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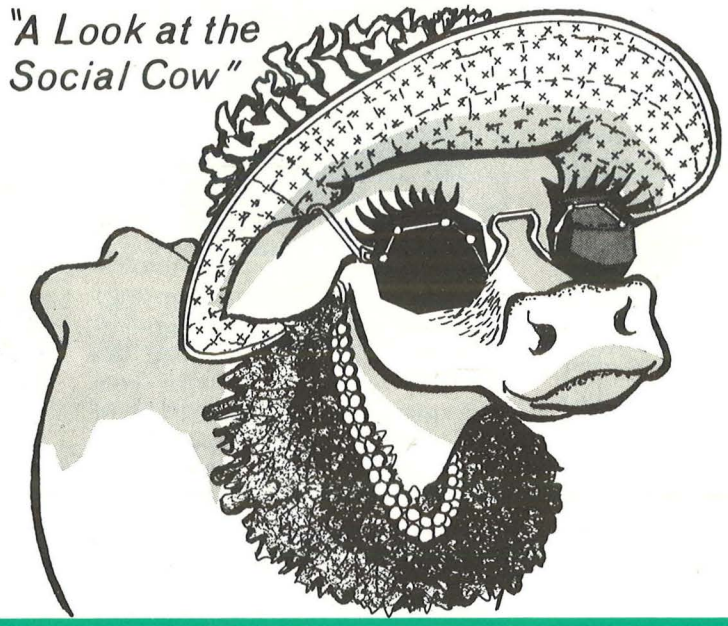

1976 DAIRY REPORT

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

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Animal Behavior—Effects on Housing and

P.H. Cole
Extension Dairyman

Research has established that cows are social creatures and that herds have a definite social structure. Evidence indicates that cows have intelligence and their social behavior can be influenced by training. The challenge to dairymen is to manage their herds and plan facilities in such a way to take advantage of normal animal behavior and to reduce the effects of undesirable behavior.

Thus, this paper will examine specifically housing and feeding systems, and how they can be adapted to fit animal behavior.

Housing

Lot Space. As herds become larger and are kept in a drylot year around the amount of space required per cow becomes a critical factor in planning dairy facilities.

It is still recommended that we provide 60 to 100 square feet per cow of lot space for cows on paved lots. If this space requirement could be reduced without any detrimental effect on the cows it would have several advantages. It will reduce:

1. Time in moving and handling of milking herd.

Acknowledgements

Appreciation is expressed to the following firms, associations and agencies who provided funds or products in support of the research program in dairy production.

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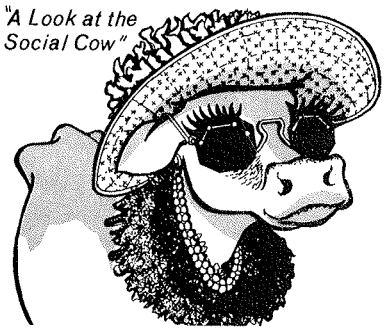


2. Costs for paving and fencing.
3. Cost of routine cleaning.

Purdue University studied the effect of reducing yard size from 100 square feet to 25 square feet of yard space and found it was actually beneficial. There was less activity, fewer encounters, little effect on production and less evidence of stress than when the same cows were given four times as much space. It is important to remember though, that this experiment was done with a relatively small group of animals which had been together previously and already had a well developed social structure. These results might be less applicable to larger herds. As herds become larger, cows may not recognize herdmates and their status in the social order. However, more frequent cleaning is needed when lot size is reduced. This can be critical when temperatures stay below 0°F (−20°C) for a week and "freeze-down" occurs.

Complete isolation of individual cows has also been studied. These cows didn't fare as well. The conclusion was that the practice of isolating cows for long periods (24 hours or more) for insemination or health checks may be detrimental. For example, cows with a previous mastitis history are susceptible to this kind of stress.

Lot Slope. It appears desirable to provide a 1 to 2 percent slope in feed lots. With bunks running down a more severe slope (3 to 4%) there will be a constant shifting of the cows down the slope. This is because of agressive cows shoving the more timid cows downhill.

Slope in the holding area is also important. If there is an excessive slope in the direction of the milking parlor, cows are hesitant about entering the holding area.

Free-Stall Design. Cows prefer to lie on their left side. In free-stalls with a level surface cows will lie on their left side about 53% of the time. When the surface is sloped 1.5 to 2.0%, the percent of animals laying with their back side uphill is increased to 55 to 68%, and when the stalls were concrete filled the percent rose to 86 to 88%. Therefore, a slight slope of uniform direction encourages cows to lie with their backs uphill and, of course, in the same direction. Thus, it may be desirable to design free-stall barns with a slope. The chance of teat injury caused by one cow stepping on another would be reduced.

Feeding

Moving cows between groups is a controversial subject. Many dairymen feel that the effort involved, and the fighting among cows which results when cows are moved from one group to another more than offsets the feed efficiency gained when cows are segregated into groups of similar production.

Grouping Studies. Dividing larger herds (80 to 100) into two or more groups offers the advantage of feeding concentrates more nearly according to the cows' needs. Feeding part of the concentrates in the lot also offers the opportunity of using certain ingredients which might not be suitable for parlor feeding where a high rate of grain intake is essential.

Ohio researchers studied the effect on milk production and behavior of moving cows from one group to another.

Their conclusion was that the transfer of cows from one group to another temporarily increased the number of encounters between cows, but did not have an important effect on production. These results differ somewhat from ear-

lier research which indicated a loss in production when cows were shifted from one group to another. The drop in production sometimes noted when shifting cows now appears more likely to be due to the change in feed rather than psychological factors.

Based on research and field observation, the following guidelines for handling cows in groups have been developed.

Guidelines For Handling Cows In Groups

1. Dry cows should be in a separate group.
2. First calf heifers may also benefit by being handled separately.
3. Allot cows to high group at freshening.
4. Provide at least three groups of milking cows to minimize ration change effects.
5. Formulate ration for top one-third of cows in a group.
6. Move cows on regular schedule.
7. Move in small groups rather than as individuals.
8. Provide adequate manger space (about 24 inches/cow).
9. Provide extra space if stanchions are used.

It is important to keep in mind that, in addition to the social change involved in moving a cow from one group to another, there may also be a significant dietary change. One of the major disadvantages of the group system is that a significant drop in milk production often occurs when cows change from a high energy to lower energy diets. This can be minimized by providing three or more groups and by grouping cows by freshening time and by making gradual ration shifts rather than moving the cows.

Complete Rations. The use of a complete ration solves one of the problems that faces all dairymen—namely that of cow preference or taste preference. The cows' freedom to select a preferred forage can be a serious problem when two forages such as corn silage and alfalfa are offered separately and free-choice, because of the large differences in their protein and mineral contents. It is nearly impossible for the dairyman to do an accurate job of concentrate formulation to match what a cow may elect to eat.

The complete ration allows little opportunity for the cow to express her choice among available feeds. Each bit consumed is as uniform and, as nearly as one can make it, a nutritively complete diet.

Magnet Feeders. The magnet feeder makes it possible to provide either additional grain or a grain mixture of higher nutritive value, or both, to an individual cow that is part of a larger group.

There are enough magnet feeders in use now so that we are beginning to get considerable field evidence of their value. At present, individuality of cow response (behavior) to the magnet feeder is one of the problems that has not been completely solved.

Number of Encounters and Daily Milk Yield

Day	Cows Transferred		Cows Not Transferred	
	Encounters	Milk (lb/day)	Encounters	Milk (lb/day)
3-day av.	–	34.3 (15.5 kg)	–	29.3 (13.2 kg)
1	10	32.8 (14.8 kg)	5	29.9 (13.5 kg)
2	5	34.1 (15.4 kg)	4	29.9 13.5 kg)
3	–	35.0 (15.8 kg)	–	39.7 (18.0 kg)
4	–	33.9 (15.3 kg)	–	27.4 (12.4 kg)
5	–	34.8 (15.7 kg)	–	29.3 (13.2 kg)
6	–	33.2 15.0 kg)	–	28.4 (12.9 kg)
7	4	33.2 (15.0 kg)	4	28.4 (12.9 kg)

Use and Behavior

	Farm				
	A	B	C	D	E
% of Time in Use	39	59	71	45	78
(by magnet cows)	(41)	(94)	(84)	(72)	(68)
(by non magnet cows)	(59)	(06)	(16)	(28)	(32)
Insults (Agressive Encounter)	61	23	15	32	60
(by magnet cows)	(05)	(20)	(11)	(10)	(24)
(by non magnet cows)	(56)	(03)	(04)	(22)	(36)

There is a wide variation in the time the magnet feeder is used (39 to 78%) on different farms. A major concern is use of the feeder by non magnet cows. Except for herd A the magnet cows used the feeder more of the time than the non magnet cows.

Insults seem to be pretty well divided between magnet and non magnet cows. A cow that has had a magnet and then has her magnet removed has been a problem in some herds.

Based on these observations, the following guidelines for use of magnet feeders have been developed.

Guidelines for Use of Magnetic Feeders

1. Provide 15-25 cows per feeder.
2. Provide protection against boss cows.
3. Do not depend on the feeder to provide total grain needs.
4. Plan schedule for attaching and removing magnets.

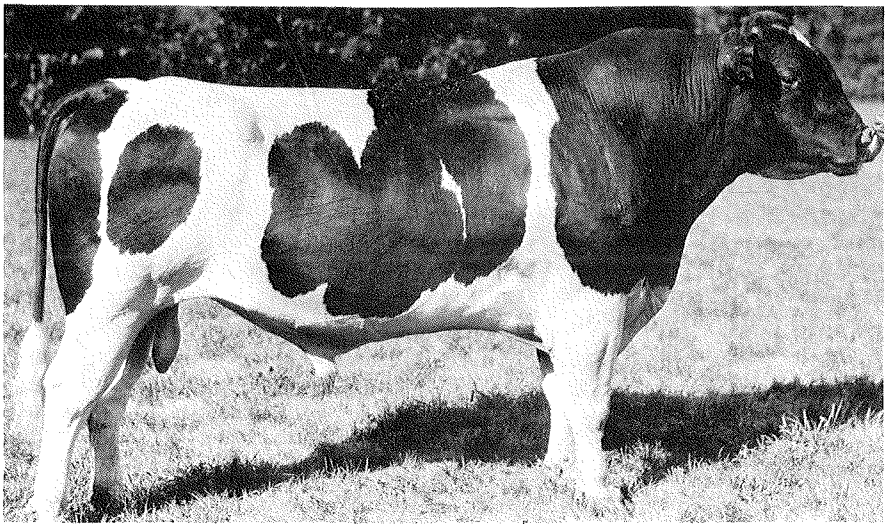
Summary

Social behavior and taste preference (or expression) are gradually being recognized as important characteristics of cows housed and fed in groups. It is becoming more and more economically advantageous to design and build cow handling facilities, i.e., feed lots, feed bunks, free-stalls, in ways that fit cow behavior. Grouping provides a practical way to manage larger herds, and shifting cows from one group to another does not seem to cause severe production problems when properly managed. The complete ration has a number of advantages over other feeding systems, particularly when used with production groups. The magnet feeder offers a method of providing extra or special grain to the individual cow within a group.

In conclusion, the suggestion is offered that the dairyman make adjustments and adaptations to take advantage of the cows' natural social nature when planning facilities and establishing the feeding system.

Selecting a Sire: The Modified Contemporary Comparison Method

Franklin Eldridge
Professor of Animal Science



The USDA Sire Summaries give evaluations for production of daughters of dairy bulls. Dairymen are especially interested in these summaries because they want to select bulls whose offspring's performance can be predicted with reasonable accuracy.

Selecting the right sire is the fastest and surest way to make genetic progress for milk production.

Why is this true? (1) Each cow in the herd contributes half the genes to her own offspring, but the sire contributes the other half of the genes to **every** offspring that will make up their future herd. (2) Since a sire can have many more offspring than any one female it is possible to select the sires with much greater accuracy than any female. (3) One bull can sire hundreds and even thousands of offspring. Therefore, one bull can be selected from a thousand prospects, whereas nearly all females in a herd must be kept for at least one lactation to obtain a record on which to select. This means that selection for females is very low, but selection for sires can be very high.

A few dairymen make a significant profit from selling cattle, both males and females, for breeding stock. However, most dairymen make the bulk of their income from milk sales, hoping to just break even on the sales of bull calves and cows that are culled. Therefore, the following is directed almost exclusively to the subject of **improving milk production** in herds through breeding.

New System

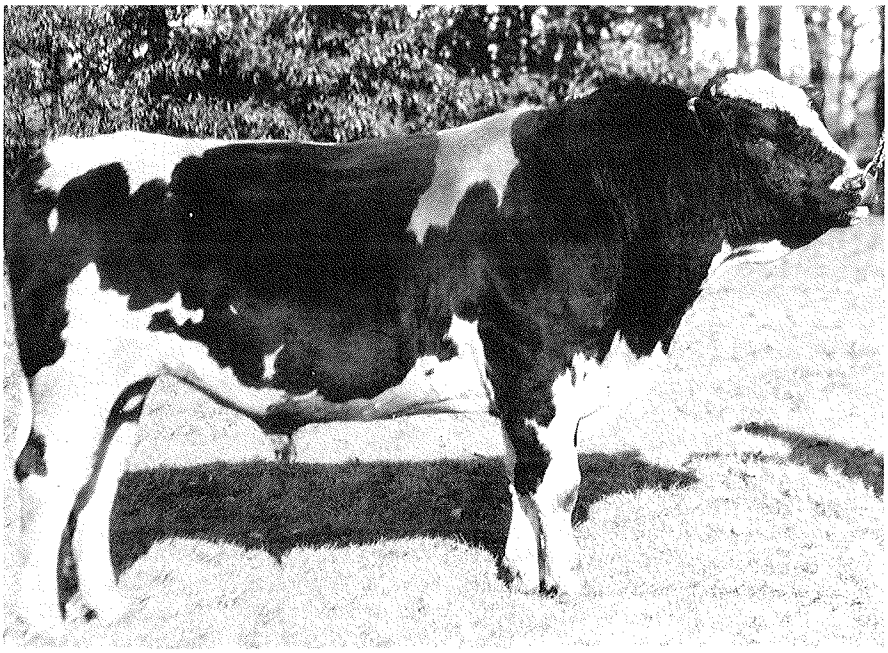
Starting in 1974 the USDA-DHIA Sire Evaluation program began using the Modified Contemporary Comparison Method of evaluating sires. Included in this new method is the Pedigree Index, which contributes to the evaluation. The changes were made in order to improve the accuracy of sire evaluations. Let's review this new system, comparing it with the previous one and see how the results can be used in selecting sires for use in artificial insemination (AI) or in the selection of young bulls for natural service.

The new modifications of the method used in sire evaluation were the result of extensive research which demonstrated the advantage of the new method. Also, the new method is fully consistent with the knowledge and theory of heredity.

Background

In the early days of this century dairy bulls were selected almost exclusively on pedigrees. A progressive dairyman tried to find a bull from an outstanding cow and by a sire that had produced better than average offspring. Then in the 1920's with a better understanding of genetics, the emphasis turned around so that the primary emphasis in selection of a young sire was placed on the "Proved Sire", while still searching for an outstanding cow as the dam. This emphasis on the sire focused attention on the need for a more reliable method for evaluating the true worth of the "Proved Sire", which then led to the development of Daughter-Dam comparisons. A **superior** "Proved Sire" had daughters that had produced more milk than their dams. Certain weaknesses soon became apparent in this method. For example, if a young bull were bred to average or below average cows his daughters would more frequently produce more than their dams than if he were bred to above average, high producing cows. Also, a dairyman wanting to get a good "Proof" on a bull could feed and manage the daughters better than their dams and could make the proof look better. He could also cull a few of the poorest offspring early in their lactations and, in this way, make the proof look better.

Dairymen were limited to natural service before the 1940's, so the use of proved sires was limited. With the beginning of AI, however, the use of "Proved Sires" was greatly extended. Many "Proved Sires", whose daughters were tested in only one herd, were found to be less superior than expected when used in a second herd. It soon became apparent that proofs on bulls tested by daughters in many herds were



much more reliable than proofs on bulls based on records of daughters and dams in only one herd.

Herd-Mate Comparision

In the late 1950's and early 1960's a new method for measuring the genetic worth of a bull was developed. In this method the daughters of a particular bull were compared with their herd-mates instead of their dams. This value was called Predicted Difference (PD). Since the records of the daughters of a sire were compared to all other animals in the same herds at the same time, some of the differences in management were eliminated. Also each daughter could be compared with the average of several other animals rather than with only one, her dam. At the same time a method for measuring the reliability of "proofs" was introduced. This was given the name "Repeatability" (R). A bull with only a few daughters would be less accurately evaluated than a bull with many daughters and this would result in a lower value for R. Or a bull whose daughters were in 3 or 4 herds was less accurately evaluated than a bull with the same number of daughters scattered over 50 herds. This R figure gave the dairyman an estimate of the reliability of the PD.

Modified Contemporary Comparison

Dairy cattle geneticists have continually worked on methods for improving the accuracy of predications of the breeding value of bulls. Based upon this research, the USDA in 1974 again changed the procedures for analyzing the production records of daughters of dairy sires. It is now known as the Modified Contemporary Comparison (MCC) method. Let us review these most recent changes.

1. Two-year old records of the daughters of a sire can be compared, most logically, with other two-year old records in the same herd, and second or later lactations compared with second or later records of other cows in that herd. A formula was developed, therefore, that used all available records, but gave greater emphasis to records made by cows of similar ages. This formula automatically accounted for selection, also, since older cows are more highly selected than two-year olds. This is sometimes known as a comparison of "True Contemporaries".

2. The herd-mate average (HMA) was based upon the assumption that from a genetic standpoint, the herd-mates of daughters of a bull were a random assortment of animals. However, because of the rapid improvement of sires used in AI over the past decade or two, this assumption is obviously false. In January 1966 the average PD of AI sires in regular service was +122 pounds (+55.3 kg) of milk, and by the winter of 1977 was +484 pounds (219.5 kg) of milk.

The genetic quality of a herd can affect the PD of a bull. The PD of a bull is an attempt to compare the production of his daughter with the production of cows of average genetic quality. If the herd-mates in one herd are of high genetic quality, the daughters of the bull being tested will not compare as favorably as when he is compared to daughters of low genetic quality. Such a bull's PD will appear lower in a high genetic quality herd, or higher in a low genetic quality herd. In the new method a formula has been developed to adjust for this difference in genetic quality of herd-mates.

3. New age adjustment factors have been developed in recent years which more accurately reflect modern cattle. These factors also include differences in breeds and differences associated with the various geographical regions of the United States. These new factors were used in adjusting production records to a 2X, 305-day, ME basis.

4. For many years dairy cattle breeders and geneticists have argued about the use of incomplete records, and records in progress (RIP's). One month's production on a two-year old is 72 percent as valuable as the completed record. Therefore, RIP's were put into the formula but were given less weight than completed records. When RIP's can be used in large numbers they: (a) increase the number of cattle and therefore give a broader sample, (b) speed up information and reduce time needed to estimate a bull's genetic worth, and (c) decrease the undesirable effects of selection.

5. Because progeny records on a sire are much more accurate in predicting his genetic value than

(continued on next page)

(continued from page 5)

pedigree information, pedigree information was ignored in the past when records on progeny became available. Recent research, shows that for bulls who have a small number of daughters, and hence, a low repeatability, information from the pedigree can be valuable. It is all that we have on a sire without progeny. The reliability of a PD based upon small numbers of daughters has been shown in one study to be increased from R of 0.35 to R of 0.50 by inclusion of pedigree information. Early summaries on a bull are less different from later summaries when the Pedigree Index (PI) is used. It is calculated by adding ½ sire's PD and ¼ maternal grand sire's PD. Therefore, PI has been included in the 1974 comparisons by a formula that decreases the effect of the PI as the R of the summary increases.

6. Repeatability was first used in the sire summaries calculated prior to 1974. Experience and research on calculations of R have shown that this could be calculated more reliably. Therefore, newer methods are now being used.

7. The final change considered long-term genetic trends. The new method should permit a dairyman to compare the real value of a bull used in 1974 with one used in 1980.

All of these modifications are possible because we live in an age of computers. It would be impossible to include all these factors in determining the value of a bull if the formulas had to be calculated by hand. Since these formulas are based on detailed genetic knowledge and complex mathematical procedures, most of us will have to accept with a degree of faith the results of this method. The final results also can be no better than the original data are accurate. Therefore, your DHIA supervisor's honesty and accuracy is vital.

The present system is probably not the last. Further improvements will probably be made in sire summaries. As new research discovers better methods for predicting the performance of future progeny of a bull these methods will likely be incorporated into the sire summary formulas. Experience with the present formula will undoubtedly uncover some weakness that can later be eliminated.

Table 1. Value of Pedigree Index as Influenced by Repeatability on Sire and Maternal Grandsire

If the Repeatability on Sire and Maternal Grandsire is:	The Pedigree Index is Worth as Much as the Following Number of Daughters[1] of the Bull For Estimating the Bull's Predicated Difference (Approximate)
20%	1.5
33	2.7
50	4
60	5
83	7
98	9

[1]Assuming each is a different herd.

How can you, as a dairyman, use these new PD's? If you are using AI, you can check in the sire summary for the PD of any bull available in the AI stud whose service you are using. Hoard's Dairyman each year publishes a list of the best available AI bulls and the AI stud where these bulls are located. You can then find out from the representative of that stud the cost of semen from those bulls you wish to use. A good rule of thumb is that on the average it will take about six (6) ampules of semen to produce a heifer that comes into milk in your herd. You can take the cost of an ampule of semen, multiply it by 6, compare that to the dollar column under Predicted Difference and get a reasonable estimate of whether you can afford to use the semen from a specific bull.

If your goal is increased production, there are many bulls on the Hoard's Dairyman list of high PD bulls that are reasonably priced and available to you. Selection of such bulls for your herd will give you the potential for increased production. You still must feed and manage those animals well, and raise a high percent of your heifers to get improved production and profit.

If you are also interested in improving the type of your cattle, there are a number of these bulls for which PD's are available on type. Attention paid to type, however, will decrease the effectiveness of selection for production. Most dairymen could safely ignore type unless there is some important weakness in conformation in the herd. Bulls in AI are highly selected for type and generally will produce daughters of acceptable type. A purebred breeder with considerable sales of breeding stock, however, cannot ignore type.

The second way to use PD's to your advantage is in the selection of a bull for use in natural service. If you locate and use a young bull sired by one of the top PD sires and out of an outstanding cow, who also is sired by a top PD sire, your chances are improved for obtaining high producing daughters. The element of chance, however, may work against you in comparison to breeding your cows artificially to high PD bulls.

Early Postpartum

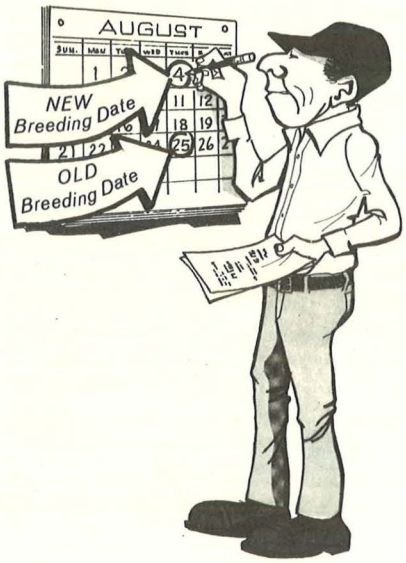
Larry L. Larson
Assistant Professor of Animal Science

We now know that dairy cows can be bred back earlier than previously recommended and bring dairyman increased milk income. Breeding dairy cows before 60 days after calving has previously not been recommended because of reported detrimental effects of the cow's later reproductive performance. However, present evidence indicates that early postpartum breeding is not detrimental and is the most practical method of maintaining a 12-month calving interval.

How important is a 12-Month Calving Interval?

Substantial evidence indicates that a calving interval of 12 months, or less, results in more milk and calves produced during the cow's lifetime. It has been estimated that for each day the calv-

Breeding of Dairy Cows



ing interval is shortened, approximately 10 pounds more milk per cow and 0.0027 more calves per year are produced. This results in about 90¢ more income from milk per cow per year for each day cut off the calving interval when the milk price is $9 per hundredweight. Reducing the calving interval by even 10 days in a 100 cow herd could mean $900 additional income, as shown in **Example 1.**

The importance of the length of calving interval is shown in **Example 2.**

As shown in **Example 2,** a cow that makes 13,000 pounds (5,897 kg) of milk and calves back in 12 months makes more profit than a 17,334 pound (7,863 kg) producer that calves back in 16 months. Both cows would have averaged 35.6 pounds (16.1 kg) of milk for each day of their calving interval, but the yearly calver will also produce one extra calf over a four year period.

This will increase genetic progress and will also result in more animals from which to cull. More intensive culling can also improve average herd milk yield.

What Factors Determine the Length of the Calving Interval?

The calving interval refers to the period of time from the production of one calf until the cow produces the next calf. This interval is controlled by the following factors:

1. Interval following calving to first insemination.
2. Conception rate.
3. Gestation period.

How Can the Calving Interval be Shortened?

Considering the above factors, only the interval to first breeding and conception rate can be influenced by management procedures. For years it has been suggested not to breed cows less than 60 days after calving because conception rates were lower. While conception rates are lowered by breeding earlier after calving (30 days = 45%, 40 days = 53%, 50 days = 59%, 60 days = 63% and 70 days = 65%), many cows will conceive to the earlier breeding, which will result in a shorter mean calving interval for the total herd. This concept is supported by a large amount of recent research which also shows that early breeding is not damaging to the cow's health or well being. Actually, conception rates do not vary greatly in cows that are exhibiting regular estrous cycles. Cows that are not in reasonably normal condition generally will not come into heat and obviously would not be bred. However, it is recommended that a veterinarian examine the cows about 30 days after calving to determine which cows are ready to breed back and those that need treatment.

The management decision that has the major effect on length of calving interval is the time a dairyman waits before starting breeding. To obtain a 12-month calving interval, the cows have to conceive at about 85 days after calving (85 days + 280 days gestation period = 365 days). Thus, it is necessary to start breeding at about 40 days after calving if you wish to get an average herd calving interval of 12 months. This is because conception is never 100 percent and because only about 50 percent of the heat periods, or opportunities to breed, are observed.

Conclusion

Beginning breeding at 40 days instead of waiting until 60 days following calving will result in:

1. Shorter calving intervals (however, services per conception will be slightly increased).
2. Increased milk produced per day of calving interval and in lifetime (305-day milk records will be slightly lower).
3. More calves produced in the cow's lifetime, increasing genetic progress and opportunity to cull.

Example 1: Increased milk income by reducing calving interval in a 100-cow herd. (Milk at $9.00/cwt and present calving interval of 405 days or 13.5 months.)

		Days reduction in interval between calves.			
(Calving Interval)	Assumed Present Interval (405)	10 (395)	20 (385)	30 (375)	40 (365)
Increased Income	_____	$900	$1,800	$2,700	$3,600

Example 2: The higher lactation yields needed with longer calving intervals to yield equivalent *daily* production.

	Calving interval months.				
	12	13	14	15	16
Lactation Yield	13,000 (5,897 kg)	14,083 (6,388 kg)	15,165 (6,879 kg)	16,248 (7,370 kg)	17,334 (7,863 kg)
Yield/day	35.6 (16.1 kg)	35.6 (16.1 kg)	35.6 (16.1 kg)	35.6 (16.1 kg)	35.6 (16.1 kg)

Computer Rations for Dairy Cows and Dairymen

Foster G. Owen
Extension Dairyman
and
Patrick J. Ebmeier
Extension Assistant

Ebmeier operates the computer terminal while Owen looks on.

Several years ago the University began using the computer to formulate dairy rations. The rations that we obtained were good, sound rations and as formulated were very palatable to dairy cows, but were apparently not so "palatable" to dairymen. During recent years and months a number of changes have been made which we believe make these rations and the entire formulation service better meet the dairyman's needs. With these improvements we expect many more dairymen will be interested in using this tool.

First, why should the dairyman want to, or need to, use the computer to formulate his rations? The basic reason is for a higher net income. The higher profit comes from (1) better ration nutrient balance, (2) improved palatability and physical qualities and (3) ingredients that provide the necessary nutrients at lowest cost. The computer will provide a ration capable of producing **optimal** milk yields at **lowest** possible feed cost.

Unfortunately, a ration poorly balanced for essential nutrients is not uncommon, even here in Nebraska where feed ingredients are plentiful. Deficiencies of the necessary nutrients reduce milk income, whereas excesses of nutrients may result in unnecessarily high feed costs.

Many dairymen will do a good job of balancing their rations for protein and some will also balance for calcium and phosphorous. Beyond this, ration balancing gets very complicated. Yet we know there are other nutrients and other quality factors important to ration formulation besides these. These other factors include palatability, dustiness, density and coarseness. Using the electronic computer we can formulate rations balanced for **all** known nutrient requirements, meeting all quality specifications desired, and using the available feed ingredients which satisfy these requirements at minimum cost.

Generally, a savings of $5 to $20 per ton can be realized from computer formulation of the grain ration alone. The average 50-cow herd would probably realize $100 per month or more from the use of the computer for ration formulation compared with the current ration.

The information required by the computer to formulate rations are in two categories: (1) basic data needed to formulate all rations and (2) specific information provided by the dairyman for formulating his particular ration(s).

Basic Data Stored in the Computer

We at the University put the following basic data into what may be called the computer's data bank.

Nutrient requirements (minimums and also maximums, in some cases) for each ration. This is to provide for such needs as energy, protein, calcium, etc.

Ration quality specifications. For situations where the grain ration is fed in the meal form (non-pelleted) we have density (bulk) and dust specifications.

1. **Bulk.** These factors are especially important for obtaining adequate feed consumption of cows which are fed all their grain ration in the milking parlor. Their eating time is often limited to between 5 and 10 minutes. Feeds that are too bulky may not permit high intake of nutrients, simply due to dilution; whereas feeds that are very dense, or heavy, require lots of saliva before swallowing. These feeds also reduce rate of intake because of the time required to produce and mix saliva with the feed. What we want, then, is a medium-bulk ration. The dairyman likes the ration with medium-bulk because it "looks like" a dairy cow's ration; the cow likes it because it "tastes like" a dairy cow's ration.

2. **Dustiness.** Dustiness may also detract from palatability and decrease intake rate because of the saliva factor. Excess dust can be kept in check by adding such materials as molasses or feed grade fat.

3. **Palatability.** To assure top palatability certain feed ingredients must be limited to an amount below which they do not

detract from ration acceptance by the cow. Included among these feeds are certain animal by-products, rye, and gluten feeds. These restrictions help assure that the **cow** will like these rations.

4. **Hay Equivalent.** In the complete type rations where roughages and grains are mixed together, we require a minimum hay equivalent level. This is to assure maintenance of a normal milk fat content, high efficiency on milk production and to minimize digestive and metabolic disorders. Because these rations are full fed on a continuously available basis they do not need density or dust specifications. If needed, dust can be eliminated by adding water to the complete ration immediately before feeding. However, palatability is important in complete feeds. Therefore, limits on certain feeds are included but at about one-half the level in grain rations. This is because cows eat about twice as much of complete rations.

List of feedstuffs (ingredients) with their nutrient composition. All the grains and by-product ingredients commonly available in different areas of Nebraska are included, as well as protein supplements of different protein levels.

Ingredient quality measures. For each feed ingredient, factors are included which adjust for density, dustiness, palatability and its hay equivalent value.

Information Supplied by the Dairyman for a Computer Formulated Ration

A ration request form can be supplied which a dairyman can complete when he wants a ration formulated by the computer. The form simplifies the request and helps make certain that needed information is not left out. Listed below are the kinds of information needed.

Specific herd data. The following information is used to select the appropriate ration(s) for your herd.

1. Average cow weight.
2. Average daily milk yield per milking cow.
3. Method of feeding. This is to provide a ration which is most practical to feed under the dairyman's own feeding program.

Prices of feed ingredients. The price supplied by the dairyman should be the selling price if the dairyman has the feed on hand, or the purchase price if the dairyman is willing to buy the feed. It should include any preparation costs (grinding, rolling, etc.). Only those feeds should be priced which are **available** and **acceptable** to the dairymen in his ration. It is necessary to include feeds representing different categories to be certain that the computer can meet ration requirements. For example, if grain is fed in the parlor, a bulky feed must be included to make the ration bulky enough for rapid intake. Sources of energy, protein, roughage, and minerals must also be included. Generally, the larger the number of feed ingredients priced by the dairyman for use in the ration, the lower will be the ration cost.

Moisture content of high moisture feeds. A moisture value should be furnished, if possible, for silages, greenchop feeds and high moisture grains when these are available ingredients. This is important because of the dilution of nutrients by moisture. A value obtained through feed analysis is best, but an estimate is generally better than simply leaving the decision to the computer. The computer must use an average value when none is given.

Feeding level of high moisture feeds. A practical **minimum** level for high moisture feeds should be indicated. When feeding out of most silos it is necessary to remove a certain minimum amount to keep the feed fresh. With greenchop a trip to the field can be justified only when a certain minimum amount is chopped. This minimum level should be expressed as pounds per head daily.

Supplement feed tag. If a protein or mineral supplement is to be used, a feed tag must be submitted with the ration request. Then the actual nutrient values for the specific supplement(s) will be used in formulation rather than standard values.

Optional data. (a) Forage test results. For a genuine custom mix the dairyman should take advantage of his specific forage quality. Dry matter, crude protein, and crude fiber should be provided by the dairyman for his own forage. A net energy value is computed by us from crude fiber and protein. (b) Desired minimum level of a particular feed can be indicated. For example, if a dairyman has some oat silage he needs to finish feeding at this time he should indicate the minimum amount in pounds per head per day that he wants to feed. On the other hand, if he wants to limit a particular feed, he should indicate, for example, that he wants no more than a specified percent of that ingredient in the grain ration.

Tips for Obtaining Most Economic Rations

Indicate the price for as many feeds as possible in each category for use in the ration(s) requested. Shop for best price for a given quality of feed.

Do not set minimum or maximum levels on any feed ingredient without important reason. (Built-in formulation procedures will prevent excessive amounts of an ingredient that **should** be restricted). When minimums are set, make them as low as reasonably possible.

When quality of any ingredient(s) is **known** this information should be included with the request.

Computer Output

The main purpose of computer formulation is to determine the amount of each ingredient to include in a ration. But the computer provides much more. If desired, the user can also get (a) actual nutrient content, (b) "shadow prices", (they are a price range for a feed ingredient **included** in the formula. Within the shadow price range, an ingredient remains economic to use at the same level now in the ration); and (c) "opportunity

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prices" (these are prices listed only for ingredients offered to the computer but **not** used in the ration). An opportunity price is the price at which that feed would be economical to use in the ration.

The shadow prices (in **Table 1** in columns labeled highest cost and lowest cost) and opportunity prices help the dairyman know when he should reformulate. If the price of a given feed moves either higher or lower, out of the shadow price, he should reformulate. For example, in **Table 2** it is shown that corn silage would have to increase from its price of $20 per ton (907 kg) to $26.01 before its level would need to be decreased. He should also reformulate if the price of one of the available ingredients drops down below its opportunity price. In **Table 1** we see that brewers grains would have to drop from $30 to $26.78 per ton (907 kg) (opportunity price) before it would be economic to use them in the ration.

The output of rations are now available on both the dry and "as fed" basis. They are also printed out for various size mixes and with cumulative scale weights as ingredients are added (see **Table 2**).

Conclusion

Dairymen should consider the use of the computer to help them maintain sound, economic ration(s) for their herd. Coupled with forage testing, this can be an ideal method of keeping nutrient levels properly balanced for different lots of cows. It also can help dairymen choose the most economic roughages and grain ingredients to use in their feeding program. In addition to lower cost rations, additional milk yields and improved health can be expected from correction of nutritional deficiencies and imbalances.

Table 2. Example Showing Amounts (and Scale readings) for a 4000 lb. Mixture of Ration.

Corn	2453 (2453)
Oats	382 (2885)
Dehy	415 (3251)
SBM	639 (3890)
P. Dical	61 (3951)
Salt, TM	26 (3977)
Limestone	15 (3992)
Vitamin D	8 (4000)

Table 1. Sample Complete Ration for Cows Producing 45-65 lb milk[1].

Variable Name	lb/Unit	% of Ration	Cost/Unit	Highest Cost[2]	Lowest Cost[2]
		(As-Fed Basis)			
Alfalfa Hay	2000 (907 kg)	13.96	$55.00	$75.73	–
Corn Silage	2000 (907 kg)	61.46	20.00	26.01	$14.81
Milo	100 (45.3 kg)	16.78	3.92	5.21	3.11
Brewers Grains	2000 (907 kg)	0.0	30.00	26.78	–
Soybean Meal	2000 (907 kg)	6.64	240.00	428.93	160.45
Molasses	2000 (907 kg)	.37	80.00	1026.31	34.24
Dical	2000 (907 kg)	.50	200.00	296.30	−36.82
Salt	2000 (907 kg)	.25	40.00	–	–
Vitamin A	100 (45.3 kg)	.05	100.00	1919.43	−.093

[1]This ration contains, on a dry basis, 65 Mcal/100 lb. of net energy for lactation, 15% crude protein, .65% calcium and .45% phosphorous.

[2]The values constitute shadow prices for those feeds that are in the ration. For feeds not in the ration, such as brewers grains, the highest cost is the opportunity price.

Feeding the High

Don J. Kubik
District Extension
Dairy Specialist
Northeast Station

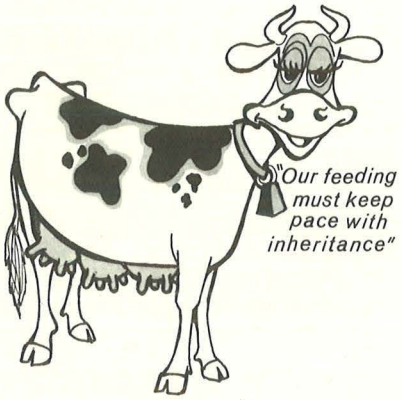
With high genetic abilities comes the need for rations and feeding systems which will let us "feed-out" what we have bred into our cows. Whether it comes from forage or grains, we need a high quality, balanced ration, particularly for the high producers (70 to over 100 pounds (32 to over 45 kg) of milk daily). Many times the approach has been to try to meet the needs of the high producing cow by simply feeding more grain. This is one approach, but usually an expensive method and also difficult because of the time required for the cow to consume this much (40 to 50 pounds [18-22 kg] of grain) in the milking parlor. For most dairymen this is impossible, or too much bother, so it is not done.

The direction which should be taken is toward high quality roughage. To get enough energy into the high producer, only high quality roughage should be fed. The reason for this is that when we are getting maximum high intakes the digestibility of the ration is decreased. That is, cows producing 35 pounds (16 kg) of milk daily obtain 15 percent more feed value per pound of ration consumed, compared to the high producer consuming 2 or 2½ times as much of the same total ration. The higher quality roughage will help compensate for the lower efficiency. The drop in efficiency is related to a decrease in digestibility of the grain ration at higher feeding rates. Therefore, feeding quality roughage will help maintain better efficiency, since lower levels of supplemental grain are needed.

Energy. When you balance a ration for the high producing cow, only high quality roughage can be used, otherwise the ration will be below the minimum energy requirement. Normal rations are also deficient in protein and minerals for the high producer.

Protein. Cows producing over 65 pounds (29 kg) of milk need 16 percent protein in their total ration dry matter. This includes the combined protein in the roughages plus the grain ration. When corn silage is the principle roughage, this means the grain ration will have to contain 21 percent protein to meet the needs of the high producer. On the other hand, when high quality alfalfa is the primary roughage, the grain ration will need to be only 10 to 12

Producer



percent protein to meet her needs.

In contrast, the low producer (less than 40 pounds [18 kg] daily) will only need about 14 percent protein in ration dry matter, so this need can be more readily satisfied with usual ingredients.

The high producer will also need more natural protein in her ration. Cows producing over about 50 pounds (22 kg) daily generally will not benefit from nonprotein nitrogen, therefore, should not be fed urea as a substitute for natural protein in the ration.

Minerals The roughage will also determine the kind and amount of minerals needed to properly supplement the ration for the high producing cow. Calcium at .7 to 1.0 percent and phosphorus at .5 to .65 percent are necessary in the total ration dry matter. When rations high in alfalfa are fed, a high phosphorus, or even an all phosphorus, mineral may be necessary. When feeding rations high in corn silage or other grass forages the primary need is for supplemental calcium. The other minerals are normally supplied in trace mineralized salt. Force feeding mineral designed to meet minimum needs is considered the best method for lactating cows.

Table 1. Complete Ration Nutrient Restrictions for Cows of Different Daily Milk Yields

	High (Above 66 lb)		Medium (45-66 lb)		Low (Less Than 45 lb)	
	Min.	Max.	Min.	Max.	Min.	Max.
Crude Protein, %	16	–	15	–	14	–
ENE, Mcal/100 lb	70	–	65	–	60	–
Calcium, %	.70	1.00	.60	1.00	.55	1.00
Phosphorus, %	.50	.65	.45	.60	.40	.55
EE (Fat), %	2.00	5.00	2.00	5.00	2.00	5.00
Fiber, %	14.00	–	14.00	–	14.00	–
Vitamin A EQ, IU/lb	2500	–	2500	–	2500	–
Vitamin D_2, IU/lb	250	–	250	–	250	–

In **Table 1** is shown the nutrient restrictions for total rations (grain and roughage) fed for three levels of production.

To better understand the problems associated with feeding this high producing cow, let's examine her changing nutritional status during early lactation (Figure 1).

In early lactation it is impossible for the high producer to consume enough feed to supply her energy needs. This means she is going to use stored body fat. It is theorized that this is one of the reasons for the higher protein percentage needed in the ration at this stage. That is, with the fat furnishing only energy, protein is needed to balance her needs. Also, during this period the cow cannot assimilate (take into the blood stream) enough mineral from the digestive tract to meet her needs. So it is important that we do the best possible job of supplying minerals to supplement the ration.

Notice that after about 20 weeks into lactation it is necessary to limit energy in order to keep cows from gaining too much weight. Before this time it is generally impossible to overfeed the good cow. Even in times of a narrow feed-to-milk price ratio, economical feeding of the high producer is feeding for near maximum production. Dry cow feeding and the reconditioning of the cow in preparation for her next lactation also need to be considered as a part of the feeding cycle. On the basis of the best information available today, conditioning the cow (replenishing body energy) in late lactation and then attempting to simply maintain body weight during the dry period seems to be most economical and also minimizes problems around freshening time. (Feeding the dry cow, with consideration of special post-calving problems is the subject of NebGuide G77-373).

Because of the complexity of balancing rations, the use of forage analysis and computer formulation is suggested whenever possible. This service is offered thru

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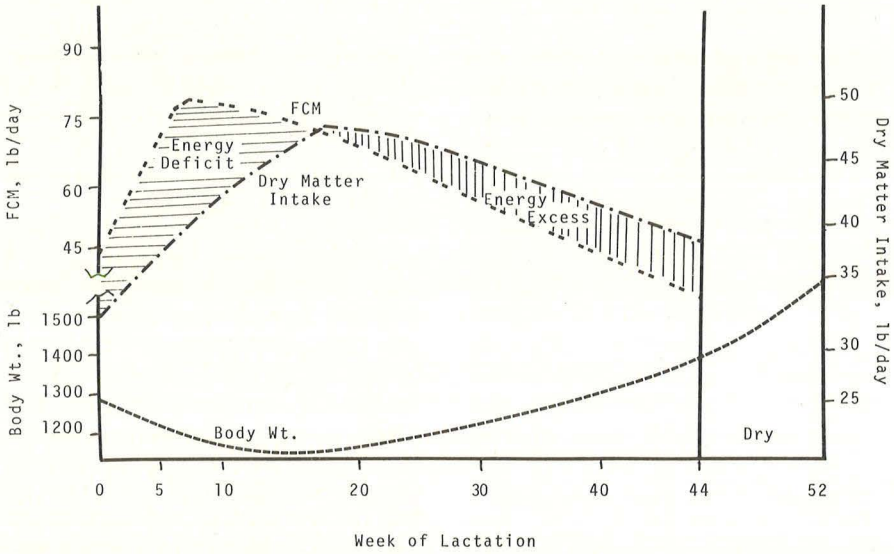


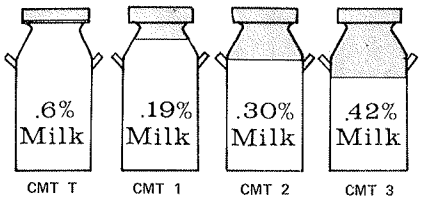
Figure 1. Milk production body weight changes and dry matter intakes at different stages of lactation.

Keeping Ahead of Mastitis

Larry L. Larson
Assistant Professor
of Animal Science

Mastitis means dollars down the drain. The average annual loss due to mastitis is estimated to be $70.00 per cow. Losses due to purchase of drugs, discarding of abnormal milk or death of the cow are readily apparent. However, the greatest loss is due to reduced milk production in cows that appear normal but are infected. The dairy farmer realizes about $5.00 in return for every dollar invested in a complete mastitis control program.

What is mastitis? Mastitis is an inflamation of the mammary gland, usually caused by bacterial organisms. Clinical mastitis is recognized as a hot, swollen gland, or quarter, and the milk is visually abnormal, containing flakes and clots or watery fluid. About 3 percent of the cows in an average herd have clinical mastitis at any one time. As the dairyman sees his herd, 97 percent of the cows would appear normal and he would be treating 3 percent for clinical mastitis. However, these serious cases are only the tip of the iceberg. Actually, herd surveys indicate that about 50 percent of the cows are infected and 50 percent are not infected. Of the total cows, about 3 percent are clinical (abnormal milk) and 47 percent non-clinical (milk appears normal). Although the 47% non-clinical cows appear normal, the loss in milk production from these infected cows is very significant due to the gradual destruction of the secretory tissue in the udder. For example, the relationship between the California Mastitis Test (CMT) and milk production has been reported as follows:



CMT Score	Decrease in Milk Yield
Negative	0
Trace	9%
1	20%
2	32%
3	43%

For example, a cow that could have been a 15,000 pound (6,804 kg) producer averages a CMT of 1, and becomes a 12,000 pound (5,443 kg) producer. If she had averaged a CMT 2 she would have even dropped to 10,200 pounds (4,627 kg).

How does clinical mastitis develop? The mammary gland of a heifer calf at birth is sterile or free of infection. In order for clinical mastitis to develop, bacteria must first enter the gland. The only way bacteria can get into the mammary gland is through the streak canal (opening) of the teat. The streak canal is normally held closed by a circular muscle that surrounds it. Also, the streak canal is lined with keratin, a material that destroys bacteria. The bacteria gain an opportunity to enter the gland (1) when there is an injury to the teat end, (2) when the streak canal is open during the milking process, (3) while the teat is leaking milk, (4) when the gland is full prior to calving or, (5) at drying off.

English workers have described the steps in the development of mastitis infections as follows:

Once the cow is infected, she is a potential mastitis case. Any stress is likely to cause a flare-up of clinical mastitis. The cow with clinical mastitis might die, remain in that condition, or be returned to the chronically infected or non-infected state by antibiotic treatment or spontaneous recovery.

Where do the mastitis organisms come from? Bacteria that can cause mastitis are located everywhere in the environment, but 95 percent of the infections are due to four organisms. Two of these live primarily in the udder or on the skin of the teat. Therefore, the major source of infections is another infected cow. For a non-infected cow to become infected, organisms must be transferred from the infected cow to the non-infected cow. In the milking process these organisms can be transferred by several methods. One method is on the hands of the milker. After milking an infected cow the organisms might be located in the cracks of the hands of the milker and transferred from cow-to-cow. Hands are nearly impossible to sanitize. Common rags and udder sponges for washing

(continued from page 11)

the University and some feed companies.

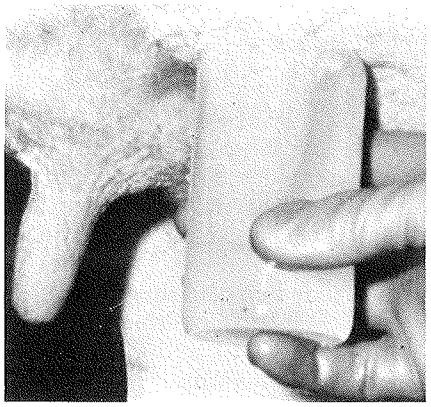
Table 2 presents a guide for grain feeding based on various roughage qualities.

The high producing herd or the high producers within a herd are worth the special consideration necessary to insure maximum production.

Table 2. Grain Feeding Levels for Milking Cows, lb/day

	Roughage Quality (Mcal ENE/100 lb DM)[1]									
	32	35	38	41	44	47	50	53	56	59
Milk/Day	Poor		Fair		Good		Very Good		Excellent	
25	17	16	15	14	13	12	10	7	4	
30	19	18	17	15	14	13	11	8	5	
35	20	19	18	17	15	14	12	10	7	
40	22	21	20	19	17	15	14	12	9	5
45	24	23	22	21	19	17	16	14	11	8
50	27	26	25	23	22	20	19	17	13	11
55	29	28	27	25	24	22	21	19	16	13
60	32	31	30	28	27	25	24	22	19	16
65	34	33	32	30	29	27	26	24	21	18
70	36	35	34	33	32	30	29	27	24	20
75						32	31	29	26	22

[1]Net energy values comparable to those given in Morrison's Feeds and Feeding, 22nd edition.



Teat dipping is preventive.

the udder and the teat cup assembly are other vehicles for the transferring of the infecting organisms. Also, organisms can be transferred directly from the environment (bedding, manure, etc.) to the cow as she is lying down.

Cows vary in their ability to resist the movement of bacteria through the streak canal (teat opening). Several conditions, such as a dirty environment, teat erosions, teat injury and removing the teat canal keratin with dilators, milk cannulae or treatment tubes, will help these organisms get into the udder. Once inside the udder, destruction of the secretory tissue begins.

When do new infections occur? New infections are greatest during the first three weeks of the dry period. Apparently the infecting organisms at this time are already present on the teats or picked up from the environment, since handling of the udder and milking would not be involved. The second most frequent period of new infections is during the first few weeks of lacation.

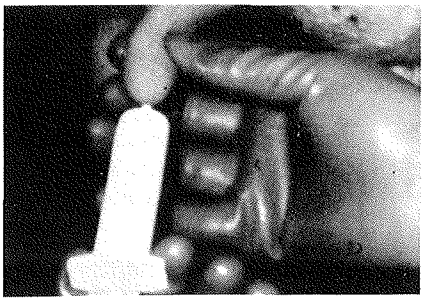
How can new infections be prevented? *Dipping teats with a safe and effective product immediately after milking has been found to be the most important single practice for preventing new infections.* New infections can be reduced 50 percent using this preventative. The purpose of dipping teats is to remove the film of milk on the teat that might provide nutrients for the bacteria and to kill the bacteria present on the teat. Since dipping teats does not eliminate existing infections, it should be combined with an effective treatment program to eliminate the existing infections.

Effective dipping involves immersing about one-half of the teat in the dip solution. Most authorities believe spraying is not as effective. It is important to use only "approved" teat dips that were designed for that purpose and proven effective. Teat dips vary greatly in effectiveness. Some teat dips actually increased the number of organisms present on the teat. Although it is difficult to characterize an effective teat dip, **do not use teat dips with an oil (mineral or vegetable oil) base.** Oil-based products create a supple condition of the teat skin, but do not prevent udder infections. If an emollient such as glycerine or lanolin is present, the concentration should be 10 percent or less. Higher levels will reduce the germicidal effect.

There are three major classes of water-based teat dips that have been proven effective. These are:

1. Sodium hypochlorite at a concentration of 4.0 percent (40,000 ppm) available chlorine.
2. Iodophor at concentrations of 0.5 to 1.0 percent (5000 to 10,000 ppm) available iodine.
3. Chlorhexidine at concentrations of 0.2 to 1.0% (2000 to 10,000 ppm).

Sodium hypochlorite solution, (Clorox), is much cheaper and more readily available than other preparations. Clorox is a commercial bleach available at all grocery stores. This product contains 5.25 percent sodium hypochlorite with a low sodium hydroxide content of 0.01 percent. Other commercial chlorine bleaches should be used only if the concentration of sodium hydroxides falls within a similiar safe non-irritating level. Dips in the hypochlorite group often cause a temporary chapping and pealing of outer skin of the teat. This condition should disappear in about 3 weeks. Some milkers find the hypochlorite solutions irritating to their hands and must wear gloves. In certain cases, the irritation is so severe that this type of teat dip cannot be used. It would not be desirable to start



Teat infusion with antibiotic.

using this type of solution in extremely cold weather.

The iodophor (iodine) teat dip preparations are very effective and less irritating to the teats. However, care must be taken to use only solutions that are low in phosphoric acid and approved for dipping teats. Sanitizing solutions that are high in phosphoric acid have been incorrectly used for teat dipping, resulting in severe irritation and injury to the skin.

While chlorhexidine solutions are effective teat dips, they might cause some initial irritation to the teats. However, this irritation usually lasts only a couple of weeks.

How can existing infections be eliminated? The most successful method of eliminating existing infections is by dry cow treatment. Dry cow treatment has several advantages over treatment of lactating cows.

1. High doses of antibiotics in longer acting cases may be used.
2. Antibiotics remain in the udder for a longer period of time.
3. Saleable milk is not lost.
4. Dry period treatment is more effective (cure rate of 60-80 percent compared to 30-40 percent for lactating cow treatments).

Authorities consider most drugs commonly available to dairymen for dry cow treatment a waste of money. High potency antibiotics considered to be effective in a dry cow treatment program are available only from veterinarians. There are at least two general types of dry cow treatment that have been proven effective. One contains 1 million units of penicillin in combination with 1 gram dihydrostreptomysin or other approved antibiotics. The other contains 500 mg cloxacillin.

(continued on next page)

Is Your Business Healthy?

Don Kubik
District Extension Dairyman
Northeast Station

It is important for the dairy industry and producers to be aware of production costs. It is also important that we keep consumers, government officials and others who are looking at our industry informed of the cost of producing milk. For this purpose we must have a systematic and sound basis for obtaining cost data.

To help in this regard, we are working with other states in the Midwest to supply data representative of an average Grade A, D.H.I.A. herd with cold, free stall housing and outside feeding.

Because we must have a common basis of comparison, we chose the average D.H.I.A. herd of 60 cows with a production average of 12,000 pounds (5,443 kg) of milk, which is approximately 2,000 pounds (907 kg) of milk above the state average of all cows. However, we did not feel it would be appropriate to use costs of production from herds with below average management, nor those with extremely good management.

Because there is a wide range in the buildings and equipment used, we have tried to identify representative facilities from our Nebraska D.H.I.A. herds. The following facilities and equipment are included in cost data: one tractor plus part use of a second tractor, scraper, manure loader, manure spreader, part use of a pickup and truck, feed bin, corrals and lots, bulk tank, pipeline, double 4 herringbone milking parlor, trench silos, free stall housing system, lot feeding system, fencing, paved lot.

This herd and facilities are used as the basis for determining overhead and fixed costs. With the production level established to determine the value of milk sold, we then use the actual milk price and cost figures of dairymen for all other cost information and adjust these on a quarterly basis. Feed costs are at market value and not cost of their production. **Table 1** shows the August and November 1975 calculations plus the November 1976 calculations for Nebraska.

The bottom line shows the profit or loss per cow after deducting all charges you should be entitled to as business owner. However, this does not necessarily reflect the personal income or available spendable income.

Then how does this data relate to what you have as spendable income? The figure in the box is income minus out of pocket expenses. This is what you could expect from this operation per cow for you and your family for your

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(continued from page 13)

The procedures of dry cow therapy are controversial. Many recommend treatment of all quarters of all cows and others suggest treatment of cows on a selective basis. Treating all quarters of all cows has the advantage of requiring no method of selection and would help protect against the new infections that develop during the dry period. Those that treat on a selective basis would treat only those quarters in cows that have a history of mastitis, or are found to be infected by using a screening test such as the CMT, or by culturing milk samples from each quarter of each cow.

Even though dry cow therapy has a higher cure rate, the lactating cow showing clinical signs of mastitis should be treated two to three times in the udder every 12 to 24 hours with an approved antibiotic to do a thorough job of killing all of the organisms. One treatment will kill some organisms and the milk might appear normal, but many times another flare-up will follow shortly, unless follow-up treatments are given.

Before infusing the udder with any kind of drug, always scrub the teat end with an alcohol swab.

Mastitis Management

A complete mastitis control program must be a total management program for controlling all avenues of new infection. This includes proper milking machine function and sound milking procedures combined with effective teat dipping, a dry cow therapy program, and general sanitation of all facilities. The following milking techniques are recommended by the National Mastitis Council and have been proven to reduce mastitis and increase milk production.

1. Remove 2 or 3 streams of foremilk from each quarter and observe for abnormalities.
2. Wash the udder with a warm sanitizing solution and dry with a single service paper towel.
3. Attach the teat cups approximately 1 minute after starting udder preparation—or when the teats are full of milk.
4. Adjust the teat cups during milking as necessary to insure effective milking.
5. Start machine stripping when milk flow slows to a minimum (usually 3 to 4 munutes after machine attachment). Machine strip quickly. **Do not overmilk.**
6. Dip the teats in a teat dip proved to be safe and effective immediately after the teat cups are removed. (An exception would be during extremely cold weather when cows go directly outside.)
7. Treat all clinical cases as outlined.
8. Treat cows at drying off as outlined.
9. Use a screening test such as the CMT at monthly intervals. Record the results for future reference. (In some areas this service is available through the Dairy Herd Improvement [DHI] record program.)
10. Have the entire milking system serviced twice a year by a qualified milking machine service man.
11. Quarter or composite sample the herd at least once a year for bacteriological culture.

labor and management—not payments, taxes, insurance and depreciation to your facilities.

So, if we look at the November 1976 information which shows $327.34 and multiply by the 60 cows we get $19,640. This would be your spendable family income, if you had the dairy unit and cows debt free. Note that this income is for your labor and management plus interest on your investment and depreciation. No charge is made for the land for the dairy nor taxes on it.

To contrast this, a family's spendable income with a five year note for $60,000 to pay would be $19,640 minus $14,860, which is the annual note payment, or $4,780. This shows why two families with similar units may not give you the same answer when you ask them, "How is the dairy business?" Even though the note payment is an out of pocket expense, $12,000 of it is principle and can be viewed as savings or equity. Only the $2,860 interest is a true expense.

During 1977, cost and return estimates will be made quarterly for herds with annual yields of 10,000 pounds, (4,536 kg); 12,000 pounds, (5,443 kg); and 14,000 pounds, (6,350 kg) of milk. They will be published for your information.

Dairymen are urged to examine their business according to the format presented here. If net returns are negative, they should investigate all phases of their operation to see if improvements can be made.

Table 1. Cost and Returns per Animal Unit in 60 Cow Herd, 12,000 Pounds of Milk Sold Per Year—Nebraska.

		Value		
		Aug. '75	Nov. '75	Nov. '76
LIVESTOCK INVESTMENT				
Milk base		0.00	0.00	0.00
Dairy cow	based on what is necessary to have a 30% culling rate	500.00	550.00	600.00
Yearling heifer		60.00	90.00	90.00
Replacement calf		30.00	45.00	60.00
Total livestock investment		590.00	685.00	750.00
PRODUCTION				
Milk	based on what is necessary to have a 30% culling rate and sell all bull calves.	918.81	1137.75	1120.80
Dairy cows		86.40	82.50	73.50
Dairy bull calves		4.50	6.75	4.50
Dairy heifer calves		7.50	9.00	9.00
Manure credit (new item in 1976)		—	—	15.00
Total receipts per cow		1017.21	1236.00	1222.80
OPERATING INPUTS (includes cows & replacement costs)				
Corn silage		99.00	115.00	134.64
Dairy ration 16%		337.63	329.52	340.93
Salt and mineral		6.50	6.50	6.50
Milk replacer		4.20	4.20	—
Calf starter		4.80	4.80	4.80
Hay		157.50	175.00	174.00
Pasture		10.00	10.00	12.50
Breeding fees		10.00	10.50	11.00
Vet med. and drugs		15.00	18.00	18.00
Supplies		18.00	22.00	22.00
Records and information		7.00	7.00	10.00
Utilities		18.00	22.00	24.00
Bedding		9.00	9.00	9.00
Milk hauling (deducted from milk price in 1975)		—	—	32.40
Tractor fuel and lube		4.62	5.74	6.27
Tractor repair cost		2.09	2.59	2.59
Mach. fuel and lube		4.14	4.14	4.63
Machinery repair cost		7.19	9.22	4.37
Equipment repair		6.50	8.49	7.37
Ownership (equipment)—depreciation, taxes, insurance		71.30	86.38	70.40
Total operating cost per cow		792.47	850.57	895.46
RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK AND MANAGEMENT		224.74	385.43	327.34
CAPITAL COST TOTAL INTEREST CHARGE		116.09	139.99	144.80
RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT		108.65	245.44	182.54
TOTAL LABOR COST		153.39	182.68	182.93
RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT		−44.73	+62.76	−.39
8% MANAGEMENT CHARGE		81.38	98.88	97.82
RETURN TO LAND, OVERHEAD, RISK (PER COW)		−126.11	−36.12	−98.21

DHI Records For 1976-77 Dairying

P. H. Cole
Extension Dairyman

Dairy production costs—feed, labor, housing, equipment, interest and taxes—all are high. DHI records provide information needed to manage each cow—feed needs, selection of cows or herd improvement, timetable for regular calving, and time to cull.

DHI records provide:

1. Grain feeding recommendations for each cow, based on the forage fed, to meet her milk production needs. More milk from redistributing grain fed pays for record investments, as does the grain saved in feeding lower-producing cows.
2. Cow ability comparisons for genetic improvement of the herd.
3. Daily income over feed cost data for each cow, to help make culling decisions.
4. Management guides—listing cows to dry off, to calve, to breed, and to pregnancy check. These are in chronological order, and pocket sized for handy use in working daily with the herd.

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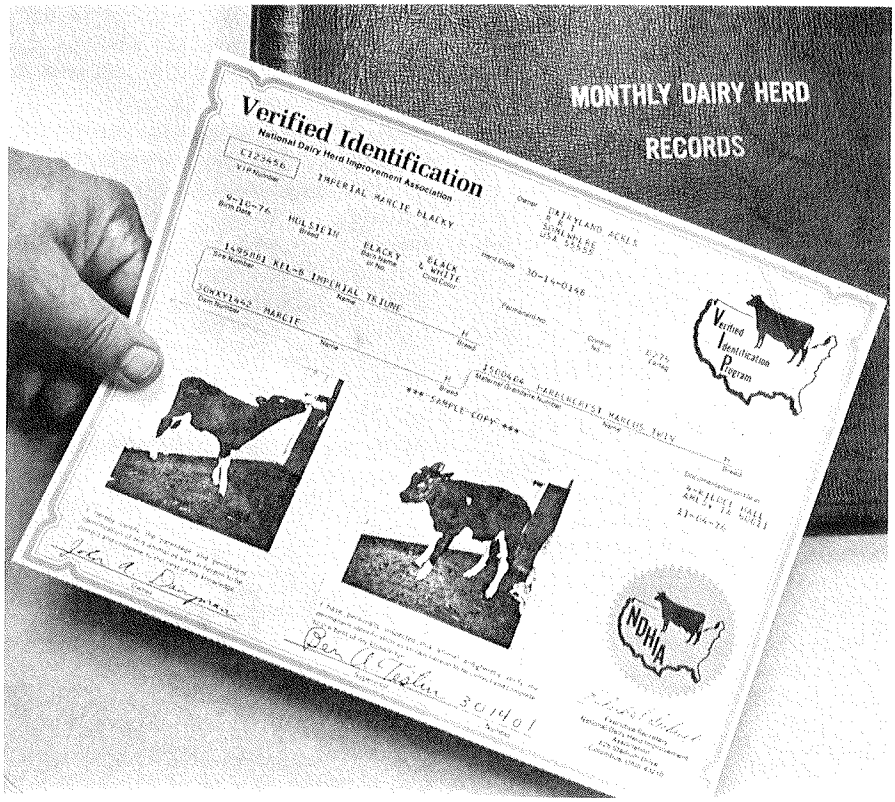


A Verified Identification certificate and DHI record book.

(continued from page 15)

DHI is making available some new service programs: 1. PLM (protein, lactose and mineral) testing on DHI milk samples. This provides dairymen with information needed to select and cull cows when component pricing of milk becomes available.

2. Mastitis screening tests using CMT (California Mastitis Test) on DHI milk samples. These tests identify problem cows for additional testing by other means and help detect milking equipment and management problems.

3. Permanent animal identification using photos or tattoos. The new **VIP** (Verified Identification Program) provides the dairyman a businesslike way to positively identify all animals in his herd.

There are record programs to fit every dairyman's need:

1. **Official DHI**—A supervised record which provides production and management information and is used for sale of cattle and national sire evaluation programs.

2. **Unofficial DHI**—may be Owner-Sampler or supervised records which do not meet the standards of official records. The dairyman receives the same information for management use at about two-thirds the cost of the official DHI, because he takes his own milk weights and samples. The following two new unofficial programs are also now available.

3. **AM-PM**—Alternate milkings are weighed and sampled, evening milking one month, morning the next. If the supervisor takes the samples, the cost is about 80 percent of the official DHI program. It is also attractive to large herds, because less sampling time is involved.

4. **MOR (Milk Only Record)**—No milk samples are taken. Milk weights are used to provide all management information. The last plant test is used for calculating income over feed costs for cow comparisons. With no samples to test and lower labor costs, this record is available at about 10¢ per cow a month less than programs requiring fat tests. Also the elimination of sampling appeals to dairymen with large herds.

Milk Progeste

Larry L. Larson
Assistant Professor of Animal Science

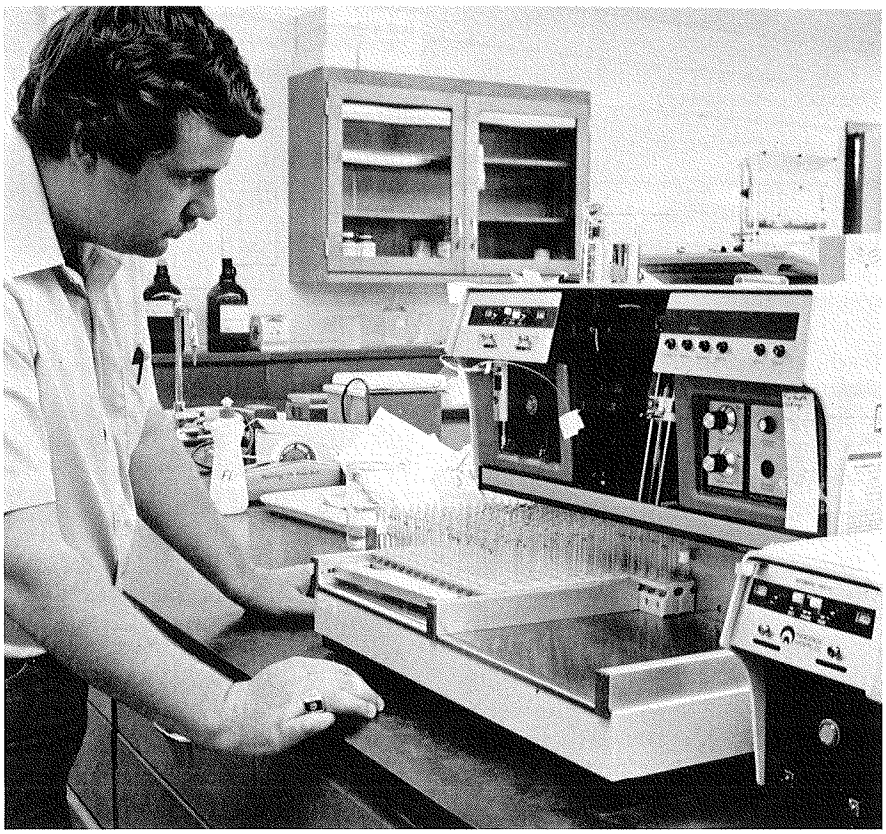
What is the Basis for the Milk Progesterone Test?

Progesterone is a female sex hormone commonly referred to as the hormone of pregnancy. The test is based on the expected changes in the production of this hormone that occur during the reproductive cycle and during pregnancy in cows. The progesterone levels present in blood or milk can be determined by radioimmunoassay techniques using sophisticated laboratory equipment. Progesterone levels in milk are higher but follow the same pattern as that found in the blood. Since progesterone is produced by the corpus luteum (yellow body) in the ovary, high levels of progesterone would indicate a functional corpus luteum. The corpus luteum forms and starts producing progesterone after the cow has been in heat and has ovulated (released the egg). If the cow does not conceive, the corpus luteum degenerates and progesterone levels are very low about 2 days before the cow comes into heat again. However, if the cow conceives, the corpus luteum continues to function and progesterone levels remain high. Therefore, if the cow is not pregnant and has a regular estrous cycle, the progesterone levels in the blood and milk would be very low from about 2 days before heat until about 4 or 5 days after heat. Checking levels in the milk could help determine when the cow is coming into heat.

How Accurate is the Test?

The accuracy of a low progesterone or negative test (open) has been shown to be as high as 99 percent; the positive test (pregnant) is not this accurate. If the progesterone level in a milk sample collected 20 to 22 days after breeding is low, the cow is not pregnant; high progesterone

terone Test for Pregnancy



Equipment needed to test for progesterone.

levels indicate a functional corpus luteum and pregnancy is only one possibility.

Some factors that could cause high milk or blood progesterone levels 21 days after breeding or artificial insemination are:

1. The cow is pregnant.
2. Unsure heat detection. The cow may have been inseminated on the wrong day and 21 days later when the sample is collected she could be in the middle of the estrous cycle and non pregnant.
3. The cow has pyometria, causing the corpus luteum to persist maintaining high progesterone, and this cow is **not** pregnant.
4. Embryonic mortality. The cow conceived but the embryo died.
5. Some cows have longer estrous cycles.

Is the Test Practical?

Progesterone is present in milk in minute amounts; about 1 to 20 parts per billion. These levels can be detected by a highly specific radioimmunoassay test. Trained technicians and specialized equipment are required to perform the test. However, a lab could provide the service for about $2.00 to $3.00 per cow once it had the estimated $25,000 in equipment and materials needed.

Conclusion

Since the hormone progesterone is essential for the maintenance of pregnancy in cattle, very low levels of progesterone in milk or blood would indicate that the cow is not pregnant. However, a high milk progesterone level 21 days after insemination does not guarantee that the cow is pregnant. Accurate heat detection is essential for the success of the milk test and may be as accurate.

Outlook For Dairy

T. A. Evans
Professor Food Science and Technology

During 1976 dairying nationally was characterized by an upsurge in production. During the first 6 months of the year an anticipated 1 percent increase in production in reality became a 3 percent increase. After July 1 the increase over the previous year was even more pronounced, between 5 and 6 percent. For the entire year the increase in production nationally was over 5 billion pounds or 4.4 percent. Nebraska producers, however, curtailed their production during 1976, dropping 2 percent below the level achieved during 1975.

There are several reasons for the increase in production nationally, including (1) heavier than normal feeding of concentrates, (2) an extremely small decline in the national dairy herd, and (3) an unusually large increase in production per cow.

Nebraska dairymen increased their feeding of grain and other concentrates about 50 percent more than did the average dairyman nationally. There was, however, a significantly larger decrease in milk cow numbers on Nebraska dairy farms than was true nationally. The size of the na-

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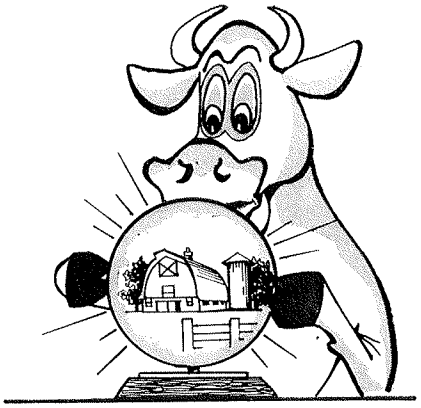

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tion's dairy herd decreased less than one-half of one percent between January and December of 1976 and actually increased in October over September, something that hasn't happenecd for many years. In Nebraska, the decrease between January and December 1976 was 5.5 percent, significantly greater than during 1975.

Both nationally and in Nebraska milk production per cow increased slightly more than 5 percent during 1976.

Outlook for 1977 is for a continuation of the present high level of production nationally, at least during the first half of the year. After three years of drought, Nebraska dairymen may have difficulty in maintaining production during the winter months. Production during the second half of 1977 will depend on milk prices, cull cow prices, crop conditions, feed prices and the general state of the economy.

Farm price of milk during 1976 was significantly above the 1975 level, averaging near $1.00 per 100 pounds higher nationally and almost $1.25 higher for Nebraska dairymen. The darker side of the picture is that the increased milk production has also resulted in an increased production of those dairy foods that most affect milk prices. For instance, 1976 cheese production nationally was up 24 percent above the 1975 level. In spite of a brisk demand for cheese, more has been produced than the market can use and storage stocks have reached a near record high. Butter and nonfat dry milk supplies are also relatively large. The result has been to depress manufacturing milk prices to near support levels. Milk prices did not rise during the fall season as they usually do. In fact, the price of milk dropped 9¢ per 100 pounds between October and November and in December was 55¢ per 100 pounds lower than it was in January of 1976. By contrast, in 1975 the milk price was $2.40 per 100 pounds higher in December than in January.

With the prospect of continued high production during at least the first six months of 1977, it appears unlikely that milk prices will rise much above government support level. USDA forecasters are predicting the possibility of 1977 average farm milk prices being below the 1976 level. If this should occur, it would be the first such annual decline since the 1950's.

The manufacturing grade milk support program will play an important part in the dairymen's 1977 income. At present, the price of this grade of milk is supported at $8.26 per 100 pounds for milk of average fat test (3.68 percent). This is approximately 80 percent of parity. The law requires that milk prices be supported between 75 and 90 percent of parity. Efforts made by Congress to raise this minimum to 85 percent of parity have not been successful to date. What the farm bill to be introduced in the 95th Congress will do about dairy prices is not yet clear. (While in press the Secretary of Agriculture increased support to 85 percent of parity.) On the bright side of the dairy picture is the substantial expansion of demand for dairy products experienced during 1976. Despite much higher retail prices throughout the year, total dairy sales for 1976 were up about 2 percent. Much of this increase came from cheese. During the first nine months of 1976, commercial disappearance of American cheese was up 11 percent from the previous year with other cheeses showing a similar gain. Fluid milk sales were also up slightly, but butter was down somewhat from the 1975 level. It is not anticipated that retail prices for dairy products will rise substantially during 1977. This could mean another increase in dairy product sales during 1977, but probably not of the magnitude of the 1976 increase. If meat prices should increase as expected, cheese sales will undoubtedly benefit.

Production of butter and cheese in Nebraska during 1976 in general followed national trends. Butter production declined nearly 10 percent to 17.5 million pounds, the lowest total since records have been kept. American cheese production increased nearly 5 percent over the 1975 level to more than 31 million pounds. Ice cream production declined about 10 percent. Since total milk production decreased only slightly during 1976, these figures would indicate that more of the state's milk supply is going into fluid uses. This is, of course, the highest return usage of milk and should result in a higher net return to Nebraska dairymen.

In relation to some agricultural enterprises, the outlook for dairying appears reasonably favorable for 1977. The farm milk price during most of 1976 was substantially above the support level. If USDA maintains supports during 1977 at 80 percent of parity, there still will not be a large drop in the farm milk price. If Congress should decide to raise the support price to 85 percent of parity, milk prices could rise above last year's level. Given present conditions of dairy product surpluses, rising production costs, drought over much of the state with the prospect of higher feed costs, it is difficult to predict that dairymen will substantially improve their net income during 1977.

Table 1. Factors Affecting Milk Production, 1976

	United States	Nebraska
Increased Feeding of Concentrates	+ 4%	+ 7%
Decline in Milk Cow Numbers (January to December)	− 0.31%	− 5.5%
Increase in Production Per Cow	+ 5.2%	+ 5.4%

Table 2. Increase in Milk Prices (price per 100 lb), 1975-76

	United States	Nebraska
Fluid Grade	+ $0.98	+ $1.36
Manufacturing Grade	+ $0.89	+ $1.04
All Milk	+ $0.97	+ $1.24

Table 3. Production of Dairy Products, 1975-1976

	United States	Nebraska
Butter	+ 1%	− 9%
Cheese	+ 23%	+ 5%
Ice Cream	− 4%	− 10%

Genetics and Breeding Problems

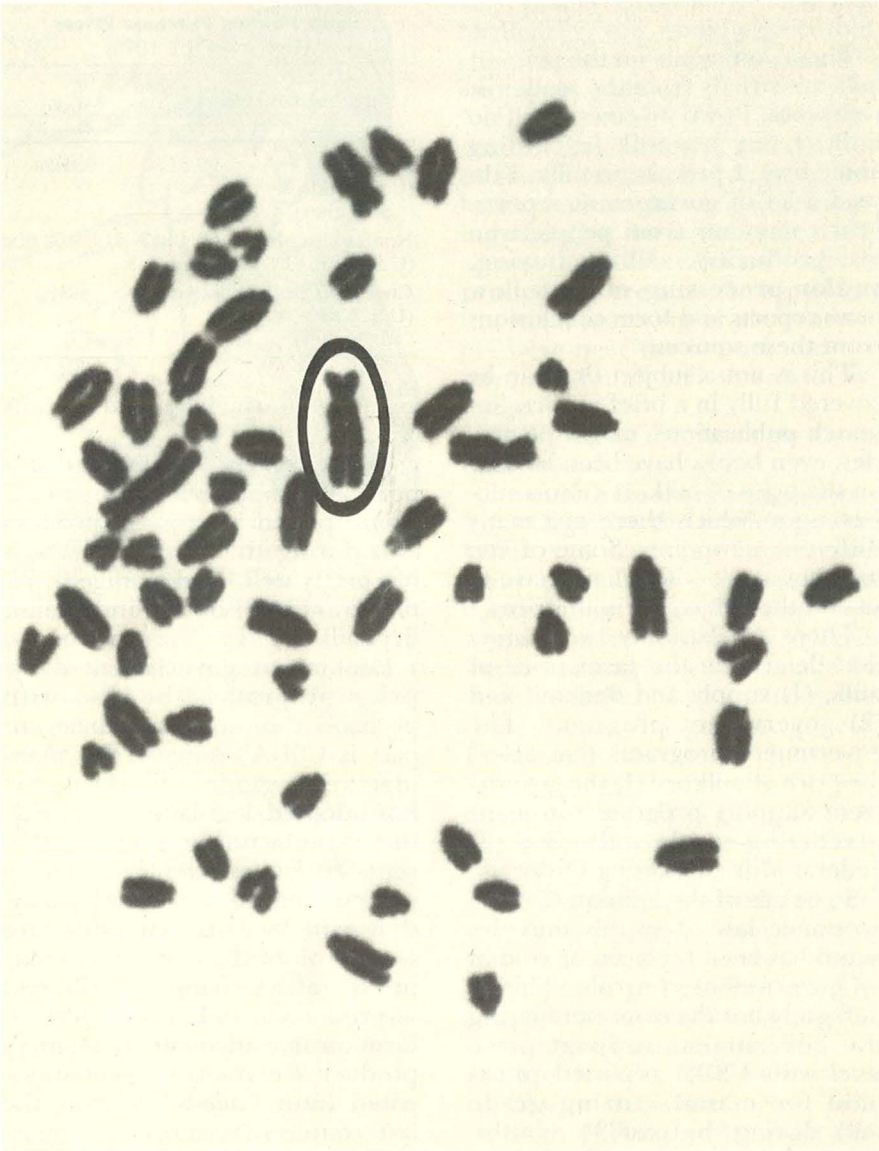
Franklin Eldridge
Professor of Animal Science

At the University of Nebraska we have found 29 animals in the Brown Swiss breed with an unusual chromosomal condition. These animals were in several different herds. We also found that animals with this condition were about 10 percent less fertile in terms of services per calf born than were their normal herdmates. Since there were only 49 calvings from the cows with this chromosomal condition this difference is not statistically significant. Other investigators have found similar results with much larger numbers in other breeds.

Cause of This Problem

Cattle usually have 60 chromosomes (29 pairs plus two sex chromosomes), with the females having 58 automsomes and two X's and the males 58 automsomes and one X and one Y. The X and Y chromosomes determine the sex of the animal. Several investigators have found cases where the longest or number one autosome has become fused with the shortest or number twenty-nine autosome. In such cases the animals have 59 instead of 60 chromosomes. This modification is called a Robertsonian translocation, and an animal with one of these is called heterozygous for the translocation. In cases where such a bull is mated to cows which are also heterzygous for this translocation, one-fourth of the offspring will have two such chromosomes and will have only 58 instead of 60 chromosomes.

In this unusual situation apparently no important genetic material is lost so that animals with 59 or 58 chromosomes do not appear to be different from animals with 60 chromosomes. However, during the formation of sperm and ova occasionally a cell may divide in such a way as to produce two normal cells. In a small number of cases one cell will have an extra chromosome and its mate will lack one chromosome. If such an abnormal ovum is produced, the resulting embryo will not survive for more than 90 days of pregnancy, and then the cow will come in heat again. Obviously, when this occurs the fertility of the animal is reduced.



The circled chromosome is the abnormal one.

What Can Be Done About This Problem?

Fertility in cows is affected by many factors, some hereditary, but management, disease, season of the year, fertility of the sire and other non-hereditary conditions influence fertility more than heredity. It may be that some improvement can be obtained in fertility through the application of results of research on chromosomes. The next step in research will be to study the early embryos so that more complete knowledge can be obtained concerning the reasons for lowered fertility associated with the chromosomal aberration. The results from such studies may indicate how fertility can be improved. Animals from other dairy breeds are also being investigated for unusual chromosomes.

Some Observations on

T. A. Evans
Professor of Food Science and Technology

These comments on the price of milk are strictly from the academic viewpoint. I own no cows, I sell no milk, I buy no milk (excluding home use), I process no milk. I do read a lot of government reports, hear comments from people who are producing, selling, buying, and/or processing milk, follow news reports and form conclusions from these sources.

This is not a subject that can be covered fully in a brief report. Research publications, magazine articles, even books have been written on the price of milk. It's also a subject upon which there are many different viewpoints. Some of you may not agree with what I have to say on the subject of milk prices.

There are basically two factors that determine the farm price of milk, (1) supply and demand and (2) government programs. The government programs that affect the price of milk are (1) the government support program for manufacturing grade milk and (2) Federal Milk Marketing Orders.

Some are of the opinion that the economic law of supply and demand has been replaced or voided by government controls. This is definitely not the case. Comparing the government support price level wtih USDA reported prices paid for manufacturing grade milk during the past 34 months, we find that during 16 of these months market price was significantly above support level.

The longest period during which manufacturing grade milk prices were either below or near support level was the 1974-75 fiscal year. During this period, farm milk prices were depressed, in part, due to the large imports of cheese, butter and nonfat dry milk authorized by the administration to offset a supposed or anticipated shortage of these products. During the past year, up until October, milk prices were well above the support level because of a good demand for cheese and to a lesser extent an unusual demand for butter.

Dairy Product Purchase Prices
(December 10, 1976)

	Announced Gov't Support	Market
	(Per Pound)	
Butter (U.S. Grade A or higher)	90.817¢	90.82¢
Nonfat Dry Milk (U.S. Extra Grade)	62.40¢	61.25-62.60¢
Cheddar Cheese (U.S. Grade A or higher)	92½¢	89¼¢

Today, prices have again dropped to the support level due to a 5 billion pound increase in production during this past year which has pretty well filled storage facilities for cheese, butter and nonfat dry milk.

Looking at government dairy price programs, the one with probably the most immediate impact is USDA's support for manufacturing grade milk. Congress has adopted legislation requiring that manufacturing grade milk be supported at a level, between 75 percent and 90 percent of parity, that will "assure an adequate supply of milk to meet current needs, reflect changes in the cost of production and assure a level of farm income adequate to maintain productive capacity to meet anticipated future needs." During the last couple of years the support level has been kept at near 80 percent of parity. Congress has been unsuccessful in its attempts to raise this level to 85 percent. Whether the 95th Congress will again attempt to raise the level is not known at this time. In view of the increase of 5 billion pounds in milk production during 1976, it may be difficult to substantially increase the support level.

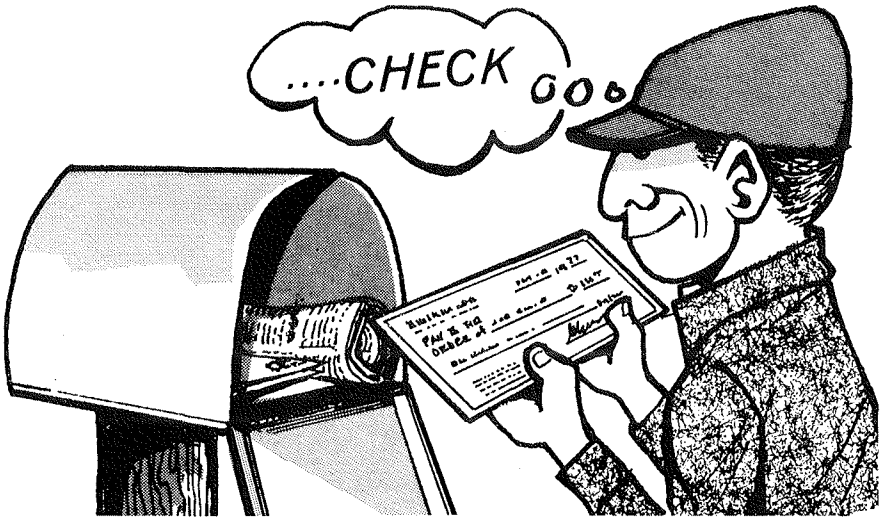
In supporting the price of manufacturing grade milk, USDA does not dictate to each and every buyer of milk that a certain specified price must be paid for milk of a certain fat content. Rather, the Commodity Credit Corporation (CCC) offers to buy three dairy products, cheese, butter and nonfat dry milk, at specified prices. The theory is that when the market price of these products drops below CCC's support purchase price, the government will provide a market and keep the price of milk at support level. On the average, this method seems to work fairly well, providing the purchase price has been set at the proper level. For instance, butter and cheese must be of Grade A quality or higher and nonfat dry milk must be Extra Grade with not more than 3.5 percent moisture. If a plant's product does not consistently meet these standards, it may not be able to take advantage of the government's purchase offer and will be forced to sell on the open market. As a result, the producers from which this plant is buying milk may receive a price below the support level.

Comparative Milk Prices
10 months—1976
(Price per pound butterfat)

	Fluid	Manfac.	All Milk
Nebraska	**2.70**	**2.36**	**2.54**
So. Dakota	2.65	2.41	2.47
Minnesota	2.50	2.38	2.43
Iowa	2.62	2.37	2.49
Kansas	2.73	2.39	2.67
Missouri	2.69	2.35	2.56
Average	2.65	2.38	2.53
Spread	2.50-2.73 23¢	2.35-2.41 06¢	2.43-2.67 24¢
United States	2.73	2.36	2.65

The Federal Milk Marketing Order program is one with which most dairymen are familiar. The principal feature of this program is "classified pricing". In other words, a producer is paid for his milk on the basis of the way it is used. In the market, Nebraska-Western Iowa Order No. 65, milk is paid for on the basis of three classes, Classes I, II, and III. In November, for instance, about 55 percent of the milk used in fluid milk products was Class I, about 10 percent in Class II and the remainder or 35 percent in Class III. Class I usage brings the highest

Milk Prices and Pricing



price with Class III price being essentially the manufacturing grade milk price. The Federal Order price is, of course, influenced by the government support price since the Class I order price is at a predetermined level above the Minnesota-Wisconsin series or the manufacturing grade milk price.

Now to answer a few questions that have been raised about the price of milk in this area:

1. How can the milk price fall below support price? This can happen in three ways, (1) the government may have improperly established the purchase price level, which happened in early 1975, or (2) a particular plant or buyer of milk is unable or unwilling to sell his product to the government, or (3) a plant's manufacturing cost is higher than normal and it is unable to pay the support price for milk and still make a profit.

2. Why can't coop's, or why don't coop's, pay as much for milk as independents?

It is my impression that they can over the long term. Sometimes the immediate pay price is not the total return to a producer or cooperative member. Such things as retains, revolving accounts, dividends, etc., are sometimes not taken into account. There is only so much product to be gotten out of 100 pounds of milk. However, such things as plant efficiency, marketing outlets, management expertise, etc., may influence to a significant extent the price that any certain buyer of milk can pay for that milk. I would think that it is not necessarily whether a buyer is a cooperative or an independent that would be the determining factor in what price a buyer might or could pay for milk.

3. Should dairymen sell where they can get the most for their milk?

This would be matter of individual preference. Sometimes the immediate return is not the best deal in the long run. Any producer should assess the reliability of any market outlet, the long-term implications, etc. Short-term advantages such as a six-month contract to furnish milk to a specific outlet should be looked at very carefully. There is also something to be said for loyalty. The producer who jumps around to different markets for a small price advantage may be the loser in the long run.

4. How will the total marketing picture be affected by independents buying at lower prices?

This question assumes that some independents are buying at lower prices. I do not know that this is true. At present, there are 8 or 10 different plants or organizations buying Grade A milk in Nebraska. No buyer can pay a lower price than his competition for very long and expect to maintain volume. There are reasons aside from price, of course, why individual producers sell where they do. Over the long term, however, price is a very potent factor in the market. Ordinarily, you would expect that competition for the rather limited supply of milk we have here in Nebraska would result in somewhat higher prices. A comparison of the price paid for milk in Nebraska and neighboring states during the first 10 months of 1976 shows that Nebraska's Grade A producers were near the top of the list, manufacturing grade producers were near the bottom and the pay price for all milk was about average.

5. What can dairymen do about milk prices?

I would have three suggestions:

(a) **Organize the market power.** When you have few buyers and many sellers, the sellers are at a disadvantage unless they are able to speak with one, or a few voice(s). I'm not saying how this should be done, whether through cooperatives, commodity groups, general farm organizations, or however, but it needs to be done if the producer of the milk is going to have any influence over the price he receives.

(b) **Become involved in government.** Since the government has a great deal to say about dairymen's prices through the support program, marketing orders, import quotas, etc., it is important that dairymen have a voice in these decisions. Not only through dollars but through personal involvement at all levels of government.

(c) **Promotion of milk and dairy foods.** With more and more agricultural commodity groups getting into the promotion act it is more important than ever that dairymen promote and market their product to the consumer. It has been proven that market promotion will sell dairy foods. This takes money, and no one is going to furnish this money except the dairymen. Nebraska dairymen have done a better job of supporting this type of activity than have dairymen in some areas of the country producing more milk.

Dairy Research in Progress

Foster G. Owen
Extension Dairyman

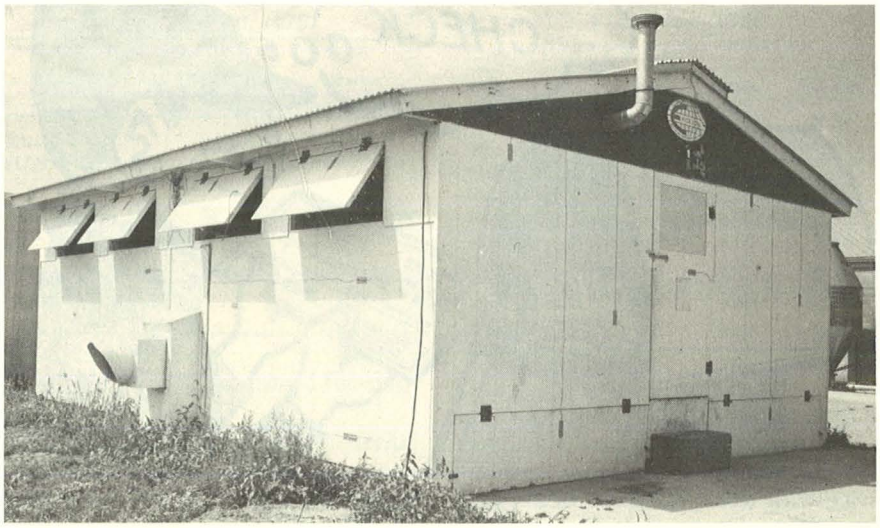
Calf starters. Rapid adaptation to consuming starter ration is critically important in calf raising programs involving early weaning. (1) "Hand-feeding" of starter, (2) a rumen stimulant bolus, and (3) addition of molasses to the starter have been evaluated for possible benefits to early intake of starter. Data is being summarized. Another experiment is now in progress to compare four pelleted starters with various levels of ground corn cobs as a "built-in roughage". Previous research showed built-in roughage helpful, but the level in the ration seems especially important.

Colostrum feeding to calves. Research is being analyzed on the comparative value of normal milk, frozen colostrum and sour (fermented) colostrum as liquid diets in early weaning programs. These diets were compared, diluted and undiluted. In addition to effects on gains and health, the effects of these diets on water consumption was also measured.

Calf growth stimulants. Preliminary results at Nebraska indicated improved growth from Ralgro implants in young calves. Therefore, the value of Ralgro for bull calves is being more critically tested as a part of the starter experiment referred to above.

Calf housing. Two environmentally controlled prefabricated calf houses are being used to study the effects of winter heating levels (temperatures) and summer ventilation rates on calf performance and utility costs. One house is managed to provide recommended, or normal environment, and the other house is managed for low energy use for heat and ventilation.

Group feeding of milk cows. One experiment is underway to evaluate methods of using a magnetic feeder for cows being full fed a basal, complete ration containing both roughages and grain. Treatments compared are: (1) no magnet (complete ration only), (2) magnetic during first four months after fresh, and (3) magnets whenever milk yields are above 55 pounds (25 kg.) per day. (The magnet allows access to additional grain feed via the magnet activated feeder.)



One of two environmentally controlled prefabricated calf houses.

Another group feeding experiment involves two lots of cows, a high lot and a basal lot where complete feeds are provided continuously. One-third of the cows receive the basal only, one-third are in the high lot during the first four months after fresh then are shifted to the basal, and one-third are assigned to the high lot only when milk yield is above 55 pounds (25 kg) daily and are in the basal lot when milk is below 55 pounds (25 kg).

Cows on these two experiments are also being used to determine whether vitamin injections or certain hormone treatments will benefit lactation or aid recovery from calving and allow earlier rebreeding.

Fiber in lactation rations. Results are being summarized from an experiment to learn the extent to which finely ground hay can be substituted for grain in the ration while restricting coarse roughage intake. This type of study relates to (1) improving economics of feeding when grains are a relatively more expensive source of nutrients than roughages, and (2) to the future when more of the land presently producing feed grains will be needed for food grains.

Silage preservatives. Preliminary trials are being run using laboratory silos to evaluate various types and levels of additives for their value in preserving silage.

Reproductive performance in postpartum cows. Methods to shorten the recovery period from calving until the cow begins cycling again and is ready for rebreeding are being examined. Various combinations of vitamin and/or hormone treatments are being given to cows 2 to 3 weeks after calving. The cows are being checked to determine if the treatments will initiate the reproductive cycle and shorten the recovery period to allow for earlier breeding, or affect the conception rate. Blood samples taken from some of these cows are being analyzed to determine if reproductive performance is related to differences in blood components. Results are not yet available.

Estrous detection. Changes in mineral and hormonal composi-

tion of milk from individual cows have been noted. Studies are in progress to determine if these changes in milk composition are related to the stage of the estrous cycle. Results are not yet available.

A series of trials relating changes in the electrical resistance of vaginal mucus to the stage of the reproductive cycle have been completed and summarized. Results indicate that on the average, electrical resistance is lowest on the day of heat and could be used as an aid in estrous detection. However, measurements in individual animals vary considerably.

Worming heifers. Preliminary trials are being conducted to determine if routine worming of replacement heifers will affect their performance as related to growth rate and health. Also, half of the heifers are being given supplemental vitamin ADE to determine if this treatment provides any protection against the symptoms of pink eye.

Genetics. Research into a genetic defect, (chromosome abnormality) to determine the extent of its occurrence and its effect on animal performance is described in detail in one of the articles of this report.

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