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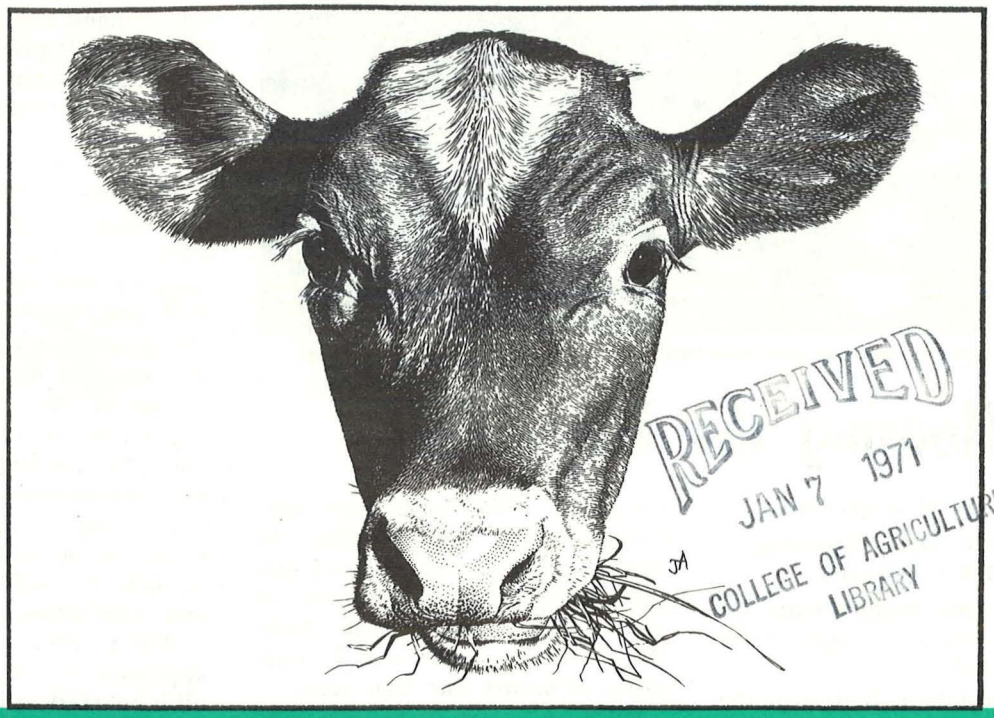

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NEBRASKA

1970 DAIRY REPORT

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Issued December 1970, 3,000

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

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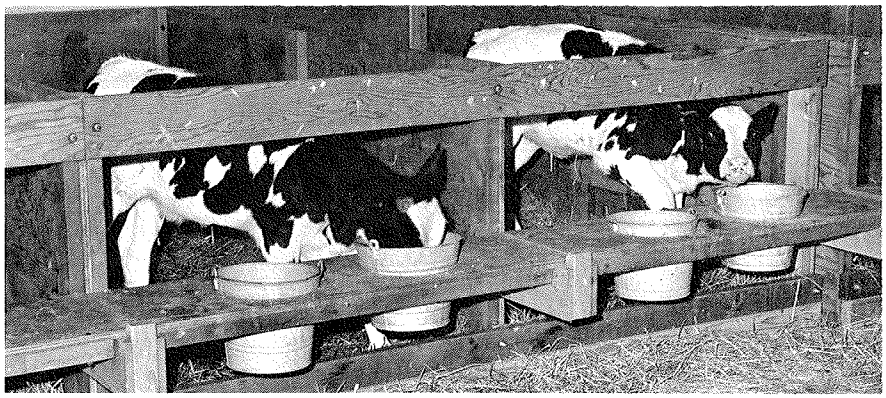

Calves should have separate pens from birth until two weeks following weaning.

Housing the Dairy Calf

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

What are the requirements for successfully raising the young dairy calf in Nebraska?

How important is it to heat the calf barn?

What is the effect of a hot, humid summer day?

Is a winter draft harmful?

What pen size is required for best growth?

All of these questions have been asked by Nebraska dairymen at one time or another during the past year.

Much has been written in the press on how to best raise calves. Some of this information, however, appears to be based more on what is comfortable to man than what the calf requires. This paper briefly summarizes the documented experimentation on calf housing and provides you with minimum suggested standards.

Low Air Temperature

While the young calf begins to increase her heat production when average air temperatures drop below 55° F., calves have been successfully raised in open sheds where the temperature dropped to a low of —20° F. for an extended period of time.

Recent work at Nebraska has shown that calves can be raised successfully, in either summer or winter, with minimum housing. Forty-eight calves were raised outdoors through mid-December in individual metal pens open on one side. Daily gains at six weeks of age averaged nearly 1.8 lb. daily. Only one calf was lost and the incidence of scours was near zero.

While dairy calves thrive in subfreezing conditions, additional stresses, such as freezing of water, inadequate diet or early weaning may deter "normal" growth.

In one trial at the University Field Laboratory, the average minimal wind-chill index in January was a —4° F. Eight calves were housed outdoors, weaned at 21 days of age, and fed only a starter ration containing up to one-half coarse chopped alfalfa hay in a 3/8" pellet. The condition of health deteriorated rapidly after weaning. Starter intake averaged 1.5 to 7.1 lb. weekly, much less than normal and the calves were losing weight.

Calves still receiving 7 lb. of milk once daily, however, remained healthy, even though weight gains were below normal. Based on these results, combined with those reported in Washington, Indiana and South Dakota, we believe that even the youngest dairy calf will remain healthy and grow normally when the average air temperature remains above freezing.

High Air Temperature

Missouri studies indicate that high temperatures can have an adverse effect on growth. Climatic temperatures above 75° F. decrease feed consumption (Table 1) and rate of gain (up to one-half lb. daily in a constant 80° F. climate).

One of the primary effects of high temperatures in enclosed housing is the resulting increase in water consumption, which doubles water vapor production and increases urine output. This results in increased bedding requirements and ventilation needs.

When average air temperatures approach 90° F., calves may exhibit marked salivation and panting. The feces become very liquid and defecation is frequent; a positive sign that such calves are not healthy.

Fall-born calves in the University of Nebraska herd have been shown to have a greater average daily gain during the first eight months than spring-born calves, even though the average weight difference at one year of age was only 11 lb. (Table 2). Furthermore, other workers have shown that in the warmer climate (75° to 95° F.), estrous cycles may be extended up to 25 days and the length of estrus shortened from a normal 20 hour to an 11 hour duration. When this occurred, a 33% incidence of anestrus was reported.

We would conclude, then, that the ideal air temperature is anywhere between freezing and 70° F.

Table 1. TDN consumption of Holstein and Jersey calves and heifers at various environmental temperatures.

Environmental temperature	2-month calves		Yearling heifers	
	Holstein	Jersey	Holstein	Jersey
35° F.	0.020	0.024	0.015	0.014
50° F.	.022	.023	.014	.013
70° F.	.018	.018	.013	.012
80° F.	.016	.014	.012	.011
90° F.	.017	.013	.008	.007

Mo. Ag. Exp. Sta. Res. Bul. 865.

Table 2. Comparative growth of Nebraska Holstein fall- and spring-born calves.

Age	Fall-born			Spring-born		
	Season	60-day gain	ADG	Season	60-day gain	ADG
(months)		(lb.)			(lb.)	
1–2	Oct., Nov.	85	1.42	Mar., Apr.	77	1.28
3–4	Dec., Jan.	125	2.08	May, June	115	1.92
5–6	Feb., Mar.	130	2.17	July, Aug.	116	1.93
7–8	Apr., May	112	1.87	Sept., Oct.	106	1.77
9–10	June, July	86	1.43	Nov., Dec.	101	1.68
11–12	Aug., Sept.	79	1.32	Jan., Feb.	91	1.52
Yr. total or average		617	1.69		606	1.66

Humidity

High humidity (above 85%) may have some effect on animal health. Condensation and damp bedding become an ideal home for disease organisms. However, there is no evidence to suggest that high humidity itself has any effect on an otherwise healthy, young calf.

Air Movement

Month-old calves require *more* protection from a combined low temperature and wind than is required by yearling heifers and mature cows. Canadian workers, using crossbred beef calves, have shown that the critical temperature increased from 16° up to 38° F. when wind velocity was increased from zero up to 12 mph. Table 3 illustrates that age of animal and wind speed are "primary" determinants of critical temperatures.

On the other hand, our experience indicates that calves kept outdoors with cabanas as their only protection are much more cold tolerant than their herdmates started in a heated calf barn. Hair coats developed rapidly and all calves started outdoors thrived well with the exception of the eight calves cited earlier.

We have concluded that while small air movements (5 mph.) are helpful to calves in the warmer climates, any wind associated with cold conditions, even 2 mph., only serves to increase the critical temperature and perhaps deter normal growth.

Table 3. Estimated critical temperature of cattle at different ages and at varying wind speeds.

Age of animal	Still air	10–15 mph. wind
	(critical temp. in °F.)	
1 month	+28	+51
1 year	+ 5	+35
4 years	+ 1	+35

Webster, Univ. of Alberta.

Pen Requirements

Calves should have separate pens from birth until at least two weeks following weaning. This minimizes contact of calves with each other, reduces sucking of each other, may reduce disease transfer, and permits individual observations of feed intake and normalcy of excreta. The desirable size of a calf pen is closely related to the maintenance of a suitable environment insofar as the excreta is concerned.

Raised stalls of 2 ft. x 4 ft. are satisfactory. These stalls are kept relatively free of excreta since pens allow the excreta to pass out of the pen through the slatted or screen bottom floor. The principal problem with these pens is maintaining control of drafts.

When calves are housed in solid bottom pens, the pens should be large enough to accommodate the bedding needed to keep the animal dry. A pen at least 4½ ft. x 4½ ft. seems satisfactory to handle calves up to six weeks of age, even if the buildup litter system is employed.

If calves are kept in individual pens until older or if they are kept in smaller pens, more frequent removal of bedding would be required. An early weaning program permits grouping of calves after six weeks of age. This reduces chores involved in cleanup of individual pens and also the number of pens required.

Construction materials used for solid bottom pens should be solid on three sides and easy to clean. Galvanized sheet metal pens used at Nebraska are cleaned by steaming. With sanitizing chemicals included in the steam treatment, such a pen can be disinfected simply and more satisfactorily than wooden

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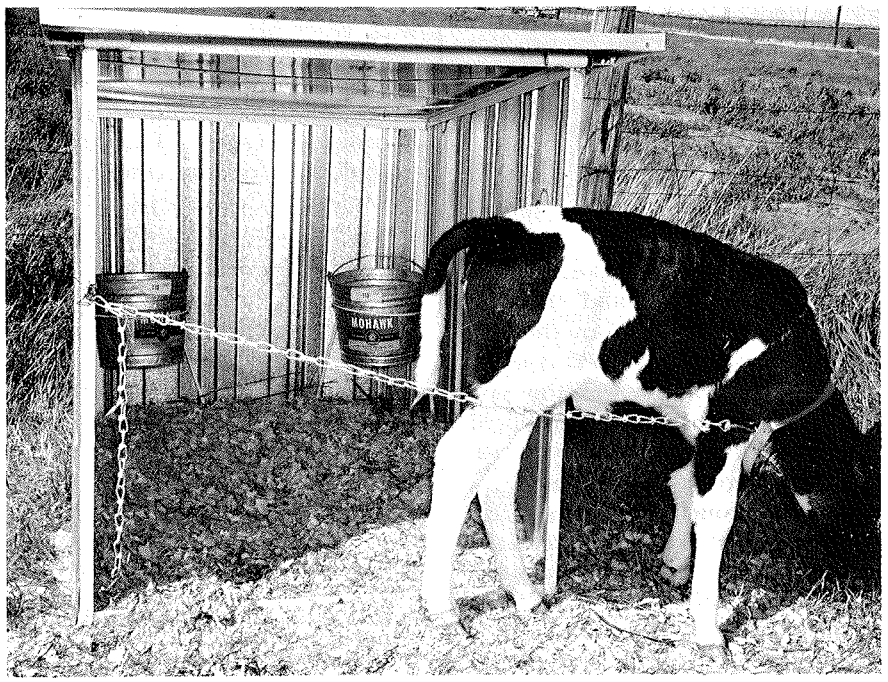


Inside view of calf cabana.

Housing the Dairy Calf

(continued from page 3)

pens or pens of tubular metal or other fabrications involving irregular surfaces.

Divisions between calves should be tall enough to minimize calf contact. A height of 40 to 48 inches will be satisfactory. The Nebraska metal pen for inside use is of modular construction which facilitates dismantling for cleaning or moving. These features are especially valuable when a severe disease outbreak occurs.

Many times the most satisfactory means of breaking the disease cycle in a contaminated facility is to move to a different building. Whatever the type of pen, it should minimize the calf's contact with disease organisms and, in addition, keep the calf dry and free from drafts to reduce susceptibility to disease.

Grouping Calves

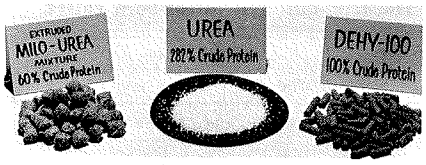
When calves are six to eight weeks of age, depending on age at weaning, they can be transferred into group pens. Free stalls are becoming more popular for young stock, especially when free stalls are used for the milking herd. When free stalls are used, young animals must be grouped into sizes which fit the free stalls. Following are suggested sizes:

4– 6 months	2′ x 4′
6–10 months	2½′ x 5′
10–16 months	3′ x 5½′
16–24 months	3½′ x 6½′

In recent South Dakota preference trials, small calves used 26″ wide free stalls significantly more than the 22″ stall, and the 22″ stall was used more than the 18″ stalls.

Similarly, sawdust was the preferred bedding material, followed (in order of preference) by straw, wood slats and a steel screen.

Another conclusion from these trials was that free stalls near the building opening were used less than those farther away, again indicating that calves are sensitive to ventilation patterns. Care should be taken to minimize drafts.



Rations compared.

Urea Rations Are Compared

By Foster G. Owen
Professor, Animal Nutrition

Urea, used at recommended low levels, is a much more economical source of nitrogen for the cow than natural proteins.

Urea at high levels, however, may reduce ration acceptability and usually will not maintain milk production as well as natural protein sources such as oil meals.

Special urea preparations may make possible inclusion of higher urea levels without adverse effects.

Recent experiments indicated that a 100% gelatinized urea-grain preparation was superior to untreated urea and equalled soybean meal as a source of nitrogen for milk producing cows. Ohio workers also found that a pelleted mixture of urea and dehydrated alfalfa (DEHY-urea pellet) yielded lactation results similar to that obtained with vegetable oil meals.

Comparisons

We compared each of these preparations with urea. Our trial involved 36 Holstein cows (12 per treatment). Cows were full-fed a complete ration of three parts of corn silage (39% dry matter) to one part of a concentrate mixture (21% crude protein). The concentrate was mainly sorghum grain and soybean meal.

The urea (control) ration contained 2.5% urea. This compares to a level of 1 to 1.5% usually recommended as a maximum.

Each of the two special urea preparations were included as a replacement for all the urea, at levels to provide these rations with the same levels of nitrogen as supplied in the urea ration. For the gelatinized urea-grain preparation, a mixture of finely ground milo and urea was run through an extruder. This product was 50% gelatinized. The DEHY-urea pellet contained a mixture of dehydrated alfalfa and urea. It was crushed before mixing into the grain ration.

Results

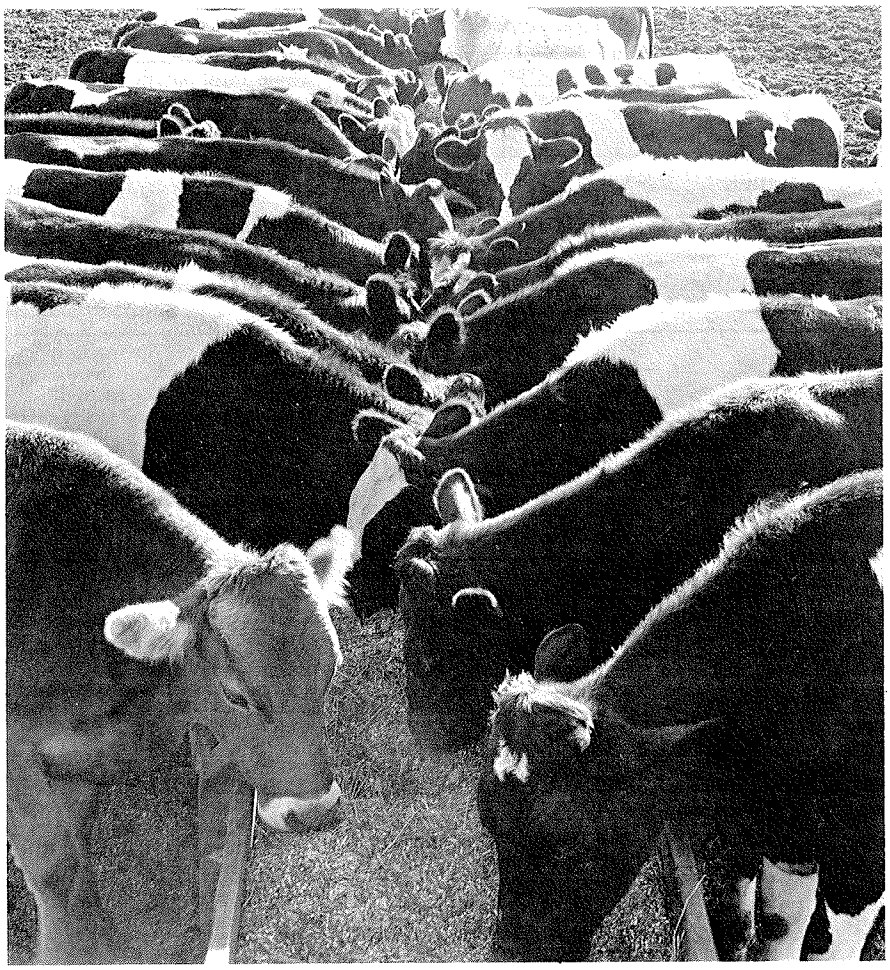
Daily milk yields and solids-corrected milk yields were improved by these special preparations (gelatinized-urea-grain or DEHY-urea pellet) compared to natural urea (Table 1). Daily solids-corrected milk (4% fat) yields were 43.1 lb. for the control (urea) ration, 45.7 lb. for the DEHY-urea preparation and 45.0 lb. for the extruded product. Both dry matter intake and net energy intake were higher for the two processed urea rations. Effects on milk fat test and solids-not-fat were small. The DEHY-urea ration, which gave the highest milk yield, also was superior in supporting body weight.

The beneficial effect of these special preparations on lactation performance could be accounted for by the improved consumption of these rations. Based on these results and current ingredient and milk prices these special urea preparations were distinctly more economical than urea as a nitrogen source for milk cows.

Table 1. Comparison of urea preparations in complete feeds.

	Dry matter intake	Milk yield	Fat test	SCM*	Body weight change
	(lb./day)	(lb./day)	(%)	(lb./day)	(lb. in 4 wk.)
Control (urea)	42.0	46.0[a]	3.56	43.1[(a)]	9.4
DEHY 100	44.2	49.3[b]	3.52	45.7[(b)]	31.9
Gelatinized urea-grain	43.1	47.5[b]	3.56	45.0[(b)]	–2.7

[a,b] Values with different superscripts are significantly different at $P<5\%$.
[(a),(b)] Values with different superscripts are significantly different at $P<10\%$.
*SCM = solids-corrected milk (4% fat), similar to fat-corrected milk.



Dairy beef feed lot.

Dairy Beef

By Philip H. Cole
Extension Dairyman

A significant portion of the nation's beef supply comes from dairy cattle. More and more dairymen are beginning to look at beef production as a legitimate part of their overall dairy income. Bull calves account for at least half of the annual calf crop in most herds and in Nebraska this accounts for about 100,000 per year.

With the exception of a few animals used as herd sires these bull calves are a by-product of the milking herd, and offer many dairymen a potential for added income.

In recent years several changes have taken place on the dairy farm, in the market place, and in consumer preferences that make dairy beef production more profitable. These include: larger herd size, good supply of roughage on many farms, and dairymen knowledgeable in beef production.

There is an increasing acceptance of and demand for dairy steers and dairy-beef cross bred steers. New methods of meat fabrication and tenderizing tend to narrow the spread between different types of beef.

Consumers are showing a definite preference for beef over other types of meat, and the consumer has also shown a preference for beef with a high lean-to-fat ratio. The dairy animal is well adapted to this trend in beef preference.

Methods of Marketing

One of the keys to the profitability of a dairy-beef operation is the dairyman's ability to match his animals to the market demand. This means having animals ready for market in reasonable numbers (not just one or two at a time), and having them fed to a size or condition that meets the market demand.

Fortunately, the dairyman has more than one way that he may market his animals. They are:

As Feeders: The successful raising of feeder calves involves the same management and feeding practices used in herd replacements. These include:

—Employ good sanitation practices at birth and through the life of the calf.

—Avoid overfeeding of milk or colostrum.

—Protect calves from drafts, cold winds and extreme fluctuations in temperature.

—Keep the calf dry.

Calves should receive colostrum for the first three days. When starting calves on milk replacer follow the manufacturer's recommendations. In using the limited whole-milk system, feed milk at eight pounds per hundredweight per day for four weeks. Recent studies have shown no advantage to feeding milk beyond four weeks of age when calves are eating ¾ to 1 lb. of starter per day.

Offer a calf starter as soon as the calf can be induced to eat it. Feed the starter free-choice up to five pounds per day along with a single 18 to 20% protein mixture such as the one in Table 1.

The feeding program for four weeks to six months should consist of up to five pounds of starter per day and good hay fed free-choice.

(continued on next page)

Table 1. Effective calf starter for feeder calves.

Ingredient	Pounds
Cracked corn	1,000
Crushed or crimped oats	400
Cane molasses	180
Soybean oil meal	400
Dicalcium phosphate	10
Iodized or trace mineral salt	10
Antibiotic feed supplement	...
Vitamin supplement	...
Total	2,000

Dairy Beef

(continued from page 5)

Limited research suggests corn silage may be substituted for hay. Hay crop silages should not be used unless four or five pounds of grain is included in the ration daily.

When calves are six months of age, grain may be reduced to two or three pounds per day. At nine months, grain feeding is usually discontinued. From six months to one year, feeders should receive roughage free-choice.

Many calves raised as feeders are sold at bout six months and weigh close to 400 pounds. Some are held until they are one year and weigh about 725 pounds. Animals of this weight will move directly into the feed lot for finishing.

A summary of feed requirements and estimated costs for feeder calves up to six months and one year of age is given in Table 2.

Table 2. Feed requirements for Holstein and Brown Swiss feeder calves.[a]

Feed required		Limited whole milk for 4 weeks		Milk replacer
		8 lb./day	6 lb./day	
from birth through six months	Whole milk	225	170	30
	Milk replacer	...	...	40
	Concentrate	530	550	530
	Hay	750	750	750
	Feed cost[b]	$34.25	$32.70	$32.90

Feed required		Fall-born calves pastured part of following summer	Spring-born calves not pastured
		lb.	lb.
from six months through one year	Concentrate	180	180
	Hay	900	1,200
	Corn silage	...	4,200
	Pasture	5 months	...
	Feed cost[b]	$36.65	$37.20

[a] Based on feed consumption studies at Agricultural Experiment Stations in Ohio, Kentucky, New York, Michigan, and Alberta, Canada.

[b] Feed costs used were: Milk, $4.00/100 lb.; Milk Replacer, $16.00/100 lb.; Concentrate, $3.00/100 lb.; Alfalfa Hay, $25.00/ton; Corn Silage, $8.00/ton; Pasture, $4.00/month.

As Finished Steers: Dairy steers should not be overfinished. Grade is determined by finish and body conformation. Feeding dairy-type animals to a grade of *high standard* or *low good* will be more profitable than attempting to raise the grade by putting additional fat on the animals.

Corn silage with or without limited amounts of alfalfa hay makes an excellent feed for finishing dairy steers. The addition of moderate levels of grain will result in greater gains and the cattle will usually grade slightly higher than those fed on roughage alone.

Workers at several experiment stations have found the average daily gains to be from 1.7 to 2.0 pounds for steers on roughage alone and from 2.3 to 2.5 pounds for those receiving concentrate at 1% of body weight in addition to roughage. Steers fed roughage alone require 30 to 50 days longer to reach weights comparable to steers fed roughage plus grain.

Table 3 illustrates results that might be expected from a roughage feeding program and from a roughage plus ground corn program.

The gains, feed consumption, and cost figures in Table 3 are based on the inclusion of stilbestrol and antibiotics in the protein supplement.

A 10% increase in gains and feed efficiency can be expected from the use of stilbestrol. Results of large numbers of experiments show feeding and implanting stilbestrol to be equally effective.

Other Considerations

In addition to deciding whether to feed bull calves out as feeders, or finished steers there are other possibilities that the dairyman may want to consider. How do steers compare with bulls for beef production? What are the merits of cross-breeding dairy with beef? Is there any difference in dairy bulls as far as beef production is concerned? How do dairy steers compare with beef steers?

Bulls vs. steers. A three-year study at Purdue indicated that the bulls gained faster and slightly cheaper, and were not as fat as the steers. The bulls had a higher proportion of their weight in chuck, a cheaper cut. Their data showed:

1. Bulls gained .25 lb. more daily than steers.
2. Feed costs for bulls were 64¢ less per hundredweight of grain.
3. Bulls had .3 inch less exterior fat on the carcass, and 1.67 inch larger rib eye.
4. Bulls and steers had about the same percent of carcass in choice cuts.

Dairy bulls present an additional management problem due to their aggressiveness and disposition. One solution is to run the bulls together in small groups of 15 to 20 animals and keep them together throughout the feeding period. Bringing new animals into the group causes fighting.

Crossing dairy with beef. This is a fairly common practice in many herds, especially with first calf heifers, but what does this do to the breeding value of the herd? It is difficult to determine just how great is the genetic effect of using beef bulls on dairy animals. Some market value has to be assigned to the offspring that goes to market as a beef animal.

In one study first calf heifers were bred to beef bulls, an average dairy bull, a dairy bull with a *predicted difference* of 500 pounds, and a bull with a *predicted difference* of 1,000 pounds of fat. Compared with the beef bull the advantages in favor of dairy bulls amounted to $5, $21, and $15 for

Table 3. Alternate feeding methods for finishing dairy beef.[a]

	Roughage		Roughage + grain	
	Corn silage + alfalfa hay	Corn silage	Corn silage + alfalfa hay	Corn silage
Initial weight (lb.)	700	700	700	700
Final weight (lb.)	1,000	1,000	1,000	1,000
Gain (lb.)	300	300	300	300
Days on feed	170	150	125	120
Average daily gain (lb.)	1.8	2.0	2.4	2.5
Average daily feed consumption (lb.)				
Ground corn	...	...	7	7
44% protein supplement	1	2	1	1.5
Alfalfa hay	5	...	5	...
Corn silage	40	55	25	40
Total consumption (lb.)				
Ground corn	...	...	875	840
44% protein supplement	170	300	125	180
Alfalfa hay	850	...	625	...
Corn silage	6,800	8,250	3,125	4,800
Feed cost[b]	$46.33	$48.00	$46.25	$47.10
Feed cost/lb. gain	15.4¢[c]	16¢[c]	15.4¢[c]	15.7¢[c]
Labor cost[c]	$ 6.80	$ 6.00	$ 5.00	$ 4.80
Total feed and labor cost	$53.13	$54.00	$51.25	$51.90

[a] Based on results of feeding trials at Agricultural Experiment Stations in Colorado, Nebraska, Ohio, Iowa, Nevada, and Michigan.

[b] Feed costs used were: Ground Corn, $2.25/100 lb.; 44% Protein Supplement, $100/ton; Alfalfa Hay, $25.00/ton; Corn Silage $8.00/ton.

[c] Labor cost calculated at $1.20/steer/month.

the average, +500 P.D. and +1000 P.D. bulls, respectively. Reasons for the advantages shown by the dairy bulls are:

1. If all first calf heifers are bred to beef bulls there will only be enough calves left to replace normal herd losses. No selection for production will be possible. Only gain that the herd can make will come through bulls.

2. First calf heifers should be better genetically than older cows. Both bulls and cows are genetically superior every year due to normal breed progress.

Which dairy bull to use. Most studies indicate that there is not any strong genetic correlation — either positive or negative — between milk yield in cows and growth rate, feeding efficiency, and carcass yield in the males.

This means if we want both milk and meat we will have to select for both. When selection for more than one trait at a time is made it will reduce the effectiveness of the selection of either one. Thus, based on present knowledge, it would seem wise to continue to base selection of bulls on milk production. This should not be detrimental to beef production.

A recent study at Wisconsin would indicate that the sires estimated breeding value for milk production has little effect on the offspring's rate of gain or carcass grade.

Dairy vs. beef. Occasionally the dairyman will need to ask himself what will be my advantage if I change from a straight dairy operation to a straight beef operation as far as beef production is concerned. How do beef and dairy steers compare for beef production? Many feedlots contain both beef feeder calves and dairy feeder calves. It is important that the feeder, whether dairyman (or beef man) understand the similarities and differences between these animals and beef-type steers.

Table 4 shows that dairy steers consistently make higher rates of gain than do beef-type steers of similar weight. Much of this difference can be attributed to stage of maturity and degree of fatness. Dairy steers are larger type animals than beef steers and when animals of the same weight are compared the beef steer will be a more mature animal carrying more fat. Rate of gain and feed efficiency decreased with increased maturity and degree of finish.

Beef-type cattle have the advantage over dairy-type steers of having less stomach and intestinal tract, giving them a 2½ to 3% advantage in dressing percentage. The increased size of the digestive tract of the dairy steers illustrates the greater capacity for fill and shrink. This is particularly important in establishing weighing conditions at time of purchase. Dairy-type steers show at least 1% more shipping shrink than beef-type steers.

Meat from dairy-type carcasses is similar to that from beef-type carcasses. A Michigan trial showed no difference in taste-panel scores on tenderness even in carcasses from Holstein grading *Standard* when compared to *Choice* carcasses of beef-type. The meat from beef-type steers was juicier and carried a more desirable flavor. It was suggested that this may have been the result of the difference in fatness.

Summary

For the dairyman who has the necessary feed, facilities, and labor the production of dairy-beef provides him with the opportunity to make this a profitable part of his overall dairy herd operation.

Table 4. Average daily gain of dairy and beef-type steers.

Trial	Initial and final weights	Breed	
		Hereford/ Angus	Holstein/ Brown Swiss
	Lb.	Lb.	Lb.
Michigan	400–900	2.25	2.39
Ohio	400–1,100	1.73	2.10
Wisconsin	400–950	2.19	2.37
Nevada	750–950	1.6	2.3
Iowa	750–1,200	2.78	3.10

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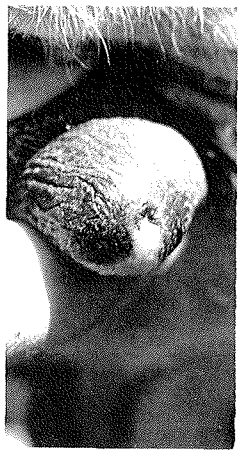

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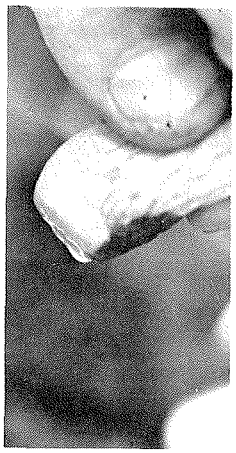

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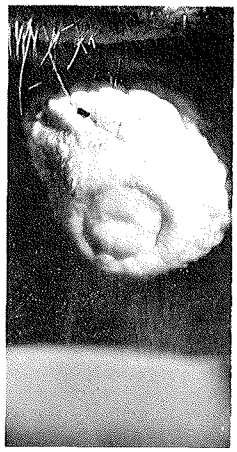

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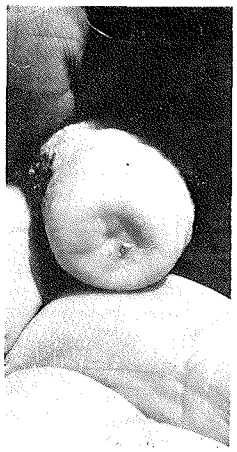

Cone.

The Cow's Teats

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

How much do you know about the teat ends of the cows in your herd? Are they pointed or round, flat, disk-like or cone-shaped? Do these different shapes have any significant meaning to you?

Recent observations and experimentation on 146 Holstein and Brown Swiss cattle in the University of Nebraska dairy herd have led to some interesting conclusions.

Most bacterial invasions of the udder usually take place via the teat "streak" canal. There is considerable evidence to indicate a relationship exists between the teat-end and resistance to new infections. Recent experimentation on teat anatomy clearly indicates that changes do occur over time (age of cow) and stage of lactation.

At the same time, a close relationship between rate of milk flow and type of teat-end has been observed.

Experimental Procedure

Radiographs (x-rays) of all teat canals were obtained to determine: (a) the length of canal, (b) proximal width, (c) median width, and (d) distal width. At the same time, two independent measures of average and peak milk flow rates using a continuous recording device were obtained. In addition, a subjective teat classification scheme was developed, indicating whether the teat-end was pointed, round, flat, disk or cone-shaped.

Each of the four teats was classified independently. If three or more teats were of the same type, the cow was so typed. If there were two quarters of each of two different types, and if the rear quarters were of the same type, this classification was given to the cow.

Results

A summary of individual quarter measurements of teat canal length and width is presented in Table 1. Teat canals were found to become both longer and wider, especially at the proximal and median positions, as the age of the cow increased.

This work, combined with that conducted at the National Disease Research Laboratory, has resulted in the conclusion that the width of the streak canal, especially at the median and proximal position, is a primary controlling factor on the rate of new infections.

The teat classification scheme appears to be a good indicator of the

Table 1. Effect of age on teat canal anatomy.

	Lactation number			
	1	2	3	4 & >
No. cows	41	33	37	35
Trait				
Length (mm.)	10.9	12.4	12.7	13.4
Width (mm.)				
Proximal	.80	.94	1.06	1.07
Median	.67	.77	.80	.82
Distal	.55	.53	.60	.59

Table 2. Relationship of teat classification, flow rate measurements and streak canal anatomy.

	Cow's classification			
	Pointed	Round	Flat	Disk or cone
Av. flow rate (lb./min.)	5.5	5.9	6.4	8.7
Peak flow rate (lb./min.)	7.4	7.6	8.4	11.1
Streak canal anatomy (mm.)				
Length	10.5	12.7	11.7	10.8
Width				
Proximal	.78	.94	.99	1.03
Median	.45	.78	.82	.85
Distal	.45	.53	.62	.63

cow's milking characteristics (Table 2). Both average and peak flow rates were low on cows with "pointed" teats, and increased as the teat-end became flatter, resulting in a wider streak canal at the distal location. The "disk" and "cone" shaped teats were characterized by still faster milk flow patterns, even though the "distal" width of the canal did not differ significantly.

There appears to be a certain uniformity of teat classification within cows. Seldom did any teat vary more than a single classification score from the other three teats, although a few cows were noted to have three different teat types.

Breed differences were apparent. Eight of every ten Brown Swiss cows were classified as being "round," a type slightly different from the typical Holstein classified similarly.

Conclusions

It appears that the cone-shaped teat-ends result in a higher incidence of new infections. Originally, it was assumed that the funnel might hold a droplet of milk which could serve as a substrate for bacteria. The use of a post-milking teat dip would help eliminate this danger and it is now assumed that the disk and cone-shaped teats are more susceptible because the streak canal is wider, allowing mastitic organisms to penetrate the mammary gland more easily.

The pointed teat, on the other hand, is reputed to be associated with early culling. Slower milk flow may be one cause. Pointed and round teats are more prone to evert (erode) than are flat teats according to European scientists, and this may contribute to earlier culling.

The data analyzed to date strongly suggest that the "flat" teat is ideal. This conclusion is substantiated by the milker's impressions regarding which cows in the herd milk-out reasonably fast and yet are reasonably resistant to new infections.

Practical Calf Feeding

By Foster G. Owen
Professor, Animal Nutrition

"What kind of a feeding plan should I use to get my calves off to a good start and reduce sickness and death loss?"

This is an important question for all dairymen. This is our No. 1 concern in developing a calf raising program to recommend to dairymen. But, in addition, the program must be simple and easy to put into operation.

During the past five years we have been studying and testing various calf raising practices to develop practical plans which will produce healthy, strong calves. We also have given continual attention to accomplishing these goals at the lowest possible cost. This article is based on our work as well as that at other universities. Consideration is directed mainly to calves up to 12 weeks of age.

Every calf born should—and usually must—have colostrum during the first day after birth to maintain health and survive the first few weeks of life. Colostrum's unique value is its antibody content. A cow which has been on the farm a period of time develops antibodies to many of the disease organisms on that farm. These antibodies are passed on to the calf through the colostrum.

To obtain these antibodies the calf must receive its dam's *first* milk as its *first* meal. The dairyman should assure that the calf gets this colostrum as soon after birth as possible, because the calf's ability to absorb antibodies decreases from birth to almost zero at 24 hours.

Another important contribution of the dam to getting this calf off to a healthy start is through the effects of vitamin A. If the dam has not been fed sufficient vitamin A or carotene during gestation her calf may be born dead, weak, or may have poor vision and lowered resistance to pneumonia and diarrhea. In addition, the colostrum will also have a reduced vitamin A value.

Beyond the first day, several alternative type diets can be fed to the young calf. The more practical choices available are: feeding colostrum for an extended period, whole milk, or a milk replacer.

Extended Colostrum Method. This consists of using only the milk produced during the first three or four days after freshening. Compared to normal milk, this milk is higher in protein, vitamins and most minerals as well as total energy value.

Although it cannot be sold, it is nutritionally the most valuable milk a cow produces. Logically, it should be fed to calves. In our experience it is *the best diet* we have found for starting calves. Fortunately, the amount our cows produce during the first three days averages more than enough to feed all the heifer calves to weaning age (21 days).

We found in two experiments (Table 1) that at 21 days of age colostrum-fed calves gained 50% faster than those fed milk. Scours was not a major problem, but in one trial calves fed colostrum scoured about half as many days as those fed normal milk. The excellent weight gains on colostrum look

(continued on next page)

Table 1. Colostrum vs. milk.

	Fed milk	Fed colostrum
Experiment I		
No. calves	20	20
3 wk. gain/day (lb.)	.42[a]	.66[b]
6 wk. gain/day (lb.)	.64[a]	.84[b]
12 wk. gain/day (lb.)	.97[a]	1.21[b]
Days scours %	8.9	4.8
Death losses	1	2
Experiment II		
No. calves	24	24
24 day gain/day (lb.)	.45[A]	.65[B]
43 day gain/day (lb.)	.83[a]	.95[b]
78 day gain/day (lb.)	1.37[a]	1.53[b]
Av. scours index*	1.40	1.40
Death losses	1	0

*Index: 1 = normal, 2 = soft, 3 = loose, 4 = runny.

[a,b] Values with different superscripts are significantly different at $P<5\%$.

[A,B] Values with different superscripts are significantly different at $P<1\%$.

Calf Feeding

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impressive. But more important is that good gains generally reflect vitality and health in young calves.

Colostrum not needed for current feeding is stored in a freezer, using gallon plastic jugs or metal cans. The colostrum is removed from the freezer 12 to 24 hours (depending on room temperature) before it is needed for feeding. Then, just before feeding, it is placed in warm water to complete thawing and is warmed to the desired temperature.

Whole Milk. Whole milk has been, for years, the standard diet to which all others are compared. However, its popularity has diminished over the years because of the development of "milk replacers." These products are generally more economical than whole milk. For many dairymen milk replacers are also more convenient to use.

Since the replacer formulas contain an antibiotic, they may prove to be superior to unsupplemented whole milk in getting calves off to a healthy start. However, in most cases growth is somewhat less and loose feces is more prevalent while feeding replacer formulas. These differences in growth and feces looseness are probably of little consequence.

Milk Replacers. As a substitute for whole milk, a high quality "milk replacer" formula is one logical alternative. A desirable replacer formula is composed almost entirely of milk derived ingredients. It contains 24–28% protein, 10–20% fat, includes at least 10,000 I.U. of vitamin A per pound and either Aureomycin[1] or Terramycin[1] at 25–50 mg. per pound. In addition, and most important, it must prove itself effective on your own farm.

Liquid Feeding Procedures

Amounts of Liquid to Feed. During the first week of life the calf should be fed liquid feeds limited to about 8% of its body weight. Higher amounts during the first week tend to cause scouring. Thereafter, calves may be fed 10–14% of body weight, generally without adverse effects. Near the end of the milk feeding period, however, lower milk feeding levels are necessary to stimulate dry feed (starter) intake. However, if a schedule was made up for each calf, with different amounts for different weights and ages, the feeding job would be too complex and impractical.

Therefore, we decided to try using a constant level of 7 lb. per day for our Holstein calves, from birth to weaning. This is about 8% of the birth weight of average Holsteins. (For the smaller breeds, 5.0–5.5 lb. daily is probably sufficient).

When replacer formulas are used, we suggest about 1 lb. dry formula with 6 lb. of water to provide the 7 lb. of liquid for Holsteins. The preset level of 7 lb. daily has worked out very sucessfully for us in starting several hundred Holstein calves.

Although calves will gain more while feeding milk or replacer at higher levels, this advantage is only temporary. Calves raised by our new system generally gain an average of 1.25–1.40 lb. per day through the first 12 weeks. Such gains are satisfactory by any standard, and indicate no adverse effects from the modest gains during the milk feeding period.

Once or Twice Daily Feeding? About 5 years ago we started testing the idea of feeding milk only once daily compared to twice. Calves got the same full day's allowance (7 lb.) in one daily feeding as the other calves got in two feedings.

Table 2. Once versus twice daily feeding.

No. calves	1X/day 44	2X/day 44
3 wk. daily gain, lb.	.60	.49
6 wk. daily gain, lb.	.91	.90
12 wk. daily gain, lb.	1.25	1.11
24 wk. daily gain, lb.	1.51	1.48
Days scours (to 12 weeks)	5.8%	6.4%
No. deaths (to 12 weeks)	3	3

(Results from Scotts Bluff Station, University of Nebraska, two experiments.)

To our surprise, results were as good for once as for twice daily feeding. Body weight gains were even a little better in one experiment (Table 2). Considering all data—gains, feed intake, scours incidence and all diseases—we see no reason to feed twice-a-day. Research at other universities supports this conclusion.

Of course, feeding only once saves half the time in feeding liquid —the time involved in feed preparation, feeding itself and clean-up of buckets and utensils.

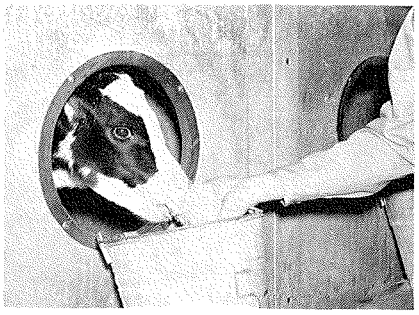
Following these experiments we have routinely used once-a-day feeding for starting herd replacements. Over the past few years, other universities and many commercial herds have shifted to this "skip-feeding" plan.

Open Bucket or Nipple Pail? In terms of calf performance, it does not make any important difference whether an open pail or nipple pail is used. This is true when the usual restricted levels of liquid feed are being fed. When large amounts are fed, as for vealers, then the nipple pail is superior. Slower consumption of large volumes of milk seems to help reduce scours. Using open pails, however, reduces the clean up operation. For calves difficult to teach to drink, the nipple gives a convenient assist.

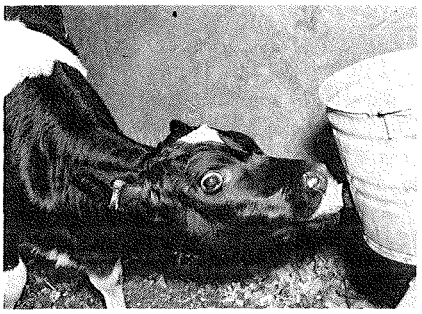
When to Wean. Calves, as well as the dairyman, are benefited by weaning as early as it safely can be done. The labor of feeding and the cost of feeds can be reduced by limiting the milk feeding period. Probably of more importance is that calves have fewer disease problems, especially digestive upsets, after they are shifted to dry feeds. Scours is seldom a concern after weaning.

The question is "How early can calves be weaned safely?" Studies on the development of digestive function show that the calf has the capability of utilizing dry feeds effectively as early as three weeks of age. Experiments indicated that they might even be weaned earlier, but not with uniform success.

[1] Registered tradenames.



Early weaning depends on palatable, nutritious starter ration.



Nipple pail aids in teaching the "difficult" calf to drink.

We compared weaning at three weeks and six weeks of age. Table 3 shows that there was no important difference in weight gains and health at 6 or 12 weeks of age. The data show that those weaned at three weeks ate 40% more starter ration during the first six weeks. This was the main difference. Weaning, you might say, was necessary as a means of converting calves to the dry ration.

Certain calves are eating very little starter ration at three weeks of age. Some think that calves should not be weaned until they are eating 1 lb. or more of starter ration daily. Others think they should be "off-to-a-good-start" as indicated by weight gains. So, we compared our method of abrupt weaning at three weeks with two other methods: (1) waiting to wean until calves are eating 1 lb. of starter daily and (2) weaning only after calves gained a minimum of 15 lb. from birth.

Results showed no advantage of these methods compared to the simple system of weaning every calf at three weeks. Based on these and additional experimental results we have been routinely using this weaning system in the University herd for several years and recommend it as a part of our suggested program for starting calves.

Table 3. Effect of weaning age on performance of Holstein calves.

	Weaned at 3 wk.	Weaned at 6 wk.
No. calves	24	24
6 wk. gain, lb./day	1.07	1.12
12 wk. gain, lb./day	1.35	1.38
6 wk. grain, lb./day	1.45	1.05
6 wk. hay, lb./day	0.15	0.16
Scours, % of days	6.0	6.1
Deaths	2	0

Milk Temperature. Most recommendations for feeding calves specify that the milk temperature should be rigidly regulated to near body temperature. However, the importance of milk temperature had not been experimentally tested until recently. Research findings at Nebraska and elsewhere indicate that a milk temperature of 35–40° F. is as satisfactory as a temperature of 90–100° F.

When feeding colostrum in our early weaning program, cold colostrum gave slightly better performance than when it was warmed to 90–100° F. In addition, use of frozen colostrum is simplified when it is not necessary to bring the temperature back to the higher level. There is more hazard, also, of getting the milk too hot.

We conclude that using the cold milk is fully satisfactory, unless calves are in a severely cold environment, and should be used whenever it will simplify the feeding program.

Starter Ration

The quality of the starter ration is critical in an early weaning program. Of primary importance is its palatability. It must be composed of ingredients especially appetizing to the very young calf. Its content of protein, minerals and vitamins should be higher than in the conventional starter used by calves fed milk for longer periods.

Palatability. To obtain high palatability the starter should be coarse textured. It should consist largely of cracked or whole grains, with a minimum of dusty or fine ingredients.

Pelleting will not improve an otherwise desirable starter, but may improve palatability if appreciable amounts of fine or dusty ingredients are included.

Certain ingredients have special effects on palatability. Molasses generally improves intake when added at 10% of the ration. Liquid molasses is preferred because it reduces dustiness, especially when rations are freshly mixed. Including an antibiotic also stimulates starter intake.

Soybean meal and linseed meal are recognized as among the more palatable protein supplements. Skim milk powder, fish meal, and meat and bone meal are among the less palatable feeds. The protein percentage (18–20%) and mineral content of the starter ration must be adequate to stimulate good rumen digestion.

Clean, fresh water is an obvious

(continued on next page)

Table 4. Starter rations for calves.

Ration No.	1	2	3[a]	4[a]
	(lb.)	(lb.)	(lb.)	(lb.)
Corn, coarse ground	27	35	21	24
Oats, rolled or crushed	20	20	20	20
Beet pulp	...	...	...	15
Corn cobs	...	...	15	...
Wheat bran	10	...	...	...
Soybean meal (44% CP)	30	32	34	31
Molasses[b]	10	10	10	10
Dicalcium phosphate or bone meal	2	2	2	2
Trace-mineralized salt	1	1	1	1
Vitamins	(include 3,000 IU/lb. of Vitamin A and 500 IU/lb. of D_2)			
Antibiotics	(include 15 mg./lb. of Aureomycin or Terramycin)			

[a] Ration includes high fiber, which may be especially helpful if raised on slotted floors.
[b] Liquid molasses preferred.

Calf Feeding

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need, but sometimes is neglected in feeding the very young calf which is still receiving milk.

Frequent clean-out of the feed box and addition of fresh starter is helpful. Even stirring the feed occasionally and rubbing a little starter on the calf's nose can stimulate the calf to begin eating grain.

Table 4 gives some recommended starter rations. They contain about 20% protein. The first ration is essentially the type we have used for several years. Some of our experiments indicated that including roughages such as beet pulp or cobs may encourage greater starter intake of calves raised in elevated pens (no bedding). Starters No. 3 and 4 have these "built-in" roughages.

The starter ration should be fed until the calf is eating about 4 lb. per cwt. daily. With our early weaning program this will be at about 8 to 10 weeks. Therefore, at 10 to 12 weeks of age all calves should be shifted to a grower ration. This will permit reducing the protein level in most cases and will reduce the complexity and cost of the ration.

Grower Ration and Roughage. Table 5 shows some suggested grower rations for feeding with different types of roughages. It is seen that the grower should have a protein content to balance that contained in the roughage. Palatability is of much less concern, so the ingredients are not so critical. Usually no antibiotic or vitamins are needed.

The most practical time to introduce hay or other roughage into the ration is probably at the time you shift to the grower ration. Before this, most calves eat very little hay. Since its nutrient contribution would be negligible, any value roughage may have for young calves is still in question.

Calf Feeding Plan

The following feeding plan is recommended as the most successful method available for minimizing calf health problems and reducing feed and labor costs in starting Holstein replacement heifers.

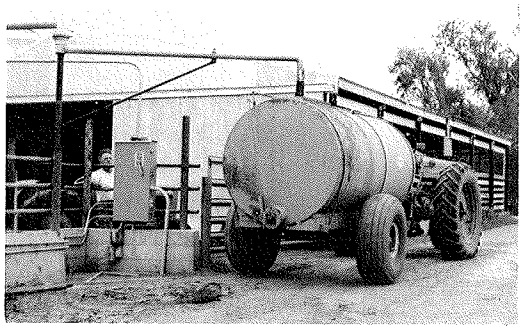
1. Assure that the calf obtains its dam's *first milk* as its *first feed.* This should be done as early as possible, and not later than six hours after birth.
2. Continue feeding colostrum[1] (milk produced during the first three days after calving) until weaning. Save all surplus colostrum by freezing. Add 40 mg. of Aureomycin or Terramycin each day.
3. Feed calves only once daily at a constant level of 7 lb. from birth to weaning.
4. Wean all normal calves at 21 days of age.
5. Provide a palatable nutritious starter ration along with fresh water beginning the first week after birth.

[1] If colostrum is not available, use normal milk. If milk replacers are used, it may be advisable to extend the feeding period to 4 weeks of age for most calves.

Table 5. Grower rations for calves.[a]

	Feed with high protein forages (18% or more)		Feed with medium protein forages (13–18%)		Feed with low protein forages (less than 13%)	
Grower No.	1	2	3	4	5	6
	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)
Ground shelled corn or sorghum grain	...	700	600	...	500	...
Corn and cob meal	980	...	...	780	...	630
Ground or rolled oats	...	280	255	...	...	...
Wheat bran	...	...	...	...	280	...
Molasses	...	...	...	...	...	50
Soybean meal (44%)	...	...	125	200	200	300
Dicalcium phosphate	10	10	10	10	10	10
Trace-mineralized salt	10	10	10	10	10	10

[a] To be fed to calves when dry feed consumption reaches 3–4 lb. per day. This is about 8–10 weeks of age when calves are weaned at 3–4 weeks of age.



Manure pump loading a honey wagon.

Manure Handling

By Don J. Kubik
Area Extension Specialist (Dairy)

Handling manure is a major problem on most dairy farms. When planning new or expanded facilities the problem of manure disposal must be considered.

As dairymen increase herd size, change to free stall housing or put in additional concrete, the amount of manure and type of manure to be moved or stored changes daily.

Add to these changes the rain runoff into the lots from buildings, plus additional concrete lots and the manure changes to a slurry type.

Handling Systems

With slurry type manure, new ways of storing and handling are getting much attention. There are two basic systems for handling manure. These are:

1. Daily removal from farmstead.
2. Periodic removal from farmstead.

Daily Removal includes:

Collection—gutter, floor or lot.

Move & elevate—gutter cleaner, blade and dock, or loader.

Transport—spreader, honey wagon or irrigation system.

Disposal—open field.

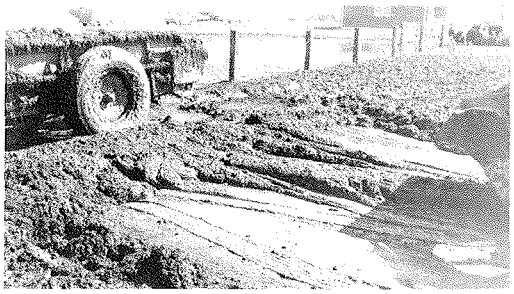
Periodic Removal includes:

Collection—gutter, floor, lot, pit or oxidation ditch under slots.

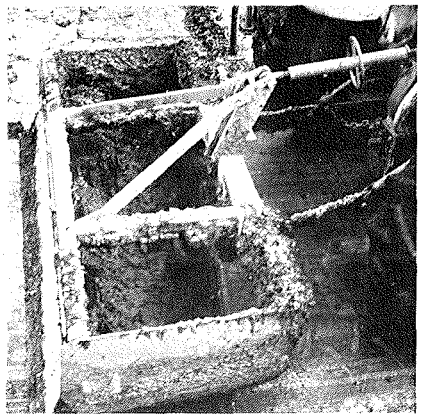
Move—gutter cleaner, blade & dock, or loader.

Temporary storage—below ground tank, paved surface area or open lot.

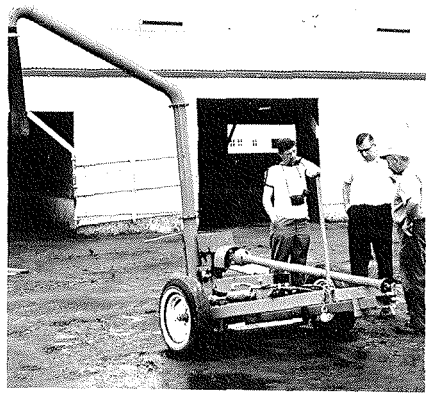
Load—pump, front end loader, or barn cleaner & elevator.



Normal consistency of manure.



Scraper designed to pull slurry manure.



Portable drop-in manure pump.

Systems for Dairy Farms

Transport—honey wagon, spreader or irrigation system.

Disposal—open field or dryer.

There are also two basic methods for handling manure:

1. As dry manure (normal accumulation).

2. As fluid or liquid manure (milkhouse & parlor liquids and or water added).

The housing system, volume of manure, cropping system and labor management all need consideration when selecting a manure handling system.

There are a few things about conventional handling of manure which need mention.

1. The value of stored manure is lowest with this system because of runoff, leaching and dehydration. This is compared to the dock and liquid system where the only significant loss is that which occurs from runoff when the manure is applied to frozen ground.

2. The labor and tractor use are high for the conventional system because the manure must be moved to storage and then later lifted onto the spreader. Most of the manure hauling for this system must be done in the spring in competition with field work.

3. This system does slightly reduce labor on the regular basis as compared with the dock system because the manure does not have to be regularly spread. The accumulation of manure is not desirable from a sanitation standpoint, especially in the summer.

4. Frozen material is of no particular problem with this system where with the liquid system it must be handled separately.

A manure dock will work well as a method of handling slurry type manure. A manure dock is provided so that manure can be pushed onto a spreader without lifting it.

A dock should not be slanted because in freezing weather it is difficult to get up an incline. With a dock system it is necessary to have a storage area where the manure can be pushed when it is impossible to spread on the field. This storage area should be convenient, outside the cow lot, and preferably with concrete bottom and sides for easy cleaning. This system is the most common today and works quite satisfactorily.

Let's direct our attention to liquid manure systems. Characteristics of a liquid manure system are:

1. The potential for preserving the most plant nutrients is present.

2. Initial investment is higher than other systems.

3. The maximum degree of mechanization is possible.

4. Odors are suppressed generally below other methods of disposal except at the time of cleaning and spreading the liquids.

5. The fly problem is lessened.

6. Frozen material cannot be handled in the holding tanks.

7. Some saving of labor is achieved.

8. The size and type (storage tank or oxidation ditch) of storage determines time limit between spreadings.

9. Materials such as hay, straw, gravel and sand may present problems in handling.

10. Wetter materials can be handled easier with this system.

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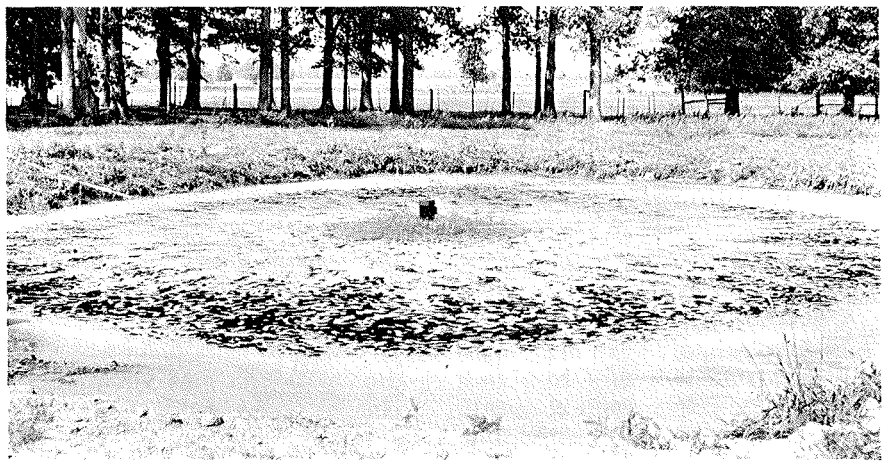


Aerator helps break down manure solids so liquid can be put through an irrigation system.

Manure Handling

(continued from page 13)

Table 1. Effect of number of cows on two manure systems.

Type of system	Number of cows 60	90	120
Conventional	Base[a]	Base[a]	Base[a]
Ramp	$600	$600	$600

[a] The tractor, loader, scraper and spreader is the base.

11. Freezing of manure pits under slats may occur in open buildings.

Our primary attention will be on the conventional holding tanks as a method of manure handling but mention should be made of two alternatives.

Slotted floors are being considered as a labor saving device.

The most logical place for slats is in an environmentally controlled unit. Cold buildings, where cows are not confined all the time, may have manure freezing both on the slats and in the pit under the slats. Beef cattle confined to 20 sq. feet per head in an open building have some build up on the slats in cold weather. The pits will also freeze up. One should observe this type of operation and decide if this problem is worth the convenience the rest of the year.

The oxidation ditch may be used under slats or in place of a holding tank. This is a shallow holding tank which uses an agitator to incorporate oxygen into the manure. This system reduces the solids and produces a liquid containing about five times that of the normal accumulation of manure. This liquid can be hauled in a honey wagon or pumped through an irrigation system using a boom gun. This system is faced with a freezing problem in buildings other than environmentally controlled ones.

Table 2. Effect of size of herd and days of storage on the investment in a liquid manure system.[a]

Liquid days[b]	Size of herd 30	60	90
10	$3300	$3500	$3700
30	3900	4300	4700
60	4800	5800	6800
90	5800	7100	8600
120	6900	8200	9700

[a] Michigan data adjusted to 1970 Nebraska costs.
[b] A minimum of 2.0 cubic feet (15 gallons) should be figured per cow per day.

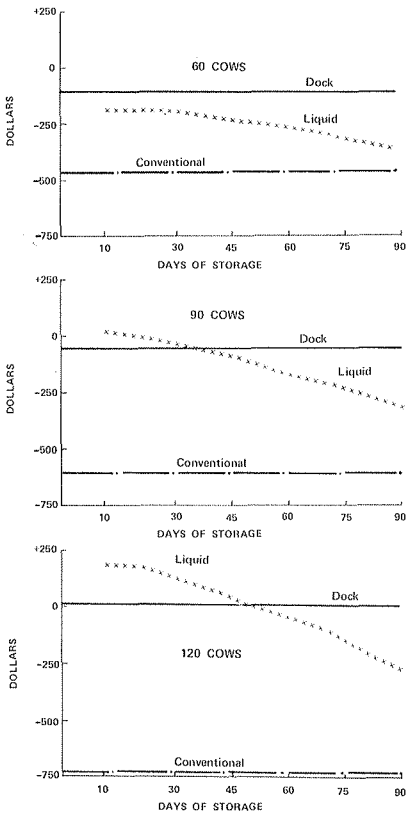


Fig. 1. Returns above disposal cost for three handling systems, by herd size.

Let's look at the expected investment and operating costs associated with the liquid manure system. For comparison we will also include conventional once-a-year hauling and the dock system.

The investment cost in a dock system or conventional system is not affected by the number of cows nor the length of storage period. Basic costs are shown in Table 1.

A $600 average figure is used as actual cost figures show $42 to $1250 depending on existing facilities, concrete, etc. This does not include an emergency concrete storage area.

The investment cost in a liquid manure system is affected by the number of cows and, even more so, by the number of days of storage needed or desired by the operator.

The basic costs of a holding tank, agitating and pumping equipment plus a 1200 gallon tank wagon are shown in Table 2.

Few systems in Nebraska show a return above disposal costs.

Figure I shows returns above disposal cost for three systems and the influence of herd size and days of storage.

The annual cost per cow is as important or more important than other considerations (Table 3).

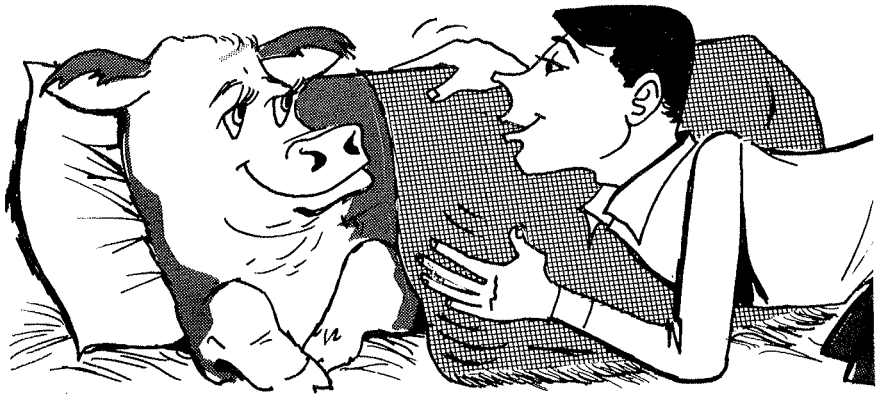
Table 3. Annual cost of three systems as affected by size of herd and length of storage period.[a]

Type of system		Number of cows 60	90	120
Conventional		$19	$18	$17
Ramp		17	15	14
Liquid	Days			
	10	23	19	18
	30	24	20	19
	60	25	22	20
	90	26	23	22
	120	27	24	23

[a] Michigan data adjusted to 1970 Nebraska costs.

Table 4. Comparison of manure handling systems.

	Conventional	Ramp	Liquid
1. Investment (Tables 1, 2)	Minimum	Low	High
2. Labor and tractor	Highest	Moderate	Low
3. Manure value	Low	High	High
4. Net cost/cow/yr. (Table 3)	Highest	Lowest	Moderate
5. Seasonal labor	High (spring)	Regular	Flexible
6. Convenience	Fair	Fair	Good
7. Sanitation	Poor	Good	Good
8. Pollution potential	High	Moderate	Low
9. Spreading	Good	Difficult	Good
10. Frozen material	No problem	No problem	Can't handle



Shipping fever resembles common cold in man.

Respiratory Infection in Calves

By Marvin J. Twiehaus
Professor and Chairman
Dept. of Veterinary Science

Respiratory infections have become more widespread in dairy herds in recent years. This is probably explained by greater movement in breeding animals, greater concentration of replacement calves and changes in management.

These infections constitute one of the most costly and troublesome disease problems in the dairy and beef industry. Losses come from death (up to 40%), treatment, preventive measures, poor utilization of feed, weight loss during illness, retarded growth, lower calf crop, etc.

The bovine respiratory disease complex is an acute or subacute inflammatory reaction within the respiratory system, which may include the nose, sinuses, larynx, trachia, bronchi and alveoli.

Causes

Causes of the inflammatory reaction may be one or more of the respiratory viruses or bacteria or a combination of both viruses and bacteria. These infections may involve other systems (digestive, nervous, reproductive) in the body as well as the respiratory tract.

Bovine virus diarrhea (BVD) gains entrance into the body by the respiratory route but the clinical signs are confined primarily to the digestive tract. Infectious bovine respiratory (IBR) virus seems to be confined primarily to the upper respiratory tract. The virus is seldom isolated from the lung tissue. Secondary infections with bacteria may occur following these virus infections.

In 1957 a virus was isolated from typical cases of shipping fever. This virus was identified by Reisinger *et. al.,* as a Myxovirus. The virus infection alone is rather mild but it apparently paves the way for bacterial invasions, especially by the *Pasteurella* group of organisms.

Environmental factors play an extremely important role in the shipping fever syndrome. Stress does enhance the shipping fever syndrome.

The role of other viruses—(reo, rhino and adeno) and the psittacosis-lymphogranuloma venereum organisms and mycoplasma is not well understood and needs further study. The shipping fever syndrome in cattle closely resembles the "common cold" in man in many ways. Over a hundred viruses have been isolated from respiratory infections in man.

Clinical Signs

The respiratory signs with shipping fever may vary from the mildest syndrome to rapidly fatal pneumonia. Calves exhibit considerable depression manifested by a lowered head, droopy ears and frequently stand alone. They refuse to take food and become gaunt. Fever is variable—temperatures may vary from 104° to 107°. The nose is dry and parched and a mucoid discharge may appear in one or both nostrils. Discharge from eyes is common in shipping fever, although if it becomes profuse IBR virus should be suspected.

Respiration is often increased and a soft cough is common in most cases. Diarrhea is usually not common but it does occur and is probably due to complicating factors.

Recovery from shipping fever usually occurs in a week to 10 days if not complicated. Calves will lose considerable weight during this time. A few usually have lingering signs for weeks or even months. Suppurative pneumonia is frequently found in these cases that do not readily recover. The attack rate in each group of calves will vary from farm to farm. In some the entire group becomes ill while in others the disease smolders and a few cases keep cropping up.

The lesions in initial stages are not well known. In the latter stages the usual findings include fibrinous bronchopneumonia, interlobular edema, pleuritis and serious effusions. Treatment of affected animals varies. In most cases treatment must be initiated early or the response will be disappointing. Most cases are not recognized early and as a result the disease is well advanced and treatment is usually of little or no value.

Early Diagnosis Helpful

Drugs commonly used include the penicillin-streptomycin combinations, other antibiotics and sulfa drugs.

The most successful management of shipping fever depends on an early diagnosis and prompt treatment. Calves should be carefully observed at least twice or three times a day.

Prevention of the disease still requires further research as cases still may develop when vaccines are used. One of the major problems associated with the control of this disease is the presence of colostral antibodies in the milk that probably interfere with antigenic response.

Are You Selecting Top Sires?

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

Sires selected for use in your herd today will be responsible for more than 90% of the genetic improvement in production potential in your herd five years from now. Can you afford to lose an extra $1,600 income yearly in your 50-cow herd?

Many dairymen are missing this extra income because they do not understand or are not taking the time to choose their bulls wisely.

Not all bulls available from A.I. studs will necessarily improve the production potential of your herd; some are chosen because of pedigree popularity, improvement of type, etc. It's up to you to select the bull, and it need not be a chore. There are only *two* factors of primary concern to you in ranking the available bulls—predicted difference and repeatability.

1. *Predicted difference* simply tells you how much more milk and fat you can expect the future daughters of a sire to produce when compared to their breed average herdmates.

2. *Repeatability* tells you how much confidence you can put in that sire's "predicted difference" as an indicator of his true transmitting ability for production.

Predicted difference and *repeatability* should be considered together. The higher the *repeatability,* the more faith we have in *predicted difference* values.

Remember that *predicted difference* is the best estimate of a sire's transmitting ability. It does not guarantee results based on individual matings, but on the average, bulls with higher *predicted difference* will sire superior offspring.

Using Predicted Difference

The *predicted difference* is related to breed average. You are more interested in what the bulls are expected to do in your herd. A rule of thumb to use is that for every 1,000 lb. of milk your herd exceeds the breed average, you would reduce the predicted difference by 100 lb. of milk. For every 1,000 lb. of milk your herd is below herd average, you would add 100 lb. of milk to the predicted difference.

Breed averages, based on 305-day lactations, twice-a-day milking and converted to "mature equivalent" (305-d, 2-x, M.E.), are increasing each year. Approximate figures (nearest 100 lb. milk or 5 lb. fat) are easier to work with in demonstrating the probable effect of using bulls with different *predicted difference* levels in herds of varying production levels. Approximate breed averages are:

	Milk	Fat
Ayrshire	11,000	430
Brown Swiss	12,200	490
Guernsey	9,600	445
Holstein	13,900	500
Jersey	8,800	440
M. Shorthorn	9,700	360

Table 1 shows the effects of *predicted difference* in Holstein herds with average milk production 3,000 lb. below, equal to and 3,000 lb. above the breed average.

Note that herds already producing 3,000 lb. milk above breed average must use bulls with a predicted difference of at least +300 lb. just to stay even. It seems reasonable, then, that dairymen should insist that the *predicted difference* of bulls be at least +400 lb. of milk.

Understanding Repeatability

It has already been indicated that *repeatability* is an indicator of confidence level in a bull's *predicted difference.* It is measured on a percentage scale from 1 to 100%.

Repeatabilities close to zero indicate that little information is available and the true breeding value for a given bull may be considerably higher or lower than the calculated *predicted difference.*

Repeatabilities that are very high (approaching 100%) indicate that the *predicted difference* is a very reliable indication of how well daughters of such a bull will produce.

There are a couple of things that *repeatability* does not do. It has no relationship to fertility or services per conception. Secondly, it has no relation to a bull's ability to sire high-producing daughters.

Table 2 shows how the 80% confidence limits for a given *predicted difference* change as repeatability increases. By an 80% confidence limit, it is implied that 80% of all bulls with a given repeatability would be expected to have a true breeding value within the limits shown. Of the remaining 20%, one-half would have a true breeding value higher than the upper range given, and the other one-half would have a true breeding value lower than the lower range.

Table 1. Expected daughter average using bulls with varying levels of *predicted difference* in herds with different levels of average production.

Predicted difference of sire	305-d, 2-x, M.E. herd average		
	10,900	13,900	16,900
+1600	12,800	15,500	18,200
+1200	12,400	15,100	17,800
+ 800	12,000	14,700	17,400
+ 400	11,600	14,300	17,000
0	11,200	13,900	16,600
– 400	10,800	13,500	16,200
– 800	10,400	13,100	15,800
–1200	10,000	12,700	15,400
Pred. diff required to maintain production	– 300	0	+ 300

Table 2. 80% confidence limits on bulls with predicted differences of +500 lb. milk at varying levels of *repeatability*.

% Repeatability	True transmitting ability of 1 bull in 10 will be below	Average true transmitting ability	True transmitting ability of 1 bull in 10 will be above
20	−130	+500	+1130
30	− 89	+500	+1089
50	+ 2	+500	+ 998
70	+114	+500	+ 886
90	+277	+500	+ 723

How You Can Use Both

Dairymen have a difficult time choosing between two bulls, when one bull has a higher *predicted difference,* but a lower *repeatability* than the other bull.

The conservative approach would be to select the sire with the higher repeatability—the bull on which the most information has been collected. The more liberal approach is to select the sire with the higher predicted difference—any one bull may be evaluated poorly, but on the average, the decision would be wise.

We recommend a compromise in which the correct decision will be made 8 out of 10 times. Table 3 provides the essential statistics. For example, assume that Bull L has a predicted difference of +600 lb. milk and a repeatability of 30%, while Bull H has a predicted difference of +400 lb. milk and a repeatability of 80%. Which bull should you use when you want to make a correct decision at least 80% of the time?

Based on data in Table 3, the predicted difference of Bull L must exceed that of Bull H by 180 lb. milk to have an 80% chance of making a correct decision. Since the actual difference was 200 lb. milk (+600 minus +400), Bull L would be the sire of choice.

Summary

In summary, remember the following facts when choosing bulls:

1. Regardless of *repeatability, predicted difference* is the best available estimate of a bull's true breeding value.
2. *Predicted difference* and *repeatability* together tell you the range of production within which a bull's true breeding value lies.
3. There is no particular *repeatability* level at which a bull's *predicted difference* suddenly becomes an "accurate" estimate of his true breeding value.
4. There is no particular relation between *repeatability* and either *predicted difference* or true breeding value.
5. The fastest genetic progress in your herd will be made by using at least several bulls at a time in your breeding program and by using bulls with the highest *predicted difference,* regardless of *repeatability.*

Table 3. Guide to sire selection combining *predicted difference* and *repeatability.*[1]

Lower Repeatability Bull	90	80	70	60	50	40	30
80	60						
70	106	46					
60	146	86	40				
50	180	120	74	34			
40	211	151	105	65	31		
30	240	180	134	94	60	29	
20	267	207	161	121	87	56	27

Higher Repeatability Bull

[1] To select the best bull, and to be right 80% of the time, the difference in *predicted difference* of the lower repeatability bull must exceed the higher repeatability bull by the figure indicated in the body of the table.

Feed Additives For Dairy Cattle

By Foster G. Owen
Professor, Animal Nutrition

Many feed additives are on the market, and they are intended for a variety of purposes. Our dairymen have to answer the following questions about these products:

Which additives should be used? When should I use additives? How should I use a particular additive?

This article will consider various additives under three main headings, those intended for milk production improvement, for disease prevention and for silage preservation.

Among the many additives which have been tested for use in the lactating cow ration, none have been found which are recommended for continuous use in all dairy herds.

Additives for Milk Production Improvement

Thyroprotein. This is a hormone found to increase production of milk by 10% to 25% in cows during the first two or three months of lactation. To obtain a response, cows should be fed 25% to 30% additional grain. This additive should not be fed in early lactation or during the last two to three months of gestation. Neither should it be fed to immature animals or cows on production testing programs.

Since cows decline in milk after withdrawal of thyroprotein, only about 50% of cows show an economic response. Questions concerning the long-term effects on cattle usefulness have limited the acceptability of this additive by dairymen.

Antibiotics. Aureomycin has been approved by the Food and Drug Administration for use in the ration at a level of 1/10 milligram

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Feed Additives

(continued from page 17)

per pound of body weight. Its acceptance is based on its value as a preventative of respiratory infections, foot rot and shipping fever. It has also produced increased milk yields in field trials. It appears that adding an antibiotic would be practical only under special conditions where the above diseases are a specific problem.

Methionine Hydroxy Analogy. This additive has only recently been evaluated. It appears to have benefits in improving fat tests and milk yields and possibly in reducing ketosis. However, results are still accumulating, and the final judgment of its value should be reserved.

Milk Fat Test Promotion. Additives have been found effective in minimizing the fat depressing affects of certain rations. The depressing affect of high grain-low roughage rations has been partially overcome by including about 1-3% potassium or sodium bicarbonate.

Other beneficial products are partially delactosed whey, magnesium oxide and bentonite. However, these additives have not been effective in bringing forth the complete recovery of severely depressed fat tests. The bicarbonates tend to depress consumption of concentrates when they are included at the higher levels which are most effective. Plastic particles and lactates have been tested, but do not benefit the fat test.

Rumen Stimulants. Various enzymes, bacterial cultures, yeasts and alcohol have been evaluated and, in some cases, appear to have benefits. However, knowledge of these materials is insufficient to recommend their use.

No flavoring compounds have been found effective in improving appetite or stimulating lactation performance.

Additives for Disease Prevention

Ketosis. Sodium propionate or propylene glycol given during the period immediately preceding and following calving are effective preventatives for this condition. These additives should be fed at least twice daily at a level of 4 oz. each feeding.

Initial studies have also suggested that the methionine hydroxy analogy, mentioned above, may also have special value in the prevention of ketosis. Contrary to popular belief, including molasses in the grain is not effective for preventing or treating this condition. However, it may be effective in assisting a sick cow to regain her appetite.

Milk Fever. An extremely high level of Vitamin D is known to be helpful. Twenty million units per day immediately before and following calving is effective in reducing the incidence and severity of this condition. Maintaining the ratio of calcium-to-phosphorus between 1-to-1 and 2-to-1 is another recommended practice. When high levels of legumes are included in the ration, a high phosphorus (calcium free) mineral supplement may be included to reduce the ratio.

Bloat. Poloxalene added to the grain ration at a level of 5-10 grams twice daily is effective in preventing bloat in grazing animals. Large animals might require larger doses. Addition of soybean oil as well as other oils also appears beneficial in minimizing this condition.

Antibiotics. Aureomycin is an approved additive. This drug has been found beneficial in minimizing foot rot, shipping fever and pneumonia. However, no benefits relative to mastitis have been shown.

Silage Additives

Under ordinary conditions and when recommended practices of harvest and ensiling are followed, silage additives do not appear beneficial for effective preservation of forage as silage. Table 1 shows when various additives might be beneficial.

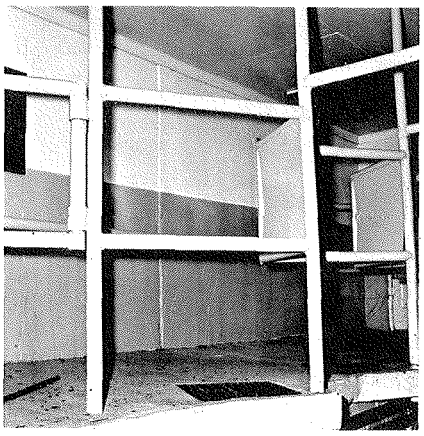
Conclusion

Since no additives are recommended for general and continual use, it is up to the dairyman as to whether conditions within his own herd or on his own farm justify the inclusion of specific additives.

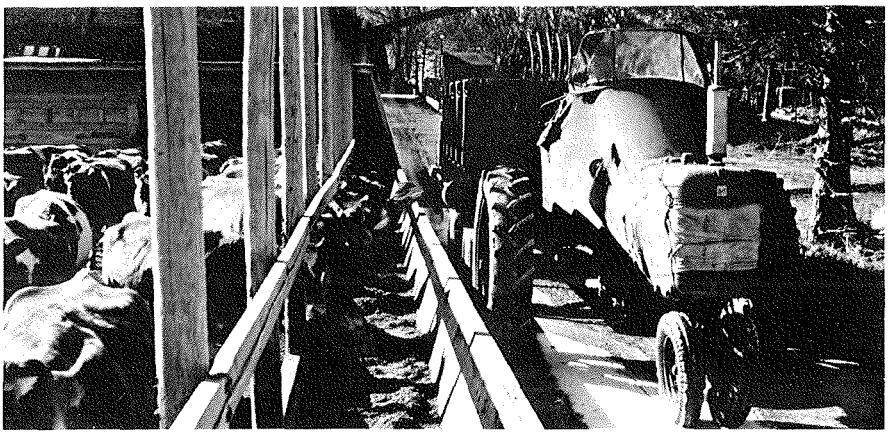
He must then determine just when, how and for which animals the specific additives can be put to economic use. To obtain economic benefits, the added income must cover the cost of the additive itself, plus any costs involved in handling and feeding.

Table 1. Silage additives.

Additive	When to use
1. Absorbent materials (beet pulp, ground hay, ground cobs, etc.)	Upright silo—forage above 75% water.
	Bunker or trench silo—forage above 80% water.
2. Water (use 5 gallons of water per ton to raise 1% unit of water)	Gas-tight silo—below 35% water.
	Upright silo—(excellent conditions)—below 50% water.
	Upright silo—(poor conditions)—below 65% water.
	Bunker or trench silo—below 65% water.
3. Fermentable carbohydrates (grains, molasses, sugars)	When hay crop forages are ensiled, direct-cut, and for all other crops low in fermentable materials, especially when high in moisture and protein.
4. Acids (mineral acids, formic acid)	Other materials usually preferred (corrosive, difficult to handle)
	When economic, add formic acid to high moisture, direct-cut forage.
5. Limestone or urea (no benefit to preservation)	Add for nutrient value when needed.
6. Bacterial cultures, yeast, antibiotics, flavors	Advantages not consistent enough for recommendation.



Home-made parlor features simplicity.



Fence line feeding adapts to group feeding.

Improve Your Grain Feeding Efficiency

By Don J. Kubik
Area Extension Specialist (Dairy)

Top dairymen in Nebraska must find new ways to get adequate grain into their cows. Cows do not remain in the milking parlor as long as they used to. One reason is the more efficient use of milking parlors brought about by good equipment.

Many systems now include automatic equipment such as washers, gate openers and closers, units which detach and move away from the cow and units which adjust milking rate to milk flow.

As equipment becomes more sophisticated the time cows are in the parlor decreases. Even with automatic feeding equipment, it is impossible to get adequate grain into high producing cows during the time they normally spend in the parlor.

Time a Problem

Besides the problem of time for cows to eat enough grain, there is the problem of the milker having time to meter grain correctly.

Milking time has been reduced but the amount of grain fed to cows has substantially increased—especially for high producing cows and in high producing herds.

This means that for these cows to eat adequate grain they must either be retained in the parlor for longer periods of time than necessary or fed additional grain elsewhere.

Holding cows for longer periods of time can be costly to the dairyman. Feeding grain elsewhere has dairymen asking "why not feed all of the grain apart from the milking operation?"

Feeding grain at milking time probably started as a means of keeping cows contented during milking. This system has also been used to get cows into the milking parlor.

Quite a few dairymen have eliminated grain feeding in the parlor and have found it quite successful. Some herds have been group feeding for a number of years and are continuing the practice.

Comparison

Experiments have compared group feeding with conventional individual feeding in the parlor at milking time. Cows fed twice daily as a group produce as well as those fed individually in the parlor. Body weight has also been maintained equally on both methods.

With a group feeding system, a dairyman can simplify both his milking and feeding programs. This system lends itself to complete mechanization and using high moisture grain, silage and reconstituted feeds.

Experimental work, as well as practice, has shown that blending grain and silage in the silo improves preservation and furnishes a "complete feed."

Another method of preparing a "complete feed" is to blend the grain and supplement to the silage as it comes out of the silo. This system does not fit a dry hay system as well as a silage or reconstituted hay feeding program.

Much can be said for group feeding dairy herds. When building or remodeling, dairymen should consider this system. If a dairyman is looking for a way to adequately feed the high producing cows in the herd or cut milking time or both, this system should be considered.

Group Feeding

There are a number of ways dairymen handle their cows when group feeding. Following is a brief discussion of some of these.

One group—Cows tend to consume on the basis of need and do well on a blended grain and forage ration fed as a complete feed.

This method has merit when we have a favorable milk-to-feed price ratio and/or favorable forage to grain price ratio. As either of the ratios change a more refined system should be considered. The same program can be used with feeds mixed before ensiling, or after the silage comes out of the silo.

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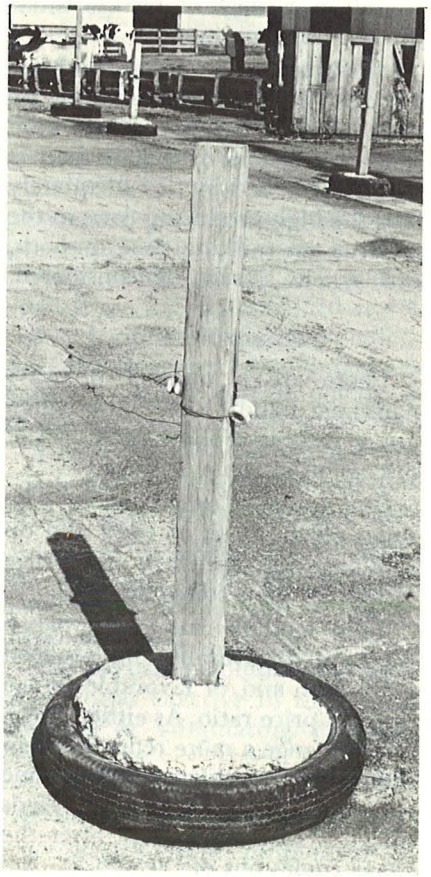
Grain Feeding

(continued from page 19)

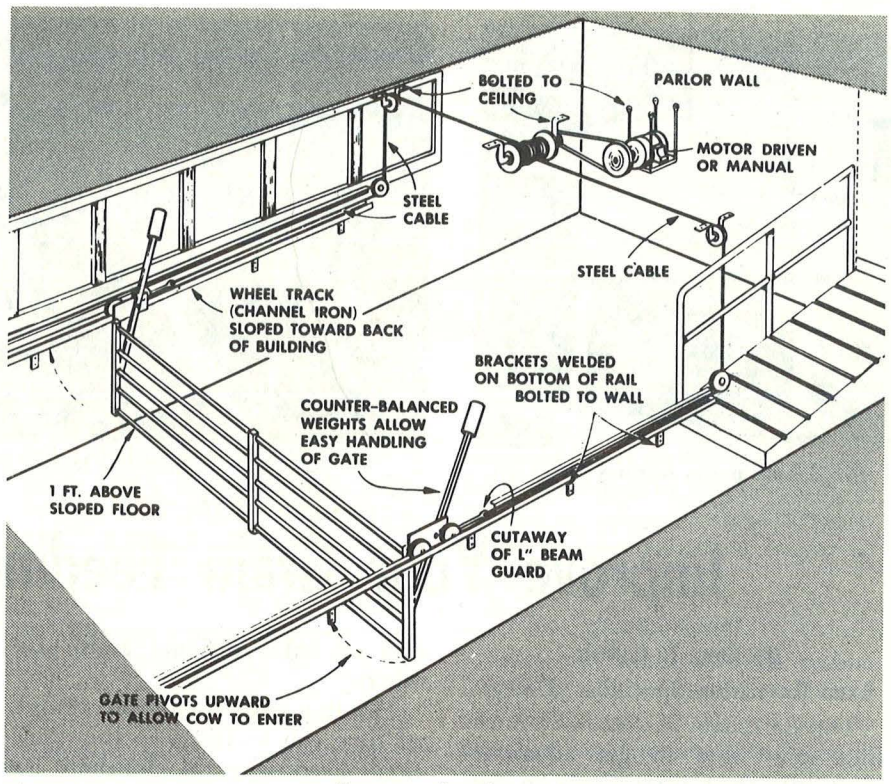
Lock gates—Some dairymen have gang head gates along the bunk, feed a base in roughage and feed extra grain to good cows when locked in the head gates. This system requires hand labor and reduces the advantages of group feeding.

Cows cut—Some dairymen can divide cows as they leave the parlor with a cutting gate controlled inside the parlor. Other dairymen sort at noon and feed extra grain to the high producing cows. Once cows know they get extra grain they will stand by the gate waiting to get in. It's harder to teach cows not to come after they no longer need the extra grain.

Divided herd—This system best fits herds of more than 40 cows but can be adapted to any size herd. Cows are divided according to production and/or stage of lactation. Most herds have at least two production groups and one "springer" heifer and dry cow group.



A simple means of dividing lots.



One type of push gate.

The high producing group can be milked first in the morning and last at night. This keeps the group on as even a milking interval as possible. The low producing group can be put on a wider interval with no loss of milk.

When building or remodeling, group handling can be planned and implemented at no extra cost

Sorting

Following is a discussion of the group feeding system of cow handling.

Experience has shown that first calf heifers are no particular problem in this system. The cows soon adjust to sorting. The time required for sorting is relatively small, as only a few cows need moving each month. Adjusting grain for lots is not a big problem, as dairymen can simply mix the amount of grain needed for the group receiving the least feed, feed them and add grain for the next higher producing group to get the ratio up to the right level.

A number of advantages can be cited for replacement of individual feeding by group feeding. Some of these are:

1. Less investment in equipment.
2. No feed dust in the parlor.
3. Less maintenance of equipment and concrete.
4. Easier feeding for top production.
5. Faster milking.
6. Cows to be bred are in one lot for easier observation.
7. Milking interval can be widened with no loss of production.

The big reason dairymen give for not wanting to go to this system is the fear of discontented cows during milking and the trouble in getting cows into the milking parlor.

Practice has shown that cows will learn that grain is waiting when they get through the milking parlor and may be more eager to get in and out of the parlor than before. If necessary, a push gate can be installed in the holding area. Reports are that cows seem more contended without grain in the parlor.

Research and experience have shown group feeding and the elimination of grain feeding in milking parlors to be a practical method of handling cows efficiently.