age of the cow. The sire of the cow was observed to have a significant influence. These measures appear to be only slightly related to either "udder health" or "rate of milk flow." There is evidence to suggest that cows with a "narrow" streak canal may be more resistant to new intramammary infections.

Improving urea utilization was the objective of an experiment in which 5% dehydrated alfalfa and 5% molasses, both singly and in combination, and in both pelleted and non-pelleted rations, were tested. No benefits in digestibility of dry matter, protein, fiber or nitrogen-free extract were derived from any of these treatments.

Positive pregnancy detection by a simple test would be of economic benefit to dairying. An experiment recently completed involved microscopic examination of vaginal mucus. Changes in type of "ferning," as well as dry matter percentage, was observed. A peculiar "clump" ferning appeared most frequently in mucus from pregnant cows, but the same type sometimes was present in mucus from non-pregnant cows, preventing this method from being a positive indicator of pregnancy.

Once-a-day milking during the last month of lactation decreases milking labor costs by $3.00 per cow. Cows previously milking 33.0 lbs. daily, when milked only once daily, produced only three-fourths as much milk as the control group. Net loss in income per cow per month was $7.90. Milking labor saved was charged at $2.00 per hour and 3.5% milk was valued at $5.00/cwt.

Roughage requirements of the young calf have not been well researched. Studies comparing a starter ration without roughage with ones containing ⅓ ground corn cob, ⅓ dehydrated alfalfa or ⅓ beet pulp have been initiated. The control starter contained corn, soybean meal, wheat midds, molasses vitamins, minerals and antibiotics. Additional trials have involved pelleted starter rations containing either ⅓ or ½ chopped hay. Questions to be answered include: Is it better to allow roughage free-choice or to include it as a part of the starter ration? How much roughage should the ration contain—33%, 50% or 100%?

Variation in milk yield and composition from milking to milking is being studied to find more economical methods of taking milk samples and still maintaining the necessary accuracy of the DHIA program for farm management and sire proving purposes. More than 50,000 milk samples are being tested for fat,

Variation in milk fat, protein and energy is studied in this laboratory.

Progress Reports

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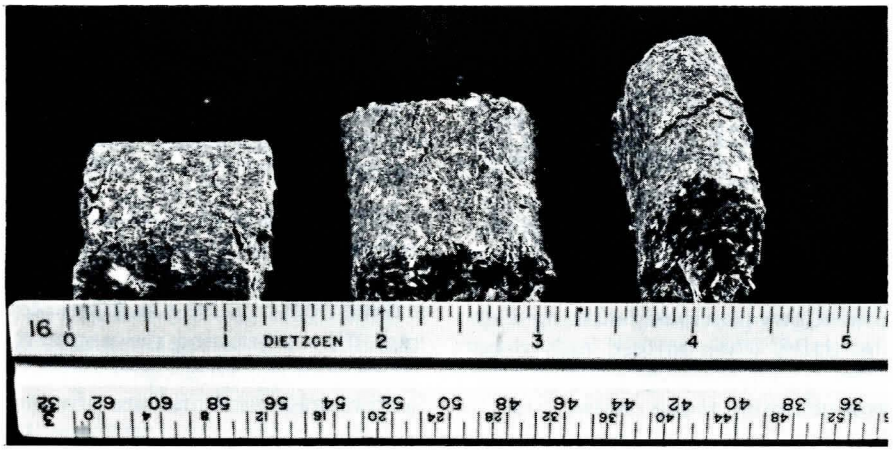
protein and energy content during an 18-month period.

Specific objectives to be obtained from this data, combined with that from other cooperating universities, include the determination of: (1) the accuracy and precision of milk and fat yields required by farmers in making management decisions, (2) the sources and magnitude of bias in estimation of lactation yield under the test interval method of calculating standard DHIA records, (3) the accuracy of periodic single-milking and 24-hour milk weights and samples, and (4) appropriate adjustments so that the most accurate possible estimates of total yield can be calculated.

Enzyme preservatives for alfalfa silage, preserved this fall in a plastic-covered stack, are being tested to determine the value of a lactic type culture and a combination lactic and *Aspergillus Oryzae* culture. Dry matter and protein losses will be measured. In addition, lactating cows will be used in evaluating the combination culture added at the time of ensiling and this same culture added to the ration at feeding time.

Complete rations in wafer form are being evaluated at the present time. A 1½″ x 1½″ x ½″ wafer composed of coarse chopped dehydrated alfalfa, dehydrated whole corn plant, and a grain mixture consisting primarily of milo and wheat middlings are being fed. Milk production and fat test response, as well as physiological normality of the 12 cows involved will be measured. Another aspect of the trial includes the feeding of pelleted dehydrated alfalfa, pelleted dehydrated corn plant, and a pelleted grain mixture. Pellets will be fed both mixed and separately.



Sample of the complete feed wafer being evaluated.

Urea preparations for the lactating cow have been evaluated. Data, now being assembled for analysis, have been collected on the value of two different products. Dehy 100 is a pellet composed of dehydrated alfalfa and urea; whereas, Starea contains gelatinized starch ingredients and urea. Both products, at the universities where developed, showed promise of improving urea utilization.

A cost of milk production study is being undertaken beginning January 1. Thirty-two farms are being included so that bench marks can be developed for determining the probable effects of: (a) modernization or the remodeling of facilities, (b) increased herd size, and (c) increased level of milk production.