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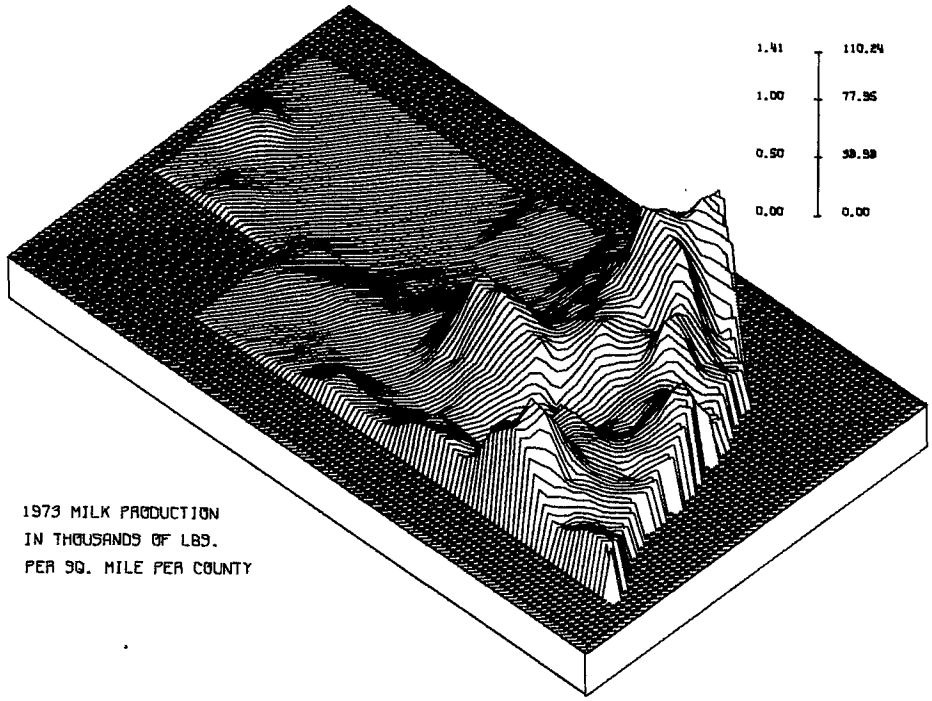

1975 DAIRY REPORT

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University of Nebraska–Lincoln Institute of Agriculture and Natural Resources

J. L. Adams, Director of Extension
H. W. Ottoson, Director, Experiment Station
T. E. Hartung, Dean, College of Agriculture

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Cow Behavior—What Can You

P. H. Cole
Extension Dairyman

Any dairyman who has watched his cows closely can tell you there is a lot of difference in how individual cows behave. There are dominant and aggressive cows, gentle cows, timid cows, those that are always first or last, those that are good mothers, and some that are downright smart.

How Cows Behave

In recent years researchers have begun to look closely at how cows behave on pasture, in the dry lot, at milking time and calving time. They have tried to decide if cows are really intelligent, and how they learn. They have also tried to determine if we can train cows to behave the way we want them to.

Both field observation and research agree that most herds are dominated by a "boss" cow and that the rest of the other cows "know their place" in the "peck order." The "boss" cow is usually an older and larger animal that has been in the herd for a longer period of time. Smaller, younger cows tend to be on the lower end of the "peck order." The dominant cow is seldom the leader of the herd as the herd moves. The dominant cow tends to stay in the middle of the group as the herd moves. She rarely shows up at the tail end of the group.

The cow that leads the herd when it is on the move usually comes from about the middle of the "peck order."

The timid or submissive cow may be just the last cow in the "peck order" or she may just plain be a timid cow. Authorities do not all agree on how this cow gets her status in the social order.

A fourth type animal in the social order is the cow that is always the first one into the milking parlor. Her aggressiveness and her stage of lactation probably both help determine who this cow will be. Lining up order definitely is not the same as social dominance or "peck order." Cows tend to line up in the same order day after day for long periods. One cow was observed to enter the parlor first for 80 weeks.

Once a herd is established and "peck order" has been determined there is usually a minimum of conflict. However, there are a number of occasions when the dominance or social position factor causes conflict in a herd.

Conflict in the Herd

One of the frequent causes of conflict in a herd is the introduction of a "new" cow. The "new"

Here is the "boss cow" doing her thing, having her own way.

The Cover: Computer generated graph shows 1973 milk production in thousands of pounds per square mile per county.

Acknowledgments

Eli Lilly and Company, Greenfield, Indiana.

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MaNuVA Products, Salinas, California.

Mid-America Dairymen, Omaha, Nebraska.

Upjon, Veterinary Products, Kalamazoo, Michigan.

Do About It?

cow has two problems: first she has to be accepted as part of the herd, and secondly she has to find her place in the "peck order."

Another cause for conflict is the result of too many cows. In extremely large herds where there were too many animals for the individual to recognize all the other animals, stress sometimes develops simply because a stable social order is never fully achieved. A case has been cited in a 800-cow herd where the timid or submissive cows had to be provided water in the parlor in order for them to get enough.

Social order stresses cows other ways, also. For example, the low ranking cows simply don't get their share of feed, water and rest. A low ranking animal must always wait in line and will have to give up her spot at the feed bunk or water if a more dominant or aggressive cow wants it.

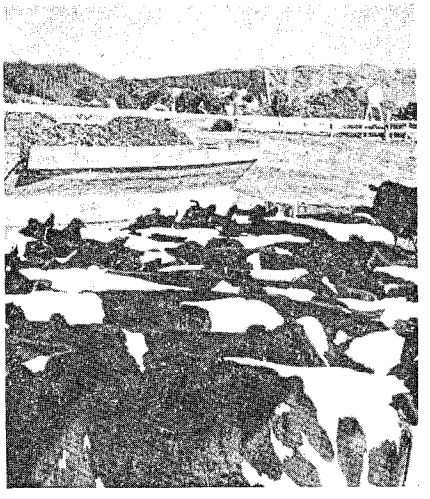
Both the low ranking cow and the high ranking cow move around more then the other cows. The timid cow is constantly being pushed aside, and the boss cow is busy defending her position and space. Cows in the middle of the social order move around the least and are likely the most efficient users of feed.

However, some competition at the feed bunk is desirable. Studies have definitely shown that cows fed individually do not eat as much as those fed in groups. A reasonable amount of competition appears to be desirable.

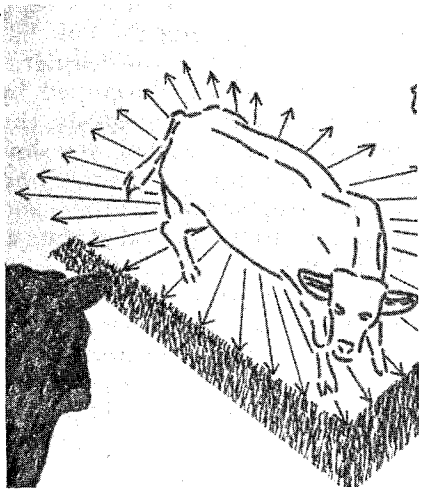
Another interesting fact about cow behavior is that the cow takes her "territory" with her. Many wild animals will stake out their territory and will not let other animals enter this area. The cow has a similar territory but it moves along with her wherever she goes. For example, as a cow moves across the lot to the waterer and other cows come into contact with her territory this is a challenge to her and will likely result in conflict.

Management Techniques

1. *Raise calves individually.* Research indicates that calves raised individually are less aggressive and easier to handle as adults.
2. *Culling.* When considering animals to cull look for low producing "boss" cows and weak, submissive cows.
3. *Limit group size.* If at all possible limit group size to 100 or less. Both Purdue and New Zealand studies have shown we can expect up to a 5% loss in production if herd size is much larger than this.
4. *Don't shuffle cows.* When grouping of cows becomes desirable consider ways to group animals that will not require constant shuffling of cows from one lot to another.
5. *Allow ample feed space.* Allow a minimum of 2′ per cow of bunk space. Ample space allows more timid cows their share of space and feed, and reduces conflict.
6. *Avoid severe slopes.* If bunks are located on a slope of more than 3-4% there will be a constant shifting and movement down the slope.
7. *Fenceline feeding.* Use fence line feeders or auger feeders that divide the herd.
8. *Keep feeding equipment in good shape.* Feed bunks and racks need to be kept in good shape so that no space is wasted.
9. *Feed a complete feed.* Using a complete feed (hay, silage and grain mixed together) gives all cows an equal opportunity at all feeds.
10. *No grain in parlor.* This gives cows more time to eat grain, and speeds up milking operation. According to one research worker the milking process and the feeding process are completely different body functions. Entirely different hormone and nervous systems are involved and it may actually be a conflict for the cow to have both processes going on at the same time. This system will require some lotting of cows and force some shuffling of cows.
11. *Use individual concentrate feeders.* There are on the market at least two different pieces of electronic equipment that allow the individual cow to receive extra feed while she is part of a larger group. These are discussed in more detail in another article in this publication.



Another cause for conflict—too many cows.



The cow takes her "territory" with her.

Effect of Rearing

Other factors affect the aggressive or submissive nature of cows. Studies have been made to determine the effect of how the cow was handled as a calf on the cow's behavior as an adult. Calves were raised (1) by being housed together and fed together, (2) housed and fed individually, (3) housed together and fed individu-

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Cow Behavior

(continued from page 3)

ally, and (4) housed individually and fed together.

Cows raised and fed together as calves were very dominant and aggressive as adults. They also tended to be nervous and shy and easily excited and, in general, difficult to handle.

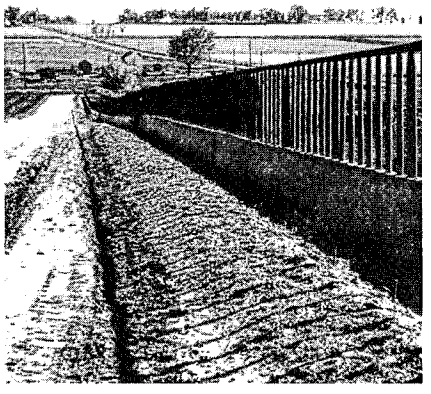
Cows raised and fed individually tended to be very submissive, calm, and easy to handle.

Cows raised together and fed individually tended to be very dominant and very aggressive toward all other animals. They rejected their calves and were difficult to handle in the parlor.

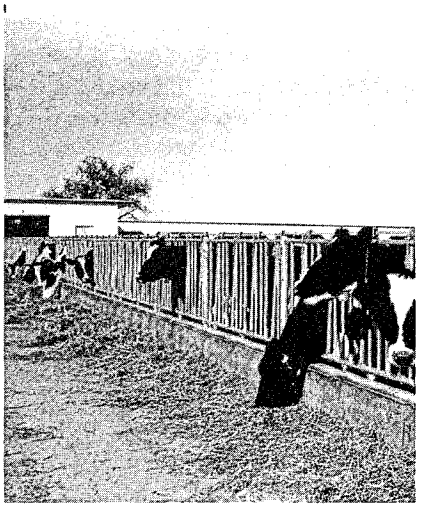
Cows raised individually and fed together tended to end up in the middle of the "peck order" as adults and were nervous and hard to handle.

How Smart Are Cows?

Research and field observations indicate that cows are not fast learners but do have the capacity to learn. An interesting example of a cow's ability to learn is given by W. G. Wittlestone, a New Zealand research worker who has studied cow behavior. Wittlestone used a device consisting of a simple grain dispenser driven by a small electric motor through a sprocket and bicycle chain mechanism. The cow operates the mechanism by means of a "nuzzle plate," a simple plastic plate connected by a lever to a micro switch.



Bunks on a slope of more than 3–4% will cause cows to shift down the slope.



Keep feeding equipment in good condition.

Normally, a cow would push the "nuzzle plate" a specified number of times and receive a small amount of grain as a reward. One cow, while learning to operate the "nuzzle plate" successfully, also learned that she could receive grain by pulling on the chain and turning the sprocket wheel. She learned to associate the noise of the motor and the turning of the wheel with receiving grain.

Another example is cited of a cow that learned to operate the control switch on the automatic feed dispenser in a parlor with her tongue.

Can Cows Be Taught?

A number of techniques have been used to check learning ability. The common maze has been used and in general the cow has been shown to be a slow learner.

Another device, developed by Russian scientists to study the cow's ability to anticipate, is a slow moving trolley carrying feed which disappears into a tunnel and reappears after a period of time at the other end.

An animal with no anticipatory ability will follow the trolley, eating from it, until it disappears and then lose interest. The cow with the ability to anticipate will project the movement of the trolley and walk along beside the tunnel in anticipation of the feed reappearing at the other end. When cows were checked on this type of apparatus they were found to be slow learners. Cows were "startled" (stare at the object with their feet set) by the trolley, and it took them two weeks to learn to anticipate the reappearance of the feed. Bulls seemed to be even more startled and never did learn to anticipate the reappearance of the trolley.

Other research has shown that cows have the ability to decide, and will alter conditions if there is a way to do it. For example, two sets of conditions may be set up in a milking parlor such as variation in vacuum levels, pulsation rates, or pulsation ratios. The cow can (and will) manipulate the conditions indicating which she prefers. It seems reasonable to assume that similar types of conditions could be set up where a cow could determine what feed, temperature, humidity, music, etc., she would prefer.

A sidelight to the study of the cow's learning ability is the similarity between cows and dolphins. Both are very curious. If anything new appears along the fenceline cows will immediately line up to see what is going on. Porpoise trainers have noticed the same type of behavior when a new object appears near the tank.

As dairymen learn more about animal behavior through observation and research they are better able to do a more effective job of managing their herds and in planning new facilities.

Feeding a "complete" feed means all cows get an equal share of all feeds.

"One-Man" Hay Handling Systems

Kenneth Von Bargen
Associate Professor, Systems Engineering

Hay harvesting and handling can be accomplished today by one-man systems using highly mechanized machines. Modern hydraulics power many of these machines and give them much operating flexibility. The pull-type windrower is an example. One model can cut to the right, left or directly behind the tractor.

Ten years ago more than 90% of the hay was conventionally baled except in the areas such as the Nebraska Sandhills. System capacities were often limited by the ability of a man to manually stack bales. Introduction of self-propelled windrowers and bale wagons began to reduce the labor required in haying. Today, big package haying machines can reduce total labor requirements by ⅓ over conventional baling. At the same time, annual tonnages needed for economical operation have dropped to the point where smaller hay growers should consider the big-package machines.

Decisions concerning selection of haying machines depend on the haying operations and the total complement of machines on the farm. Hay growers want low labor requirements, low harvesting and handling costs, the possibility of harvesting increased amounts of high quality hay, and easily managed systems for feeding dairy cows.

Machinery complement factors are related to the time available for field work. Field time depends upon the hay crop, the cutting, weather, sequences of operations and the operating policy—such as working on Sunday. A certain amount of risk must be assumed for not completing an operation in the planned time. This is done by determining the field time at some completion probability level. Other factors related to the complement of machines are the tractor-machine match, total machine costs, and the timeliness of all operations.

Big package haying machines are of two major types. One is the large roll baler and the other is the loose hay stacker wagon.

Roll Balers

Large roll bales usually weigh more than 1,000 pounds. Bales of this size make a complete handling system a must. There are two basic types of roll balers available (Figure 1). One type forms the bale by rolling the hay in the windrow between the ground and the baler. The other type forms the bale off the ground by rolling the hay between belts, rollers or chains (Figure 2). Off-ground baling has the advantage of being able to move the bale in the baler after it has been formed.

Off-ground roll balers have a maximum capacity of about 30 bales per hour. Effective capacities range from 10 to a top of about 20 bales per hour. Moisture at baling should be similar to that for conventional baling. When the hay is too dry, leaf losses can be high. Likewise, if hay is baled at a moisture higher than that of conventional baling spoilage will occur.

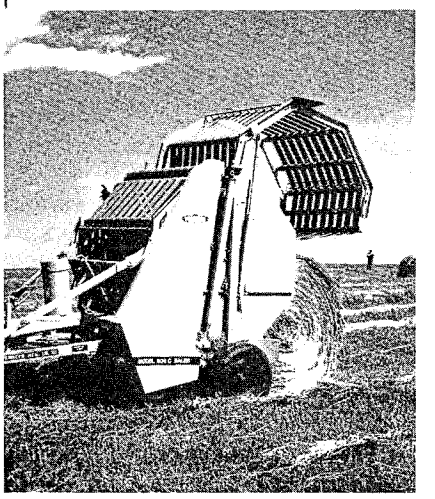


Figure 2. Off the ground roll-type baler dropping a completed bale.

An ideal windrow is uniform in depth and as wide as the roll baler. If the windrow is not ideal, the operator must drive to uniformly distribute the hay across the entire bale length. Tandem side delivery rakes are being marketed to combine windrows to make it easier to form good bales and naturally increase the effective capacity of the baler.

There are many different ways to handle roll bales. A standard front end loader can be used. Another method is to mount a bale fork on the three-point hitch of a tractor (Figure 3). This is a low in-

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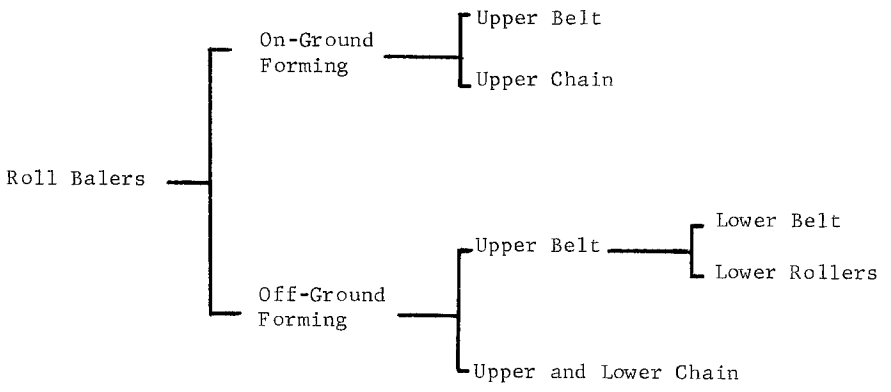


Figure 1. Options for roll balers.

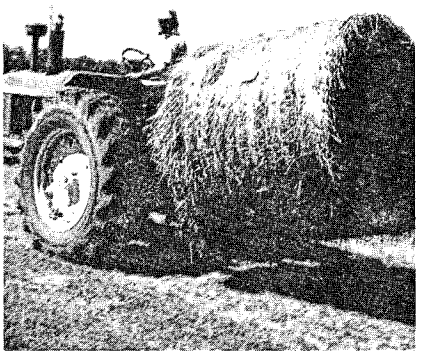


Figure 3. Tractor-mounted bale fork lift.

"One-Man" Hay Handling

(continued from page 5)

vestment method but requires much time where bales are transported a considerable distance one at a time.

Roll bale handling devices are available that mount in a pickup truck. Bale trailers either for single or multiple bale handling are also available. If more than one bale must be handled at a time, stack movers have been successfully used (Figure 4). Other bale handling devices are available that both move and unroll the bale. One such unit allows one bale to be carried on a front loader and a second on the rear of the tractor in the bale unrolling unit. It is important to check the weight carrying capacity of the tractor tires to avoid overloading and damage, and to make certain the bale handling device fits the bale length. Tractor instability caused by eccentric loading may lead to tragic accidents.

There are several points to observe when storing roll bales. They should be stored on a well-drained site. Some observations have indicated the lower six inches of the bale is likely to have a moisture build up which can cause spoilage.

Bales stored in a line should not touch and about one foot of spacing is recommended to allow moisture to drain off. The bales should be aligned for maximum sun exposure on the sides of the line of bales. For this reason a north-south line is best.

Take precautions to prevent fire losses with long lines of bales. Avoid standing the bales one on top of the other, because such stacking tends to be unstable and can cause accidents.

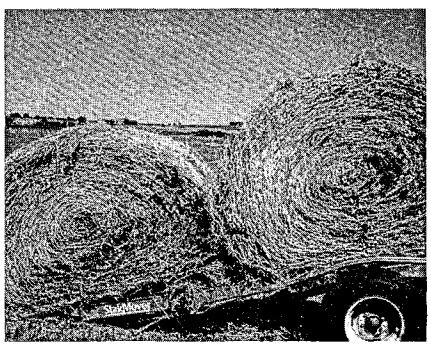


Figure 4. Tilting-chain-bed stack mover for a 3-ton stack.

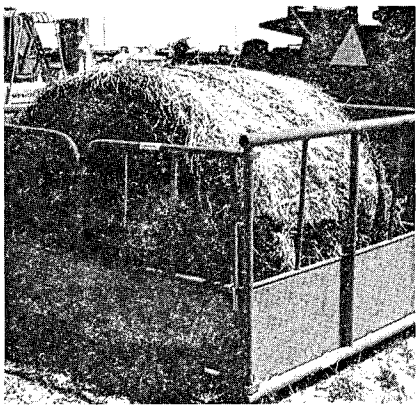


Figure 5. Tractor-mounted bale fork with attached panels for controlled feeding.

Roll bales are tied with 5 to 12 wraps of twine. Observations during 1974 indicated that 8 to 9 wraps were most common. More wraps are recommended where the bales are handled several times. It is possible to leave bales unwrapped and handle them successfully. However, there will be an initial hay loss where the bale is dropped and in some cases wind losses have occurred.

Controlled feeding is important to realize the potential cost reduction of roll baling. Panels around the bales help avoid loss but still allow self feeding by livestock. Studies at Purdue show panels reduce losses from 23% to about 5% for off-ground roll bales. A combination rear mounted mover equipped with feeding panels is shown in Figure 5.

Loose Hay Stack Wagons

The other popular big package haying machine is the loose hay stack wagon (Figure 6). An ever increasing variety and size of these machines that allow one man to pickup, form and compress, transport and unload stacks of loose hay are available. Stack sizes range from 1 to 12 tons. The major types of loose hay stack wagons are outlined in Figure 7.

Reduced labor requirements and reduced costs are the main reason hay growers are selecting these machines. Skill of the operator in forming and unloading the stacks is important. A well-shaped stack without top depressions is essential for long storage. Stacks tend to form a natural thatch that sheds water. Depressions or loss of the thatch by wind allows moisture to penetrate into the stack and cause spoilage.

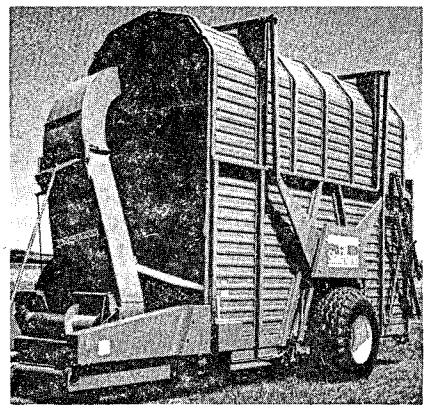


Figure 6. Compression canopy type loose hay stacking wagon.

Cooperative studies by dairy scientists and agricultural engineers at Nebraska have shown that the nutritive value of alfalfa can be retained when hay is stacked at moisture as high as 35%. Spontaneous heating and natural air ventilation of small to moderate-sized stacks resulted in rapid drying of the stacks.

Capacities of the nominal 3-ton sized stacker were about 6½ tons per hour and the stacks contained about 2 tons of dry matter at harvest time. Dry matter losses were about 15% with initial moisture contents of 20 to 35%. Top capacity observed during 1974 was 2½ loads per hour with a moderate hay yield and stacks located at one end of the field. In heavier hay nearly 4 loads per hour have been collected. Naturally, effective capacities depend greatly on the transport distance to the stacking location.

Systems for loose hay stacker wagons include the tractor, a windrower that will usually be self-propelled in larger acreage situations and a stack mover. The tractor available in a machinery complement may limit the size stacker selected. An advantage of some stacker wagons is the ability to collect crop residues which extends its use and lowers hourly costs.

The large size and bulkiness

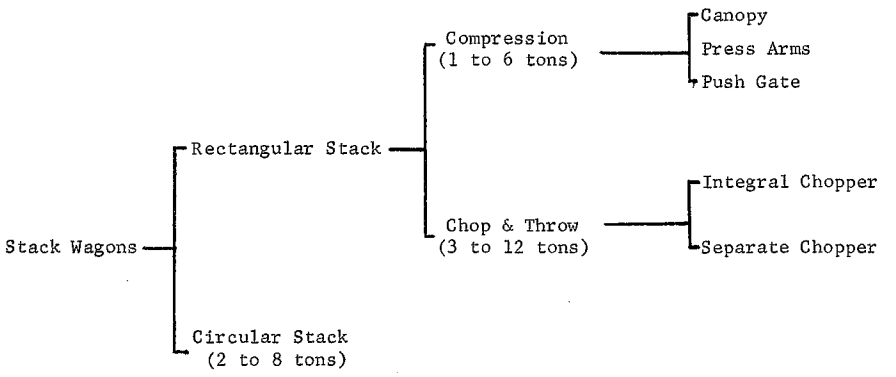


Figure 7. Options for loose hay stack wagons.

of the stacks tends to limit transport distances because of time and cost. Over-the-road transport also can cause loss of hay from the stack. Ropes or nets to secure the stack are recommended for long hauls.

As with roll bales, stack placement so that the sun reaches as much of the surface of the stack as possible is beneficial especially in areas of higher rainfall. High moisture conditions can cause spoilage losses on the shady side of stacks.

Stack movers are of two types. The most common is the tilting chain bed mover. Rear tractor mounted fork-lift units are available only for small size stacks. Some of the chopper type stack wagons are combination units. The stack forming chamber can be removed and the wagon bed then becomes a stack mover. Attachments are available so the stack mover can also serve as a means of distributing hay for feeding.

Control of feeding is essential if the potential economic gains of loose hay stack wagons are to be realized. Studies have shown losses in excess of 40% with free animal access to the stacks. Movable hinged panels placed around the stacks are the most common way to control feeding and still let the livestock self-feed. Studies at Purdue show panels reduce feeding losses to about three percent.

Comparisons

Computer models are being developed to help compare haying methods and machines and a computer simulation comparison of conventional baling and loose hay stacking was made. Yield data for alfalfa obtained at UN Field Laboratory by W. R. Kehr and R. L. Odgen were used to describe the crop. Actual rainfall data for morning, afternoon and night were used. Eighty acres were harvested per cutting with the only difference being the handling method, a pull-type baler with matching capacity bale wagon and a loose hay stack wagon handling an average of two tons of dry matter per load.

Forty-five trials with nine years of rainfall data were used. In this case, the stack system required about 25% less labor with considerable certainty compared to the baler. Hay dry matter yield was slightly better for the stack system, but with much less certainty (Figure 8).

Cost comparisons for big package hay handling systems are shown in Figure 9. Roll balers have a breakeven tonnage compared with conventional baling of about 75 tons per year. The breakeven acreage for 1-ton stackers is about the same. Three-ton stackers have a breakeven tonnage of 150 tons while 350 tons is the breakeven point for a 6-ton stacker compared to conventional baling.

Summary

Many alternatives are available that offer reduced costs and labor demands for hay growers. Selection of a haying system must fit the overall farm cropping situation, be compatible with the existing complement of machinery, and reduce losses due to untimely operation while controlling costs.

In addition, handling equipment must fit the tonnage and time available. Controlled feeding is essential to realize the potential economic gains.

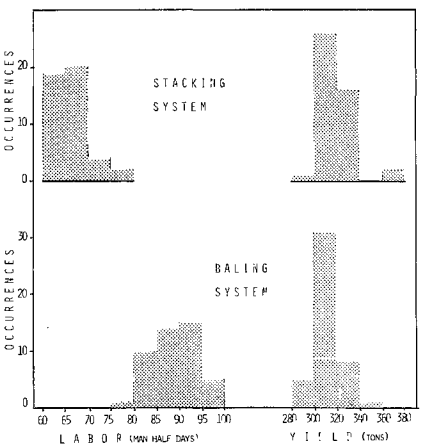


Figure 8. Labor requirements and dry matter yields for 45 simulations of a loose hay wagon and baling system.

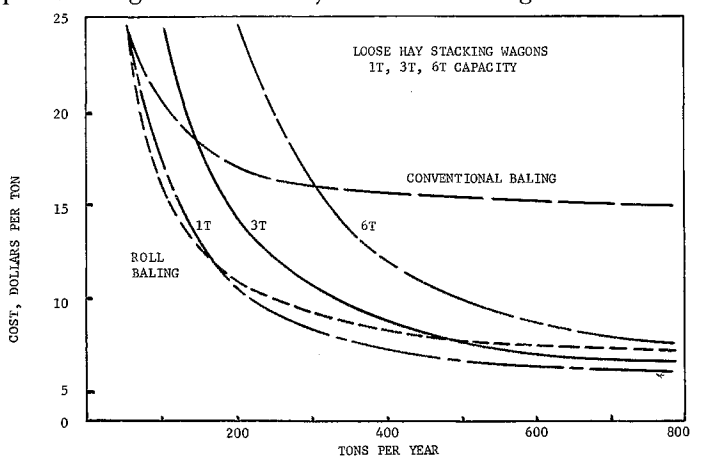


Figure 9. Cost comparisons, Oklahoma State studies. Systems compared: Conventional, off-ground roll baling with two movers by a tractor mounted bale fork, compression type stack wagons of 1, 3, and 6-ton capacities with one on-farm move.

A core sampler is an excellent tool for getting good samples of baled and stacked hay.

Forage Testing—Why and How

Foster G. Owen
Professor, Dairy Nutrition

Forages usually account for 50% to 70% of the total feed used by lactating cows. With today's high grain prices and relatively lower forage prices, forage feeds should be substituted for as much of the grain as practicable.

The extent of substitution of forage for grain depends mainly on forage quality. Because of this, forage testing is very important to the dairyman's profit potential.

Testing Benefits

Evaluation of forages produced and used on the dairy farm has immediate value for feeding the herd.

*Forage testing provides the basic information needed for formulating economic and nutritionally balanced rations.

*When a grain ration is fed separately from the forage, as in conventional feeding programs, test results can serve as a basis for establishing grain feeding levels.

*Forage evaluation data also provide a guide for pricing forages for sale or inventory. Such data can be utilized in computer ration formulation to determine the dollar value of different crops and qualities of forage (Table 1).

Computer values provide the most accurate evaluation possible of dairy ration ingredients because they are based on formulating rations specifically for dairy cows and give credit for all the nutrients and other feed factors important in the ration.

These values can help a dairyman determine what he can afford to pay for forages of different qualities. These specific values emphasize the high economic worth of the quality in forages.

*In addition, forage testing can help the dairyman evaluate his forage production practices—fertilization, time of harvest, and methods of harvesting, curing and storing. Over time this may be most important for each dairyman.

Table 1. The dollar value of forage quality.[a]

	$ value/T as-fed basis
Alfalfa hay, 20% CP	$77.60
Alfalfa hay, 15% CP	57.96
Brome hay, 11% CP	42.00
Brome hay, 7%CP	15.49

[a] Comparative values based on $3.25/bu for corn grain, $220/T for soybean meal and corn silage at $20/T in complete dairy rations.

Evaluation of Forages

Forages differ in nutritive value. Alfalfa may vary in protein from 10% to 20%; grass hays can range even more — from 6% to 20%. Energy values also vary to about the same degree. Silages vary from 35% to over 80% moisture. Laboratory methods for measuring moisture and protein are good. Laboratory methods for measuring energy are not as precise but are sound and valuable.

Laboratory values for moisture, protein and energy are all that are needed for routine evaluation of forages.

Moisture. For silages (and high moisture grains), moisture level is important since moisture dilutes all nutrients in a feedstuff. Because energy and protein differ little in the corn plant during seed formation, moisture is the main variable affecting corn silage nutritive value.

Protein. Differences in maturity at harvest result in wide differences in protein content of the grass hays and first-cutting alfalfa. Protein contents vary much less in corn, sorghum and later cuttings of alfalfa. However, because of its high cost, protein should be determined on all forage samples.

Energy. Measurements of energy values in dairy rations should be in terms of ENE. Those feeds that vary most in protein generally vary most in energy. The energy value of a forage is important because of

Table 2. Forage test and cost of concentrate ration.

	Hay protein %	Concentrate protein %	Ration cost[a]/T
Alfalfa hay			
	12	15	$135
	14	13	129
	16	11	123
	18	8[b]	116
	20	8[b]	116
Brome hay			
	6	21	152
	8	19	146
	10	17	140
	12	15	135
	14	11	123

[a] Ration based on corn $3.25/bu and SBM $220/T.
[b] Most grain rations will have minimum levels.

Table 3. Savings with forage evaluation, cow producing 50 lb (3.5% fat) milk per day.

	Assumed low quality hay	Actual high quality hay	Difference
Daily grain fed	22 lb	15 lb	7 lb
Grain cost/lb	7.3¢	6.15¢	1.15¢
Grain cost/day	$1.61	$.92	$.69
Hay intake, diff.		+4 lb	+4 lb
Hay cost @2.5¢/lb		+$.10	+$.10
Net difference			$.59

its relation to intake as well as forage quality. Forage intake plus its energy value determines the level of grain feeding required to fulfill total energy requirements.

The "eye ball" method of evaluation is not good enough for today's needs.

For example, let's say you estimated your haylage as having 40% moisture and it actually had 55% moisture. When feeding 50 lb for each cow daily, the error of estimate would be 7.5 lb of dry matter. This should be sufficient to produce 10 lb of milk!

Profit From Forage Testing

Forage tests make it possible to avoid the extra cost of feeding excessive protein. For example, Table 2 figures show that if a ration was balanced without forage test, but assuming the brome hay was of low quality (8% protein), when in fact it was high quality (14% protein), the ration cost would be $23 higher per ton than it should be.

In addition, supplemental grain needed with this high quality forage is 7 lb/day less than for the fair quality forage. The economic loss for *assuming* a lower quality for the hay is shown in Table 3.

Sampling for Forage Test

Hay sampling. Wait at least two weeks after putting up hay before taking samples. Take separate samples from each crop of hay (alfalfa, brome, orchardgrass, etc.) and also sample first-cutting and aftermath cuttings of each crop. Aftermath samples of a given crop are usually similar and therefore may be pooled. Take special samples of hay exposed to heavy rain while still still in the windrow or differ appreciably from other hays for any reason.

(continued on next page)

The "27-Method" to Figure Ration Protein

Because of today's high cost of feed dairymen need to check their ration protein level often. The cost of excessive protein can cut profits sharply. On the other hand, a protein shortage will reduce returns by lowering milk yields.

How can a dairyman determine the amount of protein needed in his grain ration? Try the following formula:

Protein % needed in the grain ration (90% dry) equals:
27 – Protein % in forage (90% dry)

We use the 90% dry basis for the grain ration because this is about the dry matter content of most grain rations prepared and fed on the farm. Hay will run about 90% dry matter after a few months storage.

The grain ration protein value will need to be adjusted for certain conditions:

1. For roughages with 18% protein or above—subtract 2 points.
2. For corn or sorghum silage fed as the only forage or with limited hay (up to 5-8 lb per head for small or large breeds)—add 2 points.
3. For cows producing 60 lb of milk or more daily—add 2 points.

This method is based on full feeding of roughage with supplemental grain to maintain high milk yields. It is assumed that the forage protein is not appreciably damaged by overheating during storage.

How it Works

Example 1. The herd is fed alfalfa hay containing 15% protein.
Grain ration protein needed = 27 – 15 = 12%
For high producers 12 + 2 or 14%

Example 2. The herd is fed corn silage as the only roughage. Corn silage tests 3% protein on a 30% dry matter base.
Step 1. Convert the silage protein to 90% dry base as follows:
90/30 × 3% = 9%
Step 2. Ration protein required = 27 – 9 = 18% + 2% = 20%
For high producers 20 + 2 or 22%

Example 3. Cows are fed 40 lb of corn silage along with 10 lb alfalfa hay. Analysis shows hay to contain 17% protein and the silage 3.2% protein on a 36% dry matter base.
Step 1. Convert the silage *protein* % to a 90% base. 90/36 × 3.2% = 8.0% protein
Step 2. Convert *amount* of silage to 90% base as follows:
36/90 × 40 = 16.0 lb
Step 3. Calculate combined roughage protein level:
Hay = 10# × 17% = 1.70
Silage = 16# × 8% = 1.28
26# 2.98
2.98/26 = 11.5% combined roughage protein
Step 4. Calculate grain ration protein needs:
27 – 11.5 = 15.5%
15.5 + 2 or 17.5% for high producers

If you do not have forage intake information, a reasonable estimate (on a 90% dry base) for average quality forage or silage is 2% of average body weight. For example, for 1,300 lb cows, estimated intake would be 1,300 lb × 2% or 26 lb per day. If they ate 40 lb of silage, as in the above problem, then we would expect them to eat 10 lb of hay:

26 lb total forage – (36/90 × 40) = 10 lb of hay (The 36/90 × 40 is the silage converted to a 90% dry weight.)

Forage Test Necessary

To make use of the "27" method a forage analysis is necessary. All that is required to use this method is a protein on each of your forages fed and a dry matter on your silage. If you need information on sampling and obtaining an analysis contact your county agent.

Forage Testing

(continued from page 9)

Sample 15 bales of each type of hay, using a *core type sampler* (the Penn State sampler is widely used). Take a full core sample from ordinary bales. For tight bales half a core will be sufficient. Sample from the end of square type bales and from the circumference of round bales. Deposit all samples in a sample bag.

Although core samples are generally the most practical, other methods may be used.

One alternative method is to take a slice of 15 representative bales, grind or finely chop, thoroughly mix and sample. Subsample as follows: make a cone shaped pile of the chopped material. Divide into four pie type portions. Keep two alternate sections, discard the other two. Repeat the process until only about 1 lb remains. Transfer the sample into a plastic bag, being careful not to lose any of the fine dusty material during handling.

For shipment, pack hay samples in a watertight container, such as a cardboard milk carton.

Both loose or compressed hay stacks can best be sampled with the core sampler as described. Randomly sample the front, back and middle of both the bottom 2 ft and upper portion of compressed stack. Remove or spread apart the top 6'' before sampling. It helps to compress loose hay by standing on the stack and sampling near the feet.

During grinding or chopping of a stack of hay, periodically take handfulls of hay from the pile at varied locations during grinding. Take at least 15 handfulls of each forage type. Take about 1/4 of the samples from the upper half of the stack and the remainder from the lower half. Guard against fines sifting through the fingers.

For sampling of previously ground stacks take the 15 handfull samples from various locations by inserting the hand beneath the surface layer.

Subsample chopped hays as previously indicated.

Silage sampling. Allow at least 30 days after storage before sampling. Include only feedable material. Do not include the first three feet of forage in uprights or material from the shallow end or the slope of horizontal silos.

When upright silo automatic unloaders are used catch forage samples periodically (at about 1 minute intervals) as silage drops down the chute. If silage is manually unloaded take samples at 15 locations well distributed across the entire surface. If the silage is bunkfed without nutrient additions, take 15 handfulls from different sections of the bunk immediately after feeding.

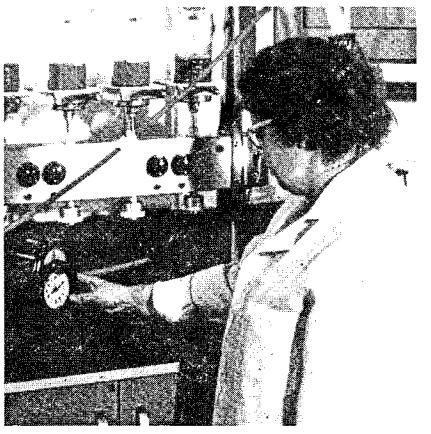
Take at least 6 quarts of silage samples. Mix well and from this mixture fill a 2-quart plastic bag, leaving just enough space for tight closure with a wire twist or rubber band. Press out as much air as possible before sealing. Keep samples cold or frozen until shipped.

The shipping container must be watertight. Insert the plastic bag with sample into a cardboard milk carton for mailing.

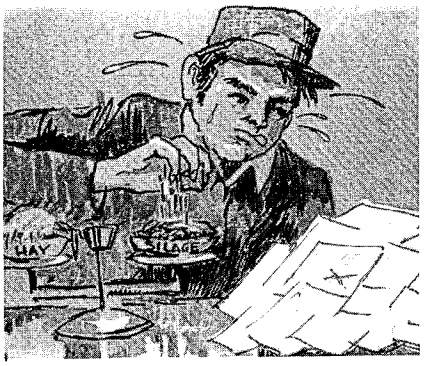
Take samples from horizontal silos at varied locations — upper, middle and lower levels and from side-to-side. Depth of sample should equal that taken off in daily feeding. Again, sampling from the bunk may be simpler if the forage removed on a given day is representative of the entire exposed surface.

Using Forage Test Results

In some parts of the U.S. test results serve as a basis for setting the selling price of hay.



Analyses of moisture, protein and fiber are needed.



Balancing rations by hand is no longer necessary. The computer can do it.

Where testing programs have been in use for several years, farmers have learned much about production practices required to produce high quality forage.

However, the immediate use of a forage testing program is to provide a basis for ration formulation and feeding. This information can be used in two ways — to provide feed composition data for complete ration formulation by computer or to determine the protein percentage needed in the grain ration and the level of grain feeding.

Complete ration program. Computer formulation is ideal for obtaining the best ration. This ration will show the level of forage and grain ingredients to combine into the total ration to meet all nutrient needs for milking cows. Forage test results provide a sound base for formulation. If computer formulation is not available, for high producing cows fed excellent hay include grain at 40-45% of the ration dry matter, with average hay use 50% grain and with fair hay 55-60% grain (see Table 4 for hay values).

Complete rations are full-fed once or, preferably, twice daily, especially in the summer months when moist feeds may heat and mold in the bunk.

Conventional program. To determine the grain ration protein level needed to balance the ration, use the "27 method," described in an article on page 9.

If a least-cost grain ration is desired, this can also be obtained via computer formulation. Computer

Table 4. ENE and hay quality.

Combined forage ENE	Quality of forage
(Mcal/cwt DM)	
45 or more	Excellent
38-44	Average
37 or less	Fair

formulation has its main benefit when a number of major feed ingredients are available.

Use the ENE values of the forages to determine the level of grain to feed individual cows or production groups. Table 4 classifies the forage based on its ENE computed on a dry basis.

Then the combined ENE determines classification of the forage; and this classification determines the grain feeding level.

To determine the combined forage ENE from the laboratory analyses, you must know the proportion of dry matter you will feed from each forage source. For example, if you want 1/3 of the forage dry matter from corn silage and 2/3 from alfalfa hay then:

Proportion	*Forage laboratory ENE (Mcal/cwt)*	
Silage: 1/3 ×	54	= 18
Hay: 2/3 ×	42	= 28
Combined ENE		= 46

With 46 combined ENE this is equivalent to the word "excellent" as found in most commonly used feeding tables.

With forage testing less than 11% protein at least 10 lb of grain mixture is needed each day to insure sufficient protein intake, to support effective rumen digestion and to make effective use of any NPN in the ration.

In the high production range, grain intakes will seldom exceed 35 lb daily even though the table shows higher theoretical needs.

Conclusion

Forage testing can serve as the basis for economic ration formulation and feeding of dairy cattle. The University of Nebraska is now able to furnish forage analyses and computer ration formulation to help dairymen develop a sound and more economic feeding program.

Superovulation and embryo transfer techniques could increase the number of offspring from outstanding cows.

Lactation Induction, Embryo Transfer

New Developments in Physiology

Larry Larson
Assistant Professor, Dairy Physiology

Artificial Induction of Lactation

One frustrating problem to the dairyman is to find that one of his better cows, which is nearly dry, is not pregnant. Since the mammary gland is part of the reproductive system, milk secretion will not be stimulated until she produces another calf. The dairyman has three choices.

One choice is to breed her and if she conceives, put her in dry lot for a 9-month vacation. Of course, she will be eating up your profits during this period and there is no assurance that she will conceive this time either.

A second and probably the best choice, except in the case of the very exceptional animal, is to bite-the-bullet and sell her. It is probably better to take your loss now and save the feed for the good lactating cows.

Many dairymen have expressed interest in a possible third choice — artificially inducing lactation.

Experimental

Induction of lactation is an experimental technique, although researchers have had limited success. Early attempts to induce lactation consisted of administering female sex steroids for a 60- to 180-day period.

Ohio workers have developed a simplified procedure. They injected a combination of 17β-estradiol (4.6 mg per 100 lb body weight per day) and progesterone (11.4 mg per 100 lb body weight per day) for seven days. Half the daily dose was given in the morning and half in the evening. Injections were made just under the skin behind the shoulders. Injections alternated from left to right side of the animal. Canadian workers report that injections should be started three days after the cow is observed in heat. Only nonpregnant dry cows or heifers were used.

Little or no change in the mammary gland was observed during the seven days that the hormones were injected. Twice daily milking was begun when the udder became distended with fluid and the teats were full and turgid. The udder may begin to fill as early as two days after treatment but milking usually was begun 14 to 21 days after the last hormone injection. Some cows responded in only two or three quarters. Cows whose mammary gland had not filled by 30 days were considered as not responding. About 60% of the cows responded to the treatment and the average production was about 70% of the cow's previous normal 305-day production level.

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New Developments

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A colostrum-like fluid was obtained the first few milkings. Milk production increased gradually and reached a peak within two months. Milk composition was similar to milk from normal lactations.

Standing heat was generally observed on the second day of treatment. Swelling of the vulva, mucous vaginal discharge and relaxation of the sacrosciatic ligaments with moderate elevation of the tail head were noticeable. Some cows exhibited increased estrous activity for a month following treatment. Conception is possible after regular estrous cycles have been reestablished following the treatment period.

The following points are emphasized concerning artificial induction of lactation:

1. This should not be a substitute for good reproductive management in the dairy herd.
2. FDA approval for this treatment has not been granted and precludes recommending immediate application at the farm level.
3. The University cannot sell or otherwise make available to dairymen or veterinarians the hormones needed to induce lactation.
4. All published information concerning the technique of hormone-induced lactation will be provided to anyone interested.
5. Ohio workers indicate that the treatment results in a successful lactation about 60% of the time. These cows produce an average of 70% of expected normal production.
6. The technique will induce lactation in both heifers and cows. Treated animals can become pregnant following treatment.

Artificial Induction of Parturition

Researchers and cattlemen have theorized that several potential advantages might be realized if parturition could be successfully induced at a desired time before term. Major objectives would be to reduce calving difficulties by having a smaller calf born and to reduce the labor requirement by controlling the time of calving so that the calvings could be grouped or to eliminate calvings on the week-ends and holidays.

It is possible to induce parturition in cattle by injecting a synthetic glucocorticoid (a hormone from the adrenal gland). Several researchers have reported inducing parturition by injecting 20 to 30 mg dexamethasone into the muscle. South Dakota workers reported cows treated on day 273 of gestation calved 45 ± 11 hours later. In a Missouri study cows treated 8 to 14 days before their expected time of parturition calved, on the average, 49 hours after the treatment. Iowa workers found that nearly all cows will calve within 72 hours of treatment. Therefore, time of calving can be controlled but treatment earlier in the gestation gives more variable and undesirable results.

Birth weight of calves is decreased by induction of parturition, but there is no reduction in calving difficulty. On the contrary, more deliveries require assistance. Therefore, the objective of reducing calving difficulties is not obtained.

The major complication after induced parturition is retained placenta. South Dakota workers reported that 76% of the induced and 10% of the control cows retained their placental membranes. Other reports indicate that incidence of retained placentas decreases as cows approach term. The high incidence of retained placentas has not had any detrimental effect on subsequent reproductive performance as measured by days to first heat, days to conception, services per conception or calving interval. Most researchers reported that the membranes were not manually removed but the cows did receive antibiotics. Iowa workers reported that intra-muscular treatment with 4 million units penicillin and 5 grams streptomycin one day after calving resulted in good postpartum recovery.

Embryo transfers require major surgical procedures.

Milk production might be affected. South Dakota workers reported the average daily milk production in Holstein cows for the first nine weeks of lactation was 55 lb and 61 lb for the induced and control groups. Also, the incidence of milk fever might be increased in the induced group.

Calf performance is affected by the stage of gestation parturition was induced. There was no difference in calf death loss if parturition was induced after day 270 of gestation. Inductions before 260 days of gestation resulted in poor calf survival. Calves from induced parturitions had satisfactory growth rates but may have smaller weaning weights due to smaller initial birth weights.

The time of calving can be controlled but the incidence of calving difficulty might be increased. Induction of parturition should not be attempted before day 270 of gestation.

Some guidelines stressed by Dr. W. C. Wagner (Iowa State University) that should be considered before attempting to induce parturition are:

1. Cattle must be in adequate to good body condition.
2. Management must be adequate to provide supervision during the calving period.
3. Assistance to newborn calves during initial suckling attempts should be provided.
4. In general, the level of disease problems in the herd should be minimal. This is especially critical with regard to neonatal calf diseases since large numbers of newborn calves could provide the ideal population for a serious outbreak of enteritis or pneumonia.
5. Appropriate therapy for animals with retention of the placenta must be provided.
6. Full discussion and cooperation between management and veterinary personnel is essential, before as well as during the calving season.
7. Any individual considering the use of parturition induction is advised to try it in a small group of animals before embarking on large scale use of such procedures.
8. Parturition induction in cattle is not a panacea for calving problems. It can, however, be an effective management procedure to limit the need for constant daily observation of cattle during the calving season to observation of treated cows during a two-day period each week.
9. Since these high potency corticoids carry a label warning which restricts their use during late pregnancy, anyone who does use them for parturition induction clearly is assuming any liability which may result from such use and presumably has no recourse to the drug manufacturer.

Embryo Transfer

The primary objective of embryo transfer is to increase the number of offspring from an outstanding cow. Most cows produce a relatively small number of offspring during their lifetime. However, by hormonal treatment, outstanding cows could theoretically produce a large number of embryos and less desirable cows in the herd could serve as the hosts for the transferred embryos. Interest in this area has been stimulated by the restrictions on importation of live cattle into the U.S. and the possibility of increasing meat production by the routine production of twins.

Superovulation and embryo transfer studies are not new. Wisconsin workers reported the results of some of their initial trials in 1943. The first transfer by surgical techniques resulting in a live calf was reported in 1951. The first calf to be born from nonsurgical embryo transfer was reported in 1964. In 1971 Cornell researchers reported the first successful transfer of an embryo from a five-month-old heifer calf to a mature recipient which resulted in a bull calf.

Numerous researchers have had limited success in transferring embryos but the results have not been consistent or very efficient. Best results to date have been obtained by English workers who reported a pregnancy rate in one study of 91% following the surgical transfer of two embryos to the uterine horn adjacent to the ovary containing the corpus luteum. However, the number of twins produced was low. Subsequently a pregnancy rate of 72% was obtained in heifers receiving one embryo in each uterine horn. Of those calving 73% had twins.

For embryo transplant to be most successful and practical, several important steps must be followed. These include:

1. Synchronization of estrous cycle of donor and recipient.
2. Superovulation (production of a large number of eggs).
3. Fertilization of superovulated eggs.
4. Recovery of eggs.
5. Selection and handling of eggs.
6. Preservation of eggs.
7. Transplantation.

1. Synchronization of donor and recipient. English workers reported that when fertilized bovine eggs were transferred into 99 recipients and the degree of synchrony between recipient and donor was −3, −2, −1, 0, +1, +2, and +3 days, the pregnancy rate was 0, 20, 52, 91, 56, 40 and 20%, respectively. Since the donor and recipients should be in heat on the same day or within ± 1 day, a large number of potential recipients are needed.

Also, the embryos recovered from the donor's tract must be transferred to the same place in the recipient's tract so that all will be compatible. Thus, the transfers must be from oviduct to oviduct or uterus to uterus. Oviduct transfers require surgery and must be done within four days after estrus since this is the time the embryo normally enters the uterus.

Most transfers into the uterus have been done on the 4th and 5th day after estrus and probably could not be done later than 12 days after estrus since a live em-

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New Developments

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bryo must be present in the uterus after this time to prevent the regression of the corpus luteum which is essential for pregnancy. Non-surgical transfers into the uterus have not been very successful because the reproductive tract is less resistant to infection at this time and manipulation of the reproductive tract often causes it to expel the embryo.

2. Superovulatory responses vary greatly and are the most uncontrollable variable in the field of embryo transfer. Gonadotropic hormones are normally produced in small quantities by the pituitary gland. By giving the donor a large dose, the ovaries are stimulated to produce a larger than normal number of eggs.

With repeated injections the cows also produce antibodies against these hormones. Therefore, the donor cows can only be used a limited number of times before they become resistant.

3. Fertilization of superovulated eggs. Fertility rates in superovulated donor cows are usually reduced. Improved fertility has been obtained by inseminating several times during the heat period and by using fresh semen or natural service.

4. Recovery of eggs. The most common approach is to place the donor cow on her back while under general anesthesia. The abdomen is entered through a midline incision just anterior to the udder. A cannula is placed in the oviduct and a special fluid forced through the reproductive tract to flush the embryos out into a collecting vessel. The number of times an animal can be operated on is probably limited because of scar tissue formation.

5. Storage and preservation of eggs. Although much has been said about "test-tube" babies, the cow embryo cannot be stored more than 48 hours. For best results the embryo should be transferred to the recipient within a few hours after collection from the donor. Some abnormal eggs can be detected by microscopic examination. Sex of the developing embryo cannot be determined.

6. Transfer of embryos to recipients. Fertilized eggs are placed into the uterus of the recipient cow by surgical techniques similar to the recovery operation. The cow is designed to produce one offspring per pregnancy. Embryonic death rate is high when several embryos are present. The highest pregnancy rate was obtained when two embryos were transferred to the uterine horn adjacent to the ovary containing the corpus luteum but the twinning rate was low. Both pregnancy and twinning rates were high when one embryo was transferred to each uterine horn. A disadvantage of transferring two eggs to a recipient is that a female calf born twin to a male will be sterile (freemartin).

The current status of superovulation and embryo transfers by seven commercial organizations is given in Table 1.

The cost of embryo transfers can vary greatly with the numerous plans available. In general, the surgical cost on the donor cow might be about $2,500. Other costs would include the cost of recipients, feed and care of the cows, semen, veterinary health exam, transportation, insurance, etc.

Embryo transplantation is not without its problems, because sophisticated surgical procedures are required for success. However, future research might make it as practical as artificial insemination.

Table 1. Survey of ova transplantation organizations in North America.[a,b]

Animals responding to superovulation (%)	74
Eggs recovered per cow responding (No.)	8
Fertilization rate of eggs recovered (%)	66
Transferable eggs from cows responding (No.)	5
Pregnancy rate of recipient cows (%)	41
Number of pregnant recipients per donor cow responding to superovulation	2.2
Number of pregnant recipients per donor cow attempted	1.6

[a]Summarized by Dr. Graham, University of Minnesota

[b]Data represents 635 successful transfers from seven organizations that reported their results.

Avoid Abnormalities

Franklin E. Eldridge
Professor, Dairy Breeding

Any dairyman with a herd of 50 or more cows who has been in the dairy business for five or more years, has undoubtedly had one or more abnormal calves born. A stillborn calf, one that couldn't stand up to nurse or be fed from a bucket, or one with any one or more of many anatomical defects is classified as abnormal.

One study of nearly 5,000 calves recorded 6.26% of the births as abnormal, but nearly half of these (44.2%) were stillborn without other obvious defects. No significant difference was found among the three breeds, Holstein, Guernsey and Jersey.

There was a significant difference between Holsteins and Guernseys in defects affecting bone, cartilage, muscle and joints, the Guernseys being higher. Holsteins had significantly more stillborns than Jerseys.

There were significant differences among sires, ranging from 4% to 16% abnormals, among nine sires, which demonstrates conclusively that defects are inherited. In addition to this statistical evidence, many abnormalities have been studied in families of cattle through pedigree analysis, and through such analysis the mode of inheritance has been established.

Inheritance Not the Only Cause

Inheritance is not the only cause of abnormalities in cattle. Some abnormalities have also been shown to be the result of environmental conditions including disease, poisons, vitamin deficiency and other factors, as well as interactions between environment and heredity. At least one abnormality has been shown to result from a chromosomal variation.

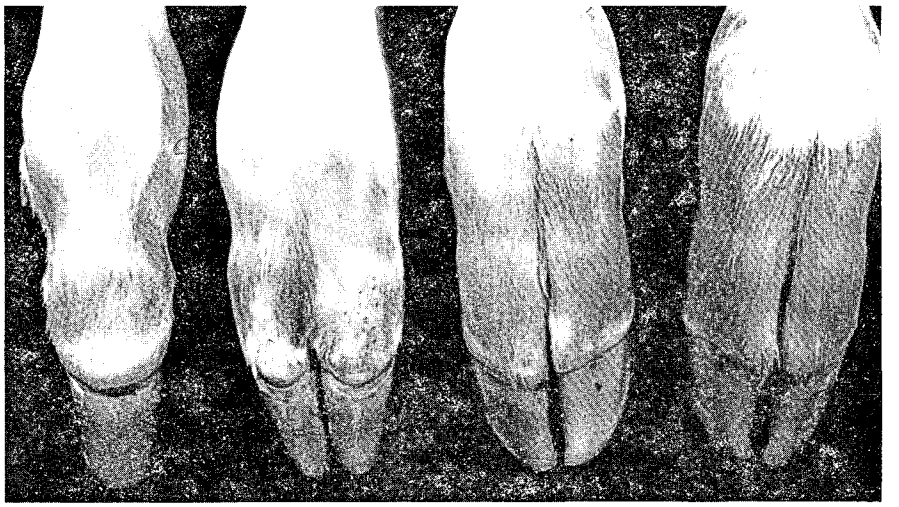
Abnormal calves are an economic loss to a dairyman. Every calf born which cannot be added to the milking herd represents a loss in income. The calf itself is a loss, and every female calf not re-

in Your Calves

sulting in a fresh heifer eventually reduces the opportunity to select, to cull effectively. In addition, abnormal calves frequently cause calving problems which in turn affect the producing ability of the dam.

Some abnormalities are never seen because the fertilized egg develops into an embryo or fetus that is so severely affected that it is aborted. In such cases, the only evidence available to us usually is the return to heat by the cow following the abortion of the embryo or fetus. This may occur in 21 days, or longer if the embryo survives for longer.

Since obviously abnormal animals are seldom kept for breeding, abnormalities caused by dominant genes are seldom a problem. A characteristic controlled by a dominant gene is only found when one of the parents shows that characteristic. Therefore, most inherited abnormalities are the result of recessive genes. A perfectly normal appearing animal may carry one or more recessive genes in the heterozygous condition. When such carriers of recessive genes are mated to other carriers, then one time out of three the gene will appear in the homozygous combination and can be observed.



Mule-foot. This condition is inherited as a recessive.

Environmental causes can be prevented by avoiding poisons, feeding adequately, and breeding on time. Hereditary causes can be controlled by finding out first how the abnormality is inherited and then taking appropriate steps in culling and breeding plans.

Defects

Some of the defects which occur in dairy herds are listed below.

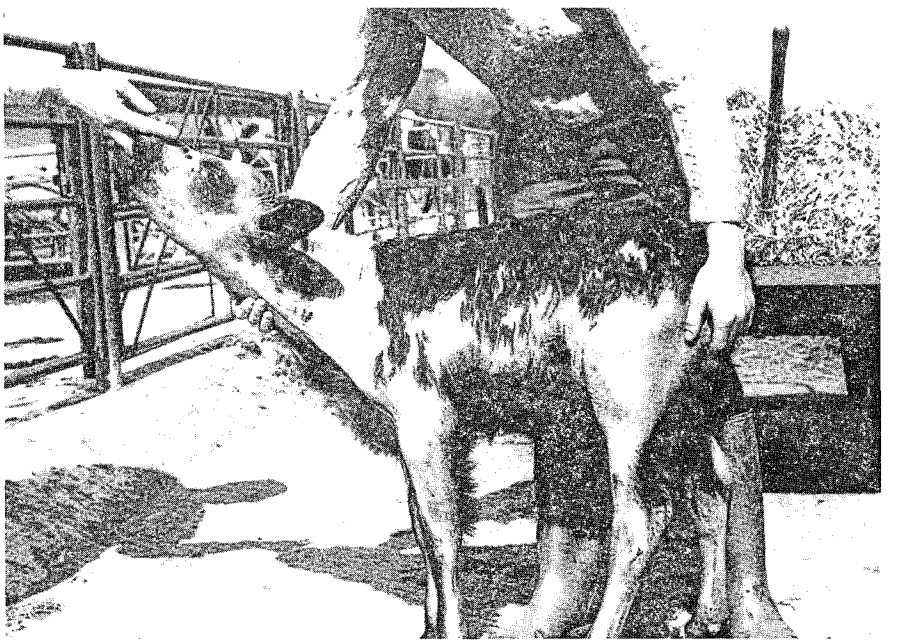
Inherited as an autosomal recessive:

1. *Syndactylism*—mule foot or single toe on one or more feet. This defect is also associated with reduced tolerance of extremes of environmental temperature.
2. *Arthrogryposis*—pasterns bent back so calf cannot stand properly on its feet.
3. *Tibial hemimelia*—very short legs, missing the bones between the stifle and hock.
4. *Congenital dropsy*—Excessive fluid in limbs, brisket area and around eyes.
5. *Epitheliogenesis imperfecta*—skin missing around hoofs and mouth.
6. *Osteopetrosis*—bones extremely dense, affecting brain and central nervous system.
7. *Hydrocephalus*—water on the brain causes enlarged head and loss of coordination.
8. *Wry-tail*—Tail not hanging straight from backbone, but set off to one side.
9. Dwarfism.

Two interesting traits inherited as a dominant are:

1. *Karakul—curl*—Hair coat, especially in newborn calves, extremely curly.
2. *Streaked hairlessness*—long narrow areas of skin along sides of neck, body and rump without hair. This also affects sex ratio, resulting in an above normal frequency of heifer calves.

When abnormalities occur, if the owner will contact the Department of Animal Science we can usually help develop a plan to reduce future occurrences.



Hairless calf. Calf is born with full hair coat but loses it in first 4–6 weeks.

Easy-to-Build Calf Hutch

Don J. Kubik
District Extension Dairy Specialist

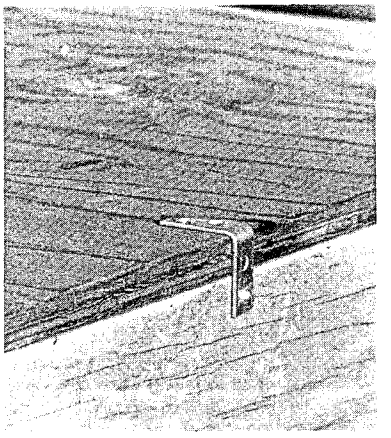
Individual calf hutches are being used successfully all over the United States. Many designs are used—depending on the geographic area. Here is an example of an inexpensive, easy to build calf hutch adaptable to Nebraska.

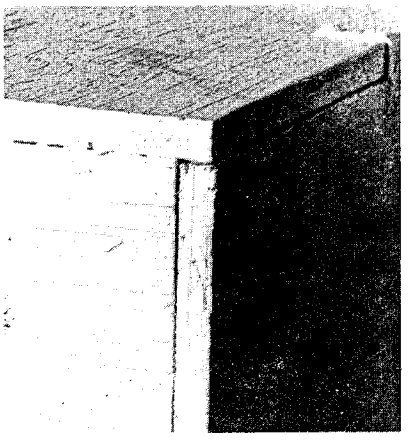
Each hutch is made from four sheets of 5/8″ CC-EXT-DFPA plywood. The top and sides are full 4′ × 8′ sheets of plywood. End sheets are made from a half sheet, less 1-1/4″. Cutting off 1-1/4″ from the side lets the end pieces fit inside the sides and allows the top to cover the end piece plus the sides, as shown. This allows the hutch to be nailed together. For added strength, 3/16″ × 3/4″ strap irons are bent at 90° and 1/4″stove bolts and washers are used at 14 locations. The cutout for the calf entry in one end of the hutch is 18″ × 30″.

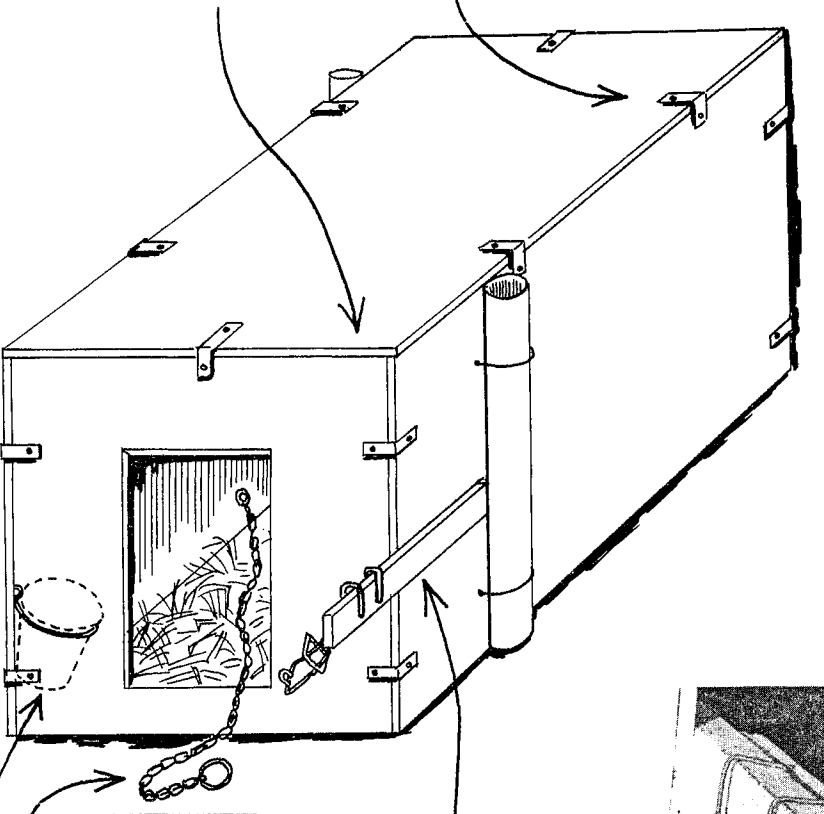
If nipple bottles are used a bracket such as the one shown may be used. Buckets are suspended by snaps fixed in the corners of the hutches.

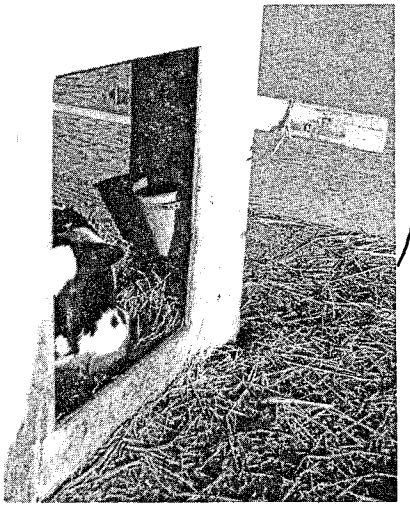
Calves are tied, as shown, with about 8′ of chain and a snap which adjusts to fit the calf's neck. The chain is fastened 6″ above the floor about 3′ into the hutch along one side.

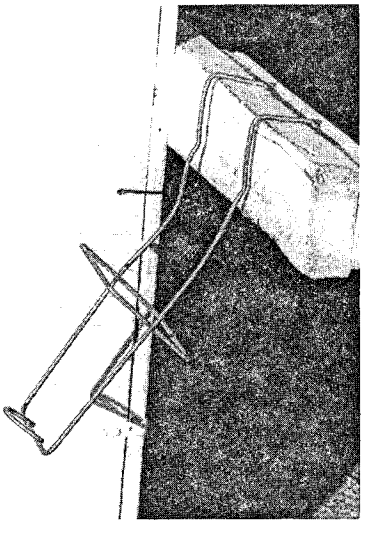
These hutches are lightweight and portable. They should be fastened down to keep the wind from carrying them away.







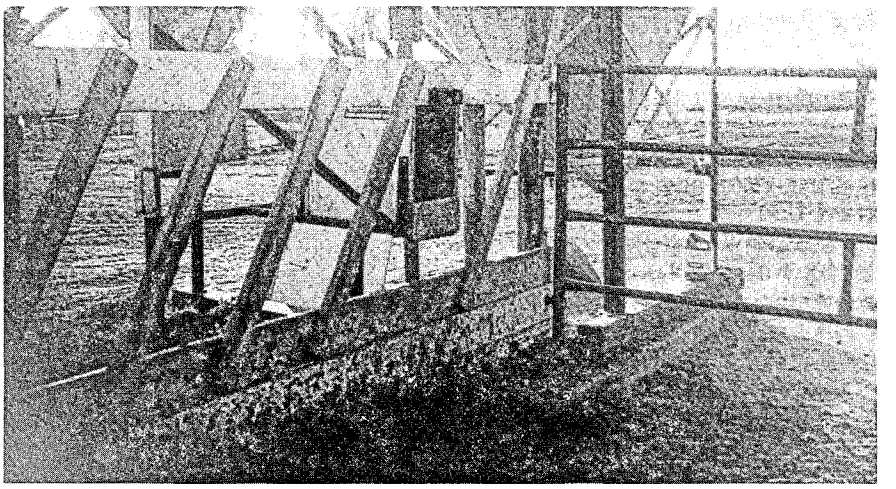




New Feeding Systems

Feeding Your High Producers

Don J. Kubik
District Extension Dairy Specialist



The Northco feeding system.

Getting extra grain or enough grain into high producing cows has been a problem for dairymen. Even when the price of milk and the price of feed are very close, getting enough grain into high producers is important for maximum profits.

A number of methods have been devised. Grain may be added to the roughage of all cows, or the herd may be divided so part of it is fed extra grain in the bunk. Another method holds good cows in the parlor long enough for them to eat what they need.

Each of these systems works, but takes extra time and, in some cases, extra facilities. To make it more complicated the number of high producing cows varies depending on the calving schedule of the herd. This changes the size of lots necessary.

New Feeders

Some new concentrate feeders are being developed to allow high producing cows obtain grain automatically by the use of a signalling device.

These devices do the same thing as grouping cows without the physical separation. Feeders require a minimum of labor and the free stall system need not be changed.

The Calan System

This system is designed so that a special neck chain or collar containing an electronic recognition device will open a door. Behind each door is a predetermined amount of grain. Each electronic door will accommodate about 10 cows. Only those cows with the recognition device can open the door.

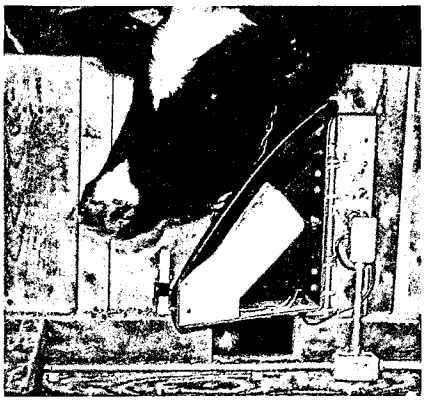
Chains or collars are placed on fresh cows and removed when production drops below a point where supplemental grain is needed.

Feeders are positioned on a high, solid fence. Experience has shown that the cows adapt readily to opening the door.

The Northco Serv-O-Matic Feeder

This system is activated by a special magnet hanging on a collar.

The cow sticks her head in the feeder, the magnet hits a switch which activates a small auger that trickles grain into the feeder at about ½ to 1 pound per minute as long as the cow's magnet is against the switch plate located at the front of the feeder.



The Calan feeding system.

Two models of this feeder are available, one for high moisture grain and one for a conventional grain ration. The feeder comes with a bin or hopper but can be mounted directly on a bulk tank or can be filled directly from a silo or feed wagon.

One of these units is designed to handle 20-30 cows in a 100-cow herd.

The recommended procedure is to place collars and magnets on fresh cows and leave them on until their milk production falls below a certain level.

Management Key to Success

Even with the automatic feeders, producers are first to point out that they must be used correctly to do a good job.

A number of things affect the usefulness of these feeders. The "boss" cow is one of the biggest problems. The "boss" cow with or without an unlocking device will push more timid cows away from the feeder—sometimes to the point that they will not even use the feeder.

A number of things have been done to try to reduce this problem. One is to put a narrow alley about half the length of a cow to the approach to the feeder. This chute protects the cow from aggressive cows. Another attempt to reduce this problem is to group cows in at least two lots—which defeats some of the purpose of the feeder. The theory here is to keep cows on a

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New Feeding Systems

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low grain ration away from the automatic feeder as they are more aggressive when they are restricted on grain. The real "bossy" cow may have to be removed from the lot with the feeder when her key is removed.

Another problem is a wide variation in use of the feeder by individual cows. No theories have been suggested for solving this problem.

Another problem is adjusting the key to work properly; it must not be too long or too short so that it will work the feeder and still not be lost easily.

This type of inexpensive feeder may have a place in our dairy herds. Observations and research are being conducted to try to evaluate them properly.

Illinois Electronic Feeder

A more accurate, more expensive feeder is capable of feeding each cow according to production. Not yet on the market, it is expected in the near future.

The Illinois feeder has been developed by H. B. Puckett of the Agricultural Research Service, USDA, over the past 10 years. Every cow wears an electronic device called a transponder. This transponder has an energy cell (a battery) which charges when the cow puts her head in the feeder. A field around the opening charges the transponder. When the transponder is charged, the feeder shuts off.

The transponder then discharges gradually while the cow is away from the feeder. The transponder can be adjusted to control the time a cow can obtain feed in a day. The feeder dispenses grain at the rate of 1 lb per minute so the time determines the amount of feed consumed.

Illinois feeding trials show cows produced as well as those hand fed grain. Observations show the feeder gives good control of the amount of grain a cow consumed. This feeder is designed to handle 20 cows.

Will Worming Help Your Herd?

Don J. Kubik
District Extension Dairy Specialist

During the last 10 years many fecal samples from lactating dairy cows have been analyzed for worm eggs. Results have shown low worm infestation on nearly all herds sampled. As a result, worming has not been recommended in Nebraska.

Because there is some indication that worming *might* be beneficial to lactating cows even with low worm egg counts a trial was set up to test Baymix 0.32% Crumbles (0.32% Coumaphos) as a treatment for lactating cows.

Lactating dairy cows in four herds in northeast Nebraska were divided by age and stage of lactation. Each cow was ranked within her group on her DHIA milk production and assigned to one of two treatment groups within production classes and age groups.

Treatment cows were given Baymix Crumbles once daily at the rate of 1 oz. of Crumbles per 100 lb body weight for 6 consecutive days. Herds 1, 2 and 3 top-dressed the Crumbles. Herd 4 was divided and treatment cows were fed a complete roughage and grain ration containing Baymix. A complete ration is the normal feeding method for this herd. In all cases, the Crumbles were fed within 10 days after the November test results were obtained. Milk production data for the next three months were used to measure effectiveness of the treatment. Production figures are shown in Table 1.

No Significant Differences

There were no significant differences in milk production between the treated and control groups of the combined data or at the different stages of lactation.

Neither were there significant differences in milk production due to treatment on any one of the four farms. The difference in the daily mean was only 0.69 pounds milk per day in favor of the control group. With no significant difference in worm egg reduction you would not expect a milk production response from treatment. The worm egg counts were higher in the control group than they were in the treated group before and after treatment; the reduction during the trial period was the same for both groups however, showing no advantage in reduc-

Table 1. Mean milk production for four-way classification derived from least squares analysis.

Classification	Period			
	Dec.	Jan.	Feb.	Dec.–Feb.
	(Production/cow/day in pounds)			
Mean	40.42	37.89	35.01	37.77
Treatment				
1. Control	40.44	38.34	35.57	38.12
2. Treated	40.40	37.44	34.45	37.43
Difference	– .04	– .90	–1.12	– .69
Farms				
1	41.92	41.30)	37.18)	40.13)
2	38.94	35.67)**	31.38)**	35.33)**
3	39.99	36.34)	35.10)	37.14)
4	40.83	38.25)	36.38	38.49)
Age				
1. 1st calf	41.50	40.51	37.67)*	39.89
2. Older	39.33	35.27	32.35)	35.65
Stage (Initially)				
1. 6-60 days	41.11	40.35	37.07	39.51
2. 61-120 days	40.81	37.59	36.37	38.26
3. 121-180 days	39.34	35.72	31.58	35.55

* F values significant at the 5% level.
** F values significant at the 1% level.

Table 2. Worm egg count means (per 10 g. sample), pre-treatment and post-treatment for control and treatment cows by farm.

	Pre-Treatment	Post-Treatment	Difference
Mean, Control cows	3.02	.90	− 2.12
Treated cows	2.16	.04	− 2.12
Farm 1. Control cows	7.39	2.20	− 5.19
Treated cows	4.20	0.18	− 4.02
Farm 2. Control cows	.67	.73	+ .06
Treated cows	2.16	.00	− 2.16
Farm 3. Control cows	1.76	.67	− 1.09
Treated cows	1.25	.01	− 1.24
Farm 4. Control cows	2.27	.00	− 2.27
Treated cows	1.03	.00	− 1.03

tion due to worming at this level of infestation.

Also, worm egg counts were taken before and after treatment on a 25% random sample of the control and treated groups. Results are shown in Table 2.

Worm Egg Counts

The only cows eliminated from the trial were those which were dried up, sold, or died during the trial period, plus their mates.

Worm egg counts differed significantly among farms. Worm egg counts were low on all farms, which is consistent with findings on samples taken in northeast Nebraska over the past 10 years. The mean difference in worm egg counts between pre-treatment and post-treatment for the treated and control groups was exactly the same.

Dairy Research in Progress

Nebraska Calf Raising Program

We are accumulating data on lactation and reproductive performance of heifers raised by a Nebraska developed calf raising program compared to a conventional calf raising plan.

The Nebraska program consists of feeding Holstein calves 7 lb of cold colostrum once daily to three weeks of age when they are weaned, whereas the conventional plan consists of twice daily feeding of 3.5 lb of normal warm milk (after one day of colostrum feeding) fed to six weeks.

The only difference seen so far is in the gain in weight at six weeks of age, which was slightly higher for the conventional program. By six months of age or thereafter, no differences were seen in growth rate, health, or death losses. Evaluation of lactation data now available indicates that there is no difference between the two treatments with respect to milk yields. Neither were there differences in services per conception or in body weight and wither heights at freshening. *F. G. Owen.* and *L. L. Larson.*

Computer Formulated Rations

Ration specifications and feedstuff analysis are continually being updated and modified as new information is available. During the past year through the use of computer formulation techniques information has been gathered on the relative economic worth of various grain ration ingredients. This is done to help dairymen select most economic alternative feed stuffs during this period of high priced grain ingredients. This same technique has been used to make economic comparisons among the various roughage sources available. This information has been distributed to dairymen and published in a popular form. *F. G. Owen.*

Sour Colostrum for Calf Feeding

Sour colostrum has been compared to frozen colostrum and ordinary milk for feeding dairy calves from the second day through weaning at three weeks of age. All three diets gave very satisfactory performance with no calf losses on any of these treatments. Adding 3½ lb of water to the basal diets of 7 lb of these diets improved gains when colostrum was used but had no effect with milk. However, when this diluted milk was fed at the rate of 7 lb daily instead of 10.5, three-week body weight gains were drastically reduced. Additional results of this study are being summarized. *F. G. Owen* and *L. L. Larson.*

Silage Additives

A propriety product containing hydroxy propionic acid was evaluated in corn silage harvested at both the milk stage and hard dent stage. This additive produced no effect on consumption rate, milk production, fat test, or feed efficiency.

Although cows fed the milk stage corn silage consumed considerably more total feed on a "wet" basis, consumption of dry matter was higher for corn silage cut in the dent stage. Fat-corrected milk yields were similar but favored the dent stage, whereas efficiency favored the milk stage. *F. G. Owen.*

DEHY in Corn Silage Rations

Dehydrated alfalfa was evaluated as a partial replacement for corn silage in a complete mixed ration containing no additional roughage. With respect to lactation performance no benefits were obtained from the addition of DEHY at 10% of the ration dry matter.

Cows freshening for the second lactation following one full lactation on the experimental rations produced lower levels of milk rather than higher levels that would have been projected. Both groups showed higher than the usual numbers of digestive and reproductive disorders. Based on these results, full feeding of all corn silage rations without additional coarse roughage continu-

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Dairy Research

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ously for successive lactations is not recommended. *F. G. Owen* and *L. L. Larson.*

Ration Fiber Requirement

An experiment was conducted utilizing soybean hulls in the form of soybean mill run as a replacement for 27% or 49% of the corn grain in the concentrate mixture for lactating cows. This change increased the fiber content of the ration from 13% to 18% and 23%. Increasing the ration fiber level with soybean mill run did not affect intake of dry matter or fat-corrected milk production. Digestibility of fiber components was improved for the high fiber rations.

Another experiment is planned where specially treated corn cobs will be substituted for corn grain to determine its effect on lactation performance.

These experiments are intended to discover possible effects of increased fiber level on lactation performance, efficiency, health, and possible long-term influences. With high grain prices, this information may also be beneficial in making shifts to alternative lower cost feed ingredients. *F. G. Owen.*

Chromosomal Translocations

During the past year and a half, more than 300 dairy cattle in Nebraska have been checked for a chromosomal translocation that results in an animal having a chromosome count of 58 or 59 instead of the usual 60.

This lower count results from two chromosomes joining toegther but still retaining all their genetic information. Some research has indicated that this condition results in a slight decrease in fertility while other information reveals possible beneficial effects. More work remains to be done before the real effects can be known. *F. E. Eldridge.*

Estrus Detection

Additional trials have been conducted to determine the possibility of detecting estrus in cattle by measuring changes in the electrical resistance (ER) of the vaginal mucus. ER measurements were taken daily for 21 days in a group of 16 heifers. In all heifers the ER values were lowest within ± 1 day of estrus and in 12 of 16 heifers, the lowest value was obtained on the day of estrus. The ER of the vaginal mucus is related to the stage of the estrous cycle and could be a practical estrus-detection aid on a limited number of problem cows. *L. L. Larson.*

Estrus Synchronization

Two trials have been conducted to determine the success of a simplified procedure of estrus synchronization. The heifers were given a single injection of prostaglandin $F_2\alpha$ and bred when in standing heat 2 to 4 days later. Heifers not responding to the first injection were given a second treatment one week later. Calving data is not yet available. *L. L. Larson.*

Calving Intervals

Possible methods of shortening the calving interval includes breeding cows earlier than the current recommended time of 60 days after calving and to have a larger percentage of cows cycling at the desired breeding time. A trial has been initiated to examine these two possibilities but no data are available at this time. *L. L. Larson.*

Calving Housing

Two environmentally controlled calf houses for 23 calves have been obtained. These units will be used to study the effects of temperature and ventilation rate on calf performance. *L. L. Larson* and *F. F. Owen.*