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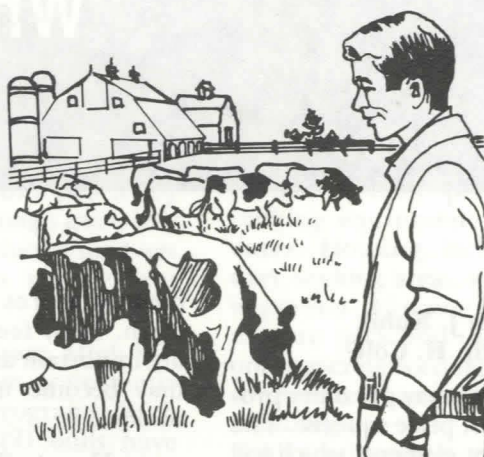
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Nebraska Cooperative Extension Service—EC83-220

Efficiency
for
Everyone



1983-84 DAIRY REPORT

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Nebraska's Top Dairy Producers Answer "What Does It Take for High

Don J. Kubik
Philip H. Cole¹

The mid-1980's may put dairy producers in a cost price squeeze. The most important elements which will insulate producers from extreme financial pressure are: (1) a reasonable debt load and repayment plan, (2) high per cow milk production levels, and (3) low production cost. High production per cow is the most important single indicator of profitable dairying.

Phil Cole, Extension Dairyman, and I recently visited and interviewed 12 of the top producers in the state and surveyed the rest of the top 1% of the producers and asked them to share ideas and techniques they felt important.

Change and Progress

Nebraska dairy producers have made many changes and much progress in the last 10 years. It has been a period of learning, intensifying, refining, and now sophistication of management practices.

All producers have some limitations whether it be experience, finances, facilities, cow sense, desire, labor, or availability of high quality feeds. The 12 producers we surveyed were no exception—all have overcome the limitations by their attitude to make things work in spite of difficulty and by getting the help they need.

The practices identified are important and obtainable.

We established a list and ranking of the most important manage-

ment practices as producers saw them. Most feel that all practices are important and any one practice may become most critical if left undone.

How to Be Successful

We asked the question, "In order for a dairyman to be successful today he must . . ." They responded:

—Be motivated by the desire to excel, use top management practices, and use credit efficiently.

—Enjoy dairying. First and foremost be committed to cows and be willing to spend time and money for their benefit.

—Enjoy milking, feeding, and breeding, and have the understanding and patience to coordinate everything to make dairying work and pay.

—Lovingly take care of cows to produce a high quality product as efficiently as possible.

—Have a cooperative family, rich, or cooperative banker, and know when and where to seek help—such as from a veterinarian, extension nutritionist, or other dairymen.

—Have some dairy background, especially if just starting; knowledge of what it takes to live with cows and what things in life will have to be sacrificed.

—Have good workers who are enthused about dairy cattle and are always striving to do their best. Must always look for ways to improve, and pay attention to *ALL* the little things.

—Be a "bug" on constantly

checking cows and all other items.

—Be able to stand financial pressure, and hard work with unpredictable hours. Must have leadership. Must be willing to learn and listen.

—Have the right attitude. There is no way a dairyman can be successful today without the attitude to be successful.

—Be willing to work long, hard hours and must have an understanding spouse. Must develop a breeding program that produces cows with the highest records possible, breed back at regular intervals, and stay in the herd for many lactations. Must be able to raise the calves as this is the future herd.

—Be willing to recognize, plan and implement the changes needed in the operation to make it a success. Must make the best use of each person's ability (not everyone is best suited to do the milking, etc.)

Most Important Single Practice

When we asked producers to identify single practices they would rank most important, the following were identified at least once:

1. Quality feed.
2. Attitude.
3. Genetically superior cows.
4. Herd health including mastitis and reproduction.
5. Milking equipment.
6. Facilities.
7. Feed storage, testing and balancing.
8. Cow comfort.
9. Milking practices.
10. Sanitation.

Question: Production?"

11. Hard work and management.

Interpretation of their responses to questions on the most important areas of concern, and credit for success indicated these were important:

1. Calf crop.
2. Feed quality.
3. Breeding, including reproductive health.
4. Feeding—balance, storage and allocation.
5. Herd health, including mastitis.
6. Records and business.
7. Facilities.

Five General Areas

We grouped responses and our reactions into five general areas and then ranked them based on total responses.

1. Feed Quality. All producers insisted on top feed quality for their cows. This included selection, time of harvest, storage, analysis, bal-

ancing rations, multiple feedings, split groups, and a special dry cow program including getting adequate energy into their dry cows. Forages were primarily alfalfa hay and corn silage. Storage ranged from dirt silos to oxygen limiting structures with inside feeding, and everything in between. Grain rations were simple. Grain feeding techniques ranged from all in the parlor to none in the parlor, grain forage, mixed rations plus parlor feeding, to mechanical outside grain feeders. Many herds were using two groups of cows plus a dry group to help get enough grain into their cows. Two producers used wet brewers grains to supplement forages.

2. Breeding Program. High PD, A.I. bulls have been consistently used in breeding programs. Each year even higher PD bulls have been used. Most herds are using bulls over 1,500 lb. milk. Because of the superior breeding program few cows are culled for low production. With a super calf program producers have the availability of 90-95% of their heifer calf crop. When you couple this with a herd health program, all heifers are potentially as good as or better than the cows. Because of this, producers are able to cull problem cows and not negatively affect the herd production level.

3. Herd Health. Mastitis and reproductive herd health are major areas of concern. Calf health, foot trimming, and routine vaccination programs are also important in the total management program.

Reproductive herd health is the

major concern. Most herds are on regular reproductive health programs but producers still are not satisfied even though they are doing an excellent job.

Mastitis levels are low and the S.C.C. on the herds bear this out.

Calf mortality is low with live healthy calves running well over 95% of potential.

Routine vaccination, hoof trimming and excellent dry cow feeding programs minimize other health related problems.

4. Facilities. Cow comfort is important to these producers, as is milking equipment and maintenance. Housing, including veterinary working areas, was considered important. Housing ranged from manure pack and dirt yards with only concrete feeding areas to total confinement and liquid manure handling.

All producers have placed a high priority on calf raising and housing. All producers were raising 95-100% of their calves and were concerned that they be raised disease free. Calf hutches were the most commonly used although a few producers used modified cold buildings. Two producers used warm environmental units.

5. Management. This area, covering all points already mentioned, also includes some others. The first is education, either formal schooling, or experience, or a combination of the two. The majority of producers took advantage of consultant help in the business and tax area, feed formulation, building and equipment, etc. All producers make time to think, plan, and analyze their business.

Most identified "attitude" as critical to success and many producers identified the moral support, tolerance and encouragement from their families as very important.

Establishment and constant use of excellent record systems were mentioned by all producers.

Love of cows and the business, and proper sanitation in all areas of the operation were also identified as important.

Surveyed Dairies in Top 1% of Nebraska Herds

The 12 dairies surveyed are in the top 1% of the state's dairy herds in milk production, but aren't necessarily the top 12 herds.

Production of the 12 herds averaged about 17,800 pounds milk and 660 pounds butterfat in 1982, compared with the statewide average of about 13,200 pounds milk and 400 pounds butterfat. The 12 dairies:

- | | |
|-------------------------------|-----------------------------------|
| —Gene George, Aurora | —Rousey Dairy, North Platte |
| —Kaup's Elkhorn Dairy, Stuart | —Richard Schnuelle, Jansen |
| —Murms Dairy, Glenvil | —Stelling Farms, Inc., Bloomfield |
| —Pfeiffer Dairy, Arlington | —Vi-View Farms, Inc., Hooper |
| —Ri-Lin Farm, Newport | —Volk Farms Inc., Battle Creek |
| —Carl O. Rood, Wahoo | —John A. Wallman, Diller |

¹Don J. Kubik and Philip H. Cole, Extension Dairymen.

On 12 of Nebraska's Top Dairy Farms A New Generation Is Emerging

Don J. Kubik¹

A new generation of dairy producers has been emerging in Nebraska. This was apparent when Extension Dairyman Phil Cole and I visited 12 of the state's top producing herds this summer to determine why these dairies were the highest producing in the state.

The visits were similar to ones we made 10 years ago to the top 10 state herds. The most apparent difference on the dairy farms this year from the ones a decade ago was that a younger generation has assumed part (and in some cases all) of the management and ownership.

Age Down

Ten years ago, the average age of the managers was in the 50's, and there were few young people involved in the dairies.

In contrast, this year the average age of those managing—or moving into management or ownership—was 32. The enterprises all are family dairies involving one to five brothers and their families. With one exception, the parents are still involved to varying degrees in the management decision.

Although none of the 12 dairy enterprises operates exactly the same, we did discover some common management threads which contribute to the success of the dairy operations. These 12 dairy producers don't rank important management practices in the same order, but do agree that many are critical to their success and their

relative importance changes from time to time.

These dairymen are a well-informed blend of an old and new generation. They include husbands and wives, fathers and sons, daughters, inlaws, and hired employees. Those who have college degrees work alongside those who have obtained their expertise through experience.

There appears to be a hard-working, energetic, competitive, and enthusiastic element in the younger generation influenced by a wise, conservative, and secure group in the older generation. A number of family members are involved in each of the operations. Responsibilities are well divided, but only one person is in charge of the total dairy enterprise.

Most parents of this new generation are still involved in management to some degree, but most have relinquished major management decisions to the new generation. However, the younger generation recognizes and uses the wisdom and experience of the older generation. In many cases, the new generation has the security of moving into financially sound, well-established operations with a history of good breeding and management.

Records Important

The business organization on these dairies varies from a simple purchase agreement to family partnerships and farm corporations. Herd control comes from de-

tailed record systems, starting with Dairy Herd Improvement Association (DHIA) records and supplemented with excellent herd-health and financial records. These records are used for decision-making, income tax planning and for credit purposes. The importance placed on the business side of these operations is apparent in the many ways records are used to increase efficiency.

The herds vary from relatively new to third generation. Average number of cows is 100. Herds range in size from 50 to 150 cows. Facilities range from modest to very modern.

Although these dairies already are in the top 1% of dairy herds (average production/cow) in the state, each expressed a desire to improve. Most have a short-term goal of a herd average of 20,000 pounds or more of milk per cow per year.

Despite the number of people involved on most of the dairy farms, we saw evidence of good communications, definite job responsibilities, mutual respect, and common high standards and pride.

Dairying today requires high management skills and high capitalization. The means by which these producers are transferring ownership of these dairies can serve as a guide to others wishing to do the same.

¹Don J. Kubik is Extension Dairyman, Northeast Station, Concord.

Compare Your Operation With The Top Twelve

Don J. Kubik¹

Top producers use their DHI records for more than individual cow comparisons. The DHI program offers many useful manage-

Table 4. Average range and variation of summit milk pounds for first, other and all lactations.

	First lactation	All other lactations	All cow average
Average, lb	57	78	71
Range, lb	51-66	73-89	63-84
Variation, lb	15	16	21

ment figures which give every dairy producer the opportunity to identify problem areas and measure herd progress.

This article presents figures from 12 of the top producing Nebraska dairy herds to show management statistics and offer them for comparison. These top 12 producers watch their progress closely using these data and are interested in how they compare to other top herds.

Table 1 shows how these top herds compare to the average state DHI herd and the amount of difference in some areas. The state DHI average used for comparison is considerably higher than that of the all-state herd average.

Income Over Feed Cost

These 12 top-producing herds are larger than the state average

and show significantly larger income above feed cost per cow than the average state herd. Income over feed cost is one of the most important economic indicators of profitability.

Feed costs vary on the basis of the source, i.e., homegrown *vs* commercial and simple *vs* very complex. Rations in these herds tended to be simple. The feed cost figures reported represent geographic difference as well as the values put on feeds by producers. These values range from actual production costs to local market values. These figures also reflect the ability to weigh or not to weigh the actual feed disappearance on the farm. These figures vary greatly and should be viewed accordingly. Table 2 shows this variation.

The 12 producers were intent on bringing the highest potential producing, healthy heifers into their herds. Table 3 shows how this emphasis for high PD sires has continued to increase over the last few years. Each age group of females on these dairies shows an increase in the +milk PD of the sires selected and used. Unfortunately, Nebraska dairy producers as a whole have been using lower PD bulls on the average than most other states. Using high PD sires is the most efficient and quickest way to improve production in a herd.

Herd Health Programs

Table 3 excludes one herd using natural service and one herd not reporting sire PD data. The 10 herds reported identify 82% of the sires and 96% of the dams for evaluation.

Not only do these herd managers use high PD bulls but they also employ herd health programs which insure healthy lungs, stomachs, intestines and udders in their replacements as they freshen.

(continued on next page)

Table 3. Average PD pounds milk of sires used by age group of females on farms.

Lactation #4	+ 570
Lactation #3	+ 850
Lactation #2	+ 965
Lactation #1	+ 987
Over > 12 mo.	+ 1,167
7-12 mo.	+ 1,418
Below 6 mo.	+ 1,609

Table 1. State DHI herd averages compared to 12 top DHI herds.

	State	Top DHI Herds	Difference
No. cows	68	98	+ 30
Milk/cow/year, lb	13206	17658	+ 4452
Butterfat, lb	487	650	+ 163
Value of product	\$1691	\$2253	\$ + 562
Feed cost	\$687	\$849	\$ + 162
Income above feed cost	\$1004	\$1405	\$ + 401

Table 2. Average range and variation of feed costs, value of product, and income over feed cost.

	Feed cost	Milk value	Income over feed cost
Average	\$849	\$2253	\$1405
Range	\$570-1229	\$2097-2392	\$1163-1769
Variation	\$659	\$295	\$606

Compare Your Operation

(continued from page 5)

These producers average raising over 95% of their heifer crop.

Good feeding practices, herd health programs, and sound management are reflected in summit milk figures. Summit milk figures represent the peak milk production of the cows in a herd. Table 4 presents the peak production on these 12 top producing herds in Nebraska.

First calf heifers comprise 35% of the milking cows in these herds.

Although Nebraska DHI dairy producers have been slow to use DHI reproductive information to its potential, these top producers use it regularly for problem identification and evaluation of their herd's progress. All of these herds are on some type of reproduction herd health program. Table 5 shows some of the useful breeding efficiency figures on these top 12 herds.

Culling and S.C.C.

There are two other important management figures which reflect producer efficiency. The first is the percent of animals leaving the herd for culling purposes. In these herds this figure is lower than you would expect (25% for 1982-83). This is abnormally low, as is the present state and national figure. A figure

Table 5. Breeding efficiency figures on 12 of the top producing herds in Nebraska.

	12-herd average
Freshening interval	399 days
Length of lactation	336 days
Length of dry period	64 days
Average days open	123 days
Reproductive efficiency	91
Milk per day for every day of life since first calving	41.4 lb.

of 30-35% is not uncommon.

The other important figure is the average somatic cell count (S.C.C.), the primary indicator of mastitis level in a herd. In these top 12 herds the average was 230,000 and ranged from 120,000 to 295,000. Low S.C.C. means lower drug and veterinary costs, higher production per cow, more salable milk and more valuable milk as it yields a better product. Mastitis control was a part of all of these producer's management programs.

As you look over the characteristics of these high producing herds you find that they excel in all categories. To develop and maintain a top producing herd requires paying attention to details in all areas.

Table 6 offers dairy producers the opportunity to compare figures with some of the top producing Nebraska dairy herds.

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Table 6. Average from 12 top producing herds for your comparison.

	12 of the top herds	Your figures
Cows/herd	98	
% Cows in milk	87%	
Rolling herd average (actual) milk pounds	17,658	
% Fat	3.69%	
Fat pounds	650	
Value of product	\$2,253	
Feed cost	\$849	
Income over feed	\$1,405	
S.C.C. (average)	230,000	
Average peak, 1st calf heifers, lb.	57	
Average peak, other cows, lb.	78	
Average peak, all cows, lb.	71	
Freshening interval, day	399 days	
Length of lactation, day	366 days	
Length of dry period, day	64 days	
Average days open	123 days	
Reproductive efficiency	91	
Milk/cow/day since fresh, lb.	41.4	
Culled, %	25%	

Abnormal Chromosomes Affect Fertility

Franklin Eldridge
J. L. Farver Koenig¹

The level of fertility in cattle is influenced by many factors. Dairy-men are familiar with the need for adequate estrus detection, proper insemination techniques, disease prevention, use of semen from high fertility bulls, and the importance of many other good management procedures.

Even with the greatest attention given to all the factors known to affect fertility, dairymen still are far from getting a calf from each in-

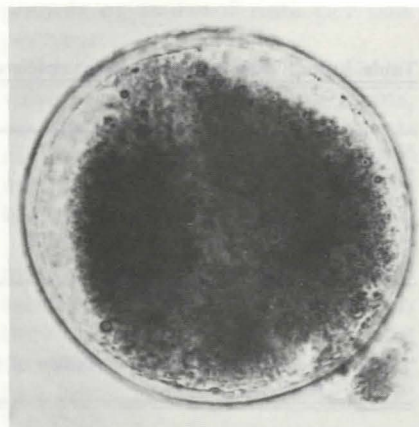


Figure 1. A bovine oocyte after culturing. A special harvesting procedure is necessary for observation of the chromosomes inside the oocyte.

semination. To understand the complex reproductive process, it is necessary to sub-divide it into its component parts, identify each factor and determine its effect upon the whole problem of infertility.

Abnormalities

One area of reproduction that has not received much attention is the possible effect of chromosomal abnormalities on fertility. It has been found that when a highly fertile bull was used for breeding nearly 100% of the ova were fertilized, based upon observations three days after breeding. Therefore, the lack of fertilization of the ova is not the primary cause of embryos loss.

In humans about 8% of all pregnancies are lost in the first three months due to chromosomal abnormalities. It is possible that some of the fertilized ova in cattle also may be lost for that reason. One way to investigate the possibility that ova with chromosomal abnormalities are causing very early embryo losses would be to look at the chromosomes of the fertilized ova, the blastocysts. This has been done in a very limited number of cases, but the cost of recovering fertilized ova is quite high. In addition, pregnancies ended by ova recovery increase the calving interval which results in lowered average milk production. Another problem with blastocyst studies is that, typically, blastocysts have been recovered about 8-11 days after breeding, but it is possible that the blastocysts with abnormal chromosomes may have died before that time.

Therefore, we have gone back one step further in the reproductive process and observed the chromosomes in the oocytes of breeding age heifers. Oocytes, the immature egg cells, develop in the follicles of the ovaries, and are called ova when they are mature and are released at the time the cow is in heat. The chromosomes in these oocytes can be examined after incubating them for 24 hours in an artificial culture medium. For our study, ovaries were obtained from 32 freshly killed beef heifers. From these animals 225 oocytes were found in which the chromosomes could be

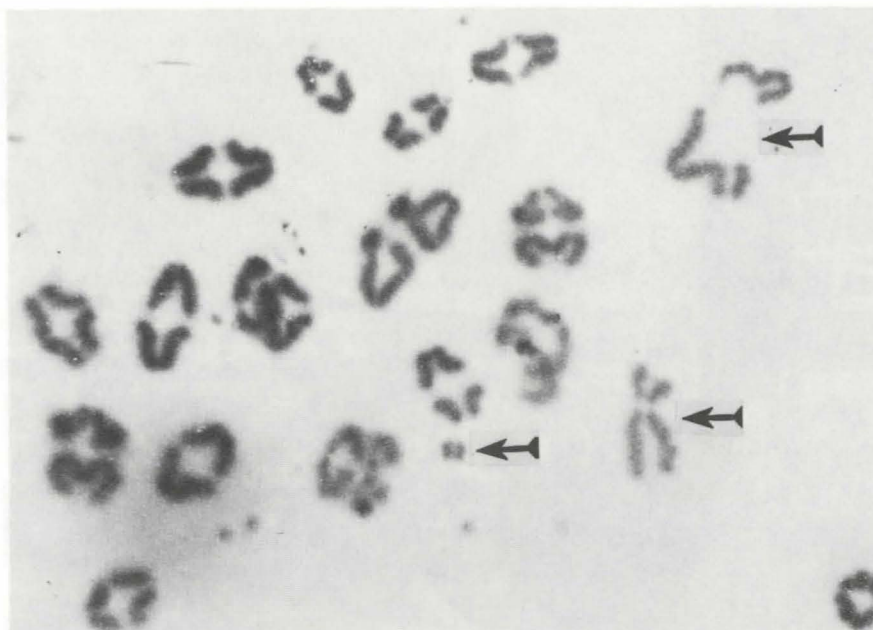


Figure 2. Chromosomes from one bovine oocyte undergoing maturation (first meiotic division). In this oocyte the arrows identify a chromosomal break, a chromosomal fragment, and one unexplained but abnormally shaped chromosome, all of which are abnormal.

clearly observed and counted. Out of these, 173 were normal and 52 or 23.1% were abnormal. Abnormal oocytes were those which had one or more extra chromosomes, or which contained abnormally shaped chromosomes, or both.

Some oocytes had less than the normal number of chromosomes, which may have been due to either an abnormal cell division, or loss of a chromosome during the preparation of the slide. From these data it was calculated that about 27 more oocytes had less than the expected number of chromosomes, making a total of 35.2% abnormal. The actual percentage of oocytes with abnormal chromosomes probably lies somewhere between 23.1% and 35.2%. However, both estimates were larger than anticipated.

It is possible that some of the chromosomal abnormalities discovered in this study have resulted from the use of feed additives or some other treatment of the animals since they were feedlot beef heifers and their background was unknown. However, a report from Russian research indicated similar results. The loss of embryos after breeding is known to be about 40%, so the percentage of oocytes with abnormal chromosomes could ac-

count for some of the embryo loss and still be well within the 40 percent.

Implications

Seven animals examined in this study had no oocytes with chromosomal abnormalities. Thus, it is possible that the frequency of occurrence of abnormal oocytes differs among animals and may be subject to some genetic control.

A similar study is now being done with swine where environmental treatment and genetic background of the animals is known. If this also results in similar findings the study may be repeated with dairy cattle, with known histories of feeding and pedigree information.

If these results are confirmed, and hereditary differences are established, then selection could be practiced against cattle with larger numbers of chromosomally abnormal oocytes. However, the unexpectedly high frequency of occurrence of oocytes with abnormal chromosomes may indicate that some chromosomal abnormalities cannot be avoided, and some embryo loss is inevitable.

¹Franklin Eldridge is Professor-Dairy Production. J. L. Farver Koenig is Research technician.



The heifer calves are the milking cows of the future. If sired by the best bulls available they should be better than the current herd.

Sire Selection for Profits

Franklin Eldridge

The genetic potential for production in dairy cattle in the United States continues to improve. For example, the average predicted difference for milk (PDM) for all active A.I. bulls increased 173 pounds in one year from +1,191 lb of milk in the summer of 1982 to +1,364 lb in the summer of 1983.

PDM is a prediction of the average increase in production of pounds of milk of future daughters of a bull compared to the average of cows in 1974. It is calculated from the milk production of the bull's daughters compared with their herdmates. When a large number of daughters have been tested, so the repeatability (R) is high, the prediction is very accurate. Similar predicted differences are made for butterfat percentage, pounds of butterfat

and type scores. PD\$ is determined by using both PDM and PDF and current milk prices. The top sire on the USDA-DHIA summary last year had a PDM of +2,717 lb of milk and a PD \$+312. This year it is +2,932 and +354. This means that every year a dairyman must use bulls with higher PD's just to stay up with the average.

A.I. Sires Productive

A comparison between the production of daughters of the active A.I. sires and contemporary non-A.I. sires once again showed a distinct advantage for the A.I. sires. On the basis of PDM the comparison was +1,364 vs. +389, or on PD\$ +166 vs +44. Obviously, the bulls selected by dairymen for natural service, the non-A.I. bulls, are on the average much less desirable. Furthermore, a dairyman does not need to use the average A.I. sires,

but can select from above average bulls. When semen from many of the top PD\$ bulls can be purchased for \$25 or less per breeding unit it is difficult to justify risking extensive use of an unproven natural service bull.

Several years ago a survey of Nebraska dairymen showed that about 50% of all the dairy cows and heifers were being bred to A.I. dairy bulls. Among dairymen in DHIA that figure is nearer 60%, or perhaps a little higher, so probably only 40%-50% of the cows and heifers in non-DHIA herds are being bred artificially. If average A.I. sires were used in place of natural service bulls, the dairymen of Nebraska now using natural service bulls could expect the daughters to produce on the average 1,000 lb more milk per lactation than the daughters of natural service bulls. This is about a 10% increase. Furthermore, half of the increased genetic potential of these daughters will be transmitted to the next generation. Feeding and management would need to be changed to profit from this increased production potential.

Nebraska Ranks Low

Another recent study shows that Nebraska ranked 3rd from the bottom of all states in the average PDM of A.I. sires selected. Data from this study were from first lactation heifers in 1981, and therefore resulted from breeding in 1978-79. If we calculate our status in 1983, based on that study we can estimate that the A.I. sires used today in Nebraska are at about the +1,600 PDM level. It would not be difficult to select A.I. sires today, which would average +1,800 to +2,000 PDM. The use of these bulls would result in about a 3% increase in production of daughters for those dairymen already using A.I., and who have already obtained the 10+ increase expected from using average A.I. sires instead of natural service. These higher producing cows would require more feed, so the increase is not all net profit, but higher producing cows are generally more profitable.

Bull studs generally select young sires for A.I. very rigorously for A.I. on the basis of PD information

in their pedigrees. It would be difficult for a dairyman to find young sires of equal potential and they would probably cost more than he could justify. One study showed that young A.I. sires had daughters whose average PDM was about 370 lb below the average PDM of contemporary summarized sires. Applying this information to the summer 1983 data, A.I. sires should have an average PDM of +1,364 minus 370 or +994. Compared to the average PDM of non-A.I. sires of +389, the young sires would average about 605 lb more. When a cow comes in heat again after being bred twice with semen from a highly selected A.I. sire at a cost of \$25 per unit (or put in your own cost figures) it is expensive to continue to breed her with similar cost semen. This is a good time to use semen from the young A.I. bulls, which is less expensive and frequently more fertile. Using several such bulls so that not too many daughters are obtained from any one bull will help the averages work for you. Nearly all bull studs have programs for proving young bulls in which the semen is provided without costs, or less than \$5 per breeding unit.

If calf mortality is kept low a dairyman should be breeding about 40 heifers each year for every 100 milking cows in the herd. If top quality A.I. sires were used in previous years these young heifers should have the greatest genetic potential of any animals in the herd. "Calving ease" information is available on many bulls, so high PD\$ bulls with above average calving ease can be used on the heifers. Breeding heifers artificially does take a little more time and appropriate facilities for handling these heifers are necessary but these good heifers could be mated to top bulls.

Production Could Increase

Nebraska dairymen produced over 1.36 billion pounds of milk in 1982. If average A.I. sires were to replace the natural service sires in use today, and if the selection of A.I. sires were to improve as suggested previously then these dairymen would produce 40.8 million

pounds more milk than if the current level of sire selection is continued. At \$12 per hundred that is \$4,896,000 additional gross income. Or, if the milk surpluses continue, then the same amount of milk could be produced from 3,660 fewer cows, and each dairyman could be reducing his feed bill, and selling a few more cull cows.

Most dairymen are also interested in type, especially those type characteristics which can be called functional, such as udder support, teat placement, and feet and legs. To the commercial dairyman these type characteristics have a utility value in longevity and freedom from problems. To the purebred breeder they are vital to a progressive program of breeding and can be supplemented with some of the less functional, but marketable traits such as strong top lines, nearly level rumps, etc. With the choices available in A.I. these type traits can also be considered and combined with high production. It must be recognized that each trait added to a selection plan reduces the rate of progress toward production alone. However, there are sires with excellent combinations of type and production.

Computer Programs

Finally, there are computer programs, such as MAXBULL that can help in making sire choices. These programs combine production and type traits with semen cost with levels and priorities set by a dairyman to meet his own goals.

Improving a dairy herd through breeding is like a capital investment. The "good" genes bought today may stay in your herd for generations. The most efficient and economical way to buy those good genes is through A.I. where reliable information has already been assembled on dairy and all bulls, including the best bulls available through A.I. in the United States.

¹Franklin Eldridge is Professor-Dairy Production.

Dairy Research At Mead

Dennis Crawley¹

The University of Nebraska Dairy Research unit is located three miles south of Mead. The main purpose of its existence is for research work. It has limited use as a teaching facility.

A major portion of operation funding comes directly from the income in milk sales and sale of surplus cattle. Research projects are supported by research accounts and grants.

The research herd consists of about 120 milking age Holstein cows and 130 heifers and calves. Seventy percent of the cattle are registered. The October 31, DHIA Rolling Herd Average was 15,933 milk and 593 fat with 3.72 percent butterfat. All heifers are kept and raised as herd replacements. Every animal on the farm is available for research.

Cows are milked in a double-three herringbone type parlor. Milk weights are important in the research projects so milk weights are recorded from the weigh jars on each cow daily. Some of the equipment in the milking facility is old and outdated and should be replaced as funding becomes available. One major improvement made last year was a new milk tank and heat recovery system. Cows are milked at 12:30 AM and PM each day.

Nutrition Barn

A major portion of the nutritional research is done in the Nutrition barn, a 40-cow, tie-stall barn. The cows on trial in the Nutrition barn leave the barn for only a few hours daily while they are milked

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Research at Mead

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and checked for heat. The cows are fed individually with their intake of feed being weighed daily. It is important that the weighing of feed is accurate as well as efficient and labor saving. The feed is mixed and weighed in a battery-operated feed cart that has an electronic scale. Cows are fed a corn silage and alfalfa haylage forage mixture. The grain is either fed separately or with the forage as a complete ration, depending on the research trial. Some research done in the Nutrition barn during the past year included: palatability and effect of volatile fatty acids; blood meal and corn gluten meal as bypass proteins; different treatments of soybeans as a protein source; *B. subtilis* as a feed additive and Beta Carotene as a feed additive.

Those milking cows not on experiment in the Nutrition barn are housed in a freestall and lot system. One freestall barn and concrete lot can be separated into several sections so that cows may be fed different rations. This system is also equipped with a computer feeding system which allows the feeding of different rations and amounts of grain without confining the cows in the Nutrition barn. The computer system is being used now in an experiment in which the cows are fed low, medium, and high levels of grain during the late part of their lactation. The computer also aids in herd management. Since the cows were switched from a complete ration to the computer system grain usage has been reduced by 30-35 percent. Milk production has decreased slightly and the cows have stayed in better working condition. It also allows close monitoring of feed intake that is not available with complete rations. Off feed problems can be seen immediately on individual cows and these problems diagnosed before a great loss in milk production occurs.

The other freestall system features two large dirt mounds in the lot area. This type of a lot is especially helpful in reducing stress on feet and legs that is usually associated with cows spending much

of their time on concrete. There are no computer feeders in this lot so the cows are fed a complete balanced ration of corn silage, alfalfa haylage and grain. This lot is always used for very early lactation and high producing individuals.

Calves are taken away from their dams within 24 hours after birth and moved to individual hutches. Colostrum from the dam is fed as soon as possible after birth. Calves are fed whole milk, 10 percent of their body weight at birth, once daily and are weaned at 21 days of age. Water and starter rations are given to the calf as soon as the calves are moved into the hutches. After weaning the calves stay in their hutches until they are about 60 days old, at which time they are moved to group pens. Each group pen has 8 to 10 calves. These calves have good quality hay available and are fed starter ration at the rate of four pounds per head. Calves are moved from the group pens to pasture at about six months of age.

Employees Dedicated

The Research Farm employees are three full-time milkers, three feeders, and a relief person who fills in for the others when they are on vacation or ill. They are concerned with the health and well-being of the cows, heifers, and calves. Besides normal dairy farm jobs, they have the responsibility for collecting research data. On most trials they have to weigh each cow's feed and measure what she doesn't eat at the end of the day. This is very labor consuming but is necessary for the accuracy of the research.

The number one goal of the University of Nebraska Dairy Research Farm is to serve the dairy farmers in Nebraska by doing research that will help them better understand different feeding and management practices. The support of Nebraska dairymen has always been appreciated. We encourage each dairyman in the State to stop by and take a closer look at what we are doing.

¹Dennis Crowley is Dairy Unit Manager, Mead Field Lab.

Genetically Superior Replacements

P. H. Cole¹

What kind of cows will you be milking three, four, or five years from now? Their milking ability and profitability will be determined by the sires you select today. Herd progress results from three sources:

- The quality of replacement females that enter the herd each year.
- Improvement due to culling below-average milking females.
- Improvement in the present milking females in the herd.

In the mid-states area, first calf heifers make up slightly more than one-third of all milking animals. Quality herd replacements begin with the genetic ability of the calves. The best feeding and management program will not increase production beyond the inherited (genetic) potential of a calf. Choosing the right bull is the first step in a successful replacement program.

All dairymen have the opportunity to buy semen from sires whose transmitting abilities have been carefully evaluated.

USDA-DHIA Sire Summaries estimate the transmitting ability of bulls. Using bulls ranked high for (PD\$) increases the "odds" of obtaining genetically superior offspring. Using semen from a bull



Proper housing and management play an important role in raising healthy herd replacements.

with a PD of +2,000 pounds for milk will not guarantee that all heifers will be better than cows now in your herd, but on the average, 8 of 10 heifers from that sire will be better. Similarly, 8 of 10 heifers sired by a bull with a PD of -2,000 pounds will have less producing ability.

Bull studs continually add young sires to maintain a future supply of proven sires. Although the transmitting ability of these young sires has not been completely evaluated, they are carefully selected sons of proven bulls with high predicted differences and from highly selected cows. The chance of getting a good heifer from a young sire or

from any unproven bull increases if he is the son of a bull ranked high on the Sire Summary.

A North Carolina geneticist found that a bull with a PD of +1,467 lb sired 72 sons with an average PD of +637 lb. A bull with a PD of -1,872 lb. sired 59 sons with an average PD of -981 lb.

In herds where natural service is used it is desirable to use sires which are the sons of high PD bulls if you expect to improve the genetic ability of your herds.

Generally, the cost of purchasing and maintaining a bull for natural service is greater than the cost of semen available from A.I. organizations. When only one unproven

young sire is used, there is a higher risk because he might turn out to be below average and all heifers would be from this poor bull. If several unproven bulls are used the risk can be reduced. For these reasons, those relying on natural service usually make less genetic progress than those who use several top A.I. sires.

Unless replacement calves are the progeny of parents with good genetic ability, you may be forced to select the "least worst" calves among a crop of poor calves, a strategy that almost guarantees no improvement in genetic ability of the herd unless you *keep the best and cull the rest*.

The essentials for genetic progress are:

1. A good breeding program
 - Use sires ranked on the Sire Summary list on 70-80% of the herd.
 - A group of young sires with a high pedigree index may be used on 20-30% of the cows and heifers in the herd.
 - If you use natural service, select a son of a high PD sire, and out of a cow with a high index.
2. A good selection program
 - Keep complete production, feeding, reproduction, and health records on each cow. Dairy Herd Improvement Association (DHIA) records are recommended.
 - Keep complete records on each calf, including the identity of sire and dam.
 - Raise all heifers possible, including daughters of first-calf heifers bred to good dairy bulls.

Number of Replacement Heifers Needed

The annual culling or replacement rate in a good milking herd is about 30%. This means that 15 good 2-year-olds are needed each year in a 50-cow herd. In an average 50-cow herd, at least 20 heifer calves would be required annually to provide 15 fresh 2-year-olds. About 25% of the heifer calves born are lost from birth to freshening. Death from birth to six weeks of age is 15-20%; another 5% are lost due to accidents or gross abnormal type traits; and about 5% are non-

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Table 1. Heifer calves needed for one replacement heifer with varying mortality and culling rate.

Heifer calf mortality rate, %	Heifer culling rate, %				
	4	6	8	10	12
5	1.10	1.12	1.15	1.17	1.20
10	1.16	1.19	1.21	1.24	1.27
15	1.23	1.26	1.28	1.31	1.34
20	1.30	1.33	1.36	1.39	1.43
25	1.39	1.42	1.45	1.49	1.52

For example, with a 15% calf mortality rate and a 12% culling rate, 1.34 calves must be started to provide one 24-month-old replacement heifer.

Table 2. Degree of artificial insemination and effect on milk production.

Amount of A.I.	Milk production (lb/year)	Increase in milk production above herds using all natural service (lb/year)
All natural service	13,973	----
All cows artificially inseminated	15,255	1,282
All cows and heifers artificially inseminated	16,080	2,107

Superior Replacements

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breeders (Table 1).

In a 50-cow herd, breeding 2-year-olds to high PD\$ dairy bulls instead of a beef bull lets you cull five additional poor cows or undesirable heifers each year. Such selection makes a substantial difference in the rate of genetic progress. Good heifers not needed in the herd can be sold for two or three times more than dairy calves from beef bulls.

Table 2 shows the increased milk production possible when both cows and heifers are bred to good A.I. sires. Clearly, the 825 lb increase in milk production indicates the benefits of breeding heifers as well as cows to A.I. sires.

For maximum genetic improvement, calves from 2-year-olds cannot be "sacrificed." This will occur if heifers are bred to beef bulls or poor dairy bulls. The genetic potential of a heifer's first calf is the same as that of her later calves. Since a good breeding program will continually increase genetic potential, daughters of heifers should have more genetic ability than daughters of older cows.

Benefits of Heifer A.I.

Maximum Genetic Improvement. The sires you use account for the greatest share of your herd's genetic improvement. After raising three generations of daughters from superior A.I. sires, seven-eighths of your herd's genetic makeup comes from the sires.

More Replacement Heifers. In an "average year", between one-fourth to one-third of the calves born in your herd will be from first-calf heifers, and therefore one-fourth to one-third of your replacement heifers will be the first calf from their dams.

If you have superior replacements coming into the herd as a result of heifer A.I., you'll have an opportunity to cull your low producers and improve your herd production average. You'll also be able to sell any excess A.I. -sired heifers at a better price.

Better Breeding Records. Using A.I. on your heifers allows you to pre-

dict their calving dates more accurately. Instead of guessing when a heifer will freshen, you'll have a written record of it and you'll be able to plan properly for it.

Control Disease. Sires from established A.I. studs offer semen free from infectious diseases.

Purchasing herd replacements, or bulls, poses a disease threat to your herd's health. Having your own home-grown replacements through heifer A.I., eliminates this possibility.

No Bull Expense. Aside from the direct expense of buying a sire for your heifers, many of the costs involved in keeping a bull on the farm are hidden. They include your expenses in raising or buying a bull and in maintaining separate facilities for housing and handling.

More Control of Breeding Program. A.I. gives you control of your replacement breeding program in several key ways. First, you decide when your heifers are the right size and the right age to breed. Second, you know which animals are bred and which are open. Knowing these variables can help you reduce the number of nonproducing animals in your herd. And third, you can select sires to meet the individual heifer's requirements.

Added Safety. On the farm, bulls

can be very dangerous, unpredictable animals. They have the potential to kill or maim family members or employees. Through the use of A.I., however, you eliminate this danger.

Concerns and Solutions

Catching Heifers in Heat. Make checking your heifers for heat as easy as possible and you'll find it will be less time consuming and more productive.

- Establish a regular daily routine for heat checking.

- Design facilities for catching and restraining heifers that are easy to get to and simple to use.

- Have heifers located close to your main buildings so you can observe them easily without disrupting your daily schedule.

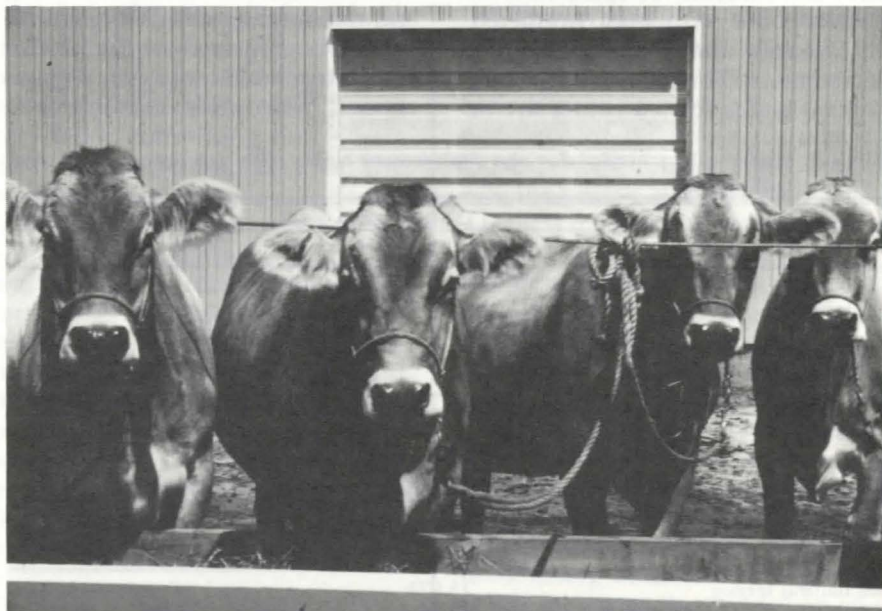
Estrous Synchronization. Planned breeding through estrous synchronization of dairy heifers gives you the option of using A.I. on your heifers at a predetermined date. Besides this advantage, estrous synchronization also offers the following benefits:

- Permits insemination at convenience of dairyman.

- Shortens the A.I. period.

- Reduces or eliminates heat detection.

- Simplifies the scheduling of



Proper nutrition will help insure that your heifers will be the right size when they reach breeding age.

labor.

- Improves management by knowing calving due dates.

- Allows closer control of calving time.

Heifers Aren't Large Enough. If this is a problem, you should review your nutrition program. Proper nutrition will help assure you that heifers are the right size when they reach breeding age.

- Use a growth table and check your heifers' growth rates against it periodically to see if they are progressing normally. A weight tape or scale is a good aid.

- Check your rations from calf starter through breeding age to make sure you're meeting your animals' energy and protein requirements.

- Set up a health program with your veterinarian that includes routine vaccinations and checks for parasites and insects.

- Minimize competition among heifers by grouping them according to size and age and providing adequate feed manger space.

Calving Difficulties

Easier First Calving. Two primary factors affecting calving ease are size of the heifer and size of the calf she's carrying. The first step in minimizing calving problems is making sure heifers are in good condition and the right size for their age at breeding time.

The sire also plays a role in determining calf size. With natural mating, you'll usually be using an unproven bull and it's difficult to predict calf size until several calves are born. The National Association of Animal Breeders (NAAB) Calving Ease Summary can help you select A.I. bulls that have a history of siring smaller than average calves.

The NAAB compiles information on calving ease using data reported by dairymen. The ratings are calculated on a herdmate basis with adjustments for sex of calf, age of dam, season of the year and pedigree of the bull.

The NAAB published data lists three items on each bull:

- **Number of Direct Comparisons.** This is the number of births used to compare with calvings sired

by other bulls in the same year, herd and season. It tells how much data were used in determining the rankings. Less than 100 comparisons should be considered preliminary information.

- **Percent Probability That Calvings Will Be Easier Than Average.** This is the probability, in percent, that a bull's calves are easier calving than breed average. It is the degree of confidence that you can place on the "expected difficult" first births prediction.

- **Expected Percent Difficult First Births.** This predicts the percentage of a bull's calves that would arrive with extreme difficulty or require assistance to be born if the bull were bred randomly to yearling heifers in many herds. Breed average is nearly 14 percent. Numbers above 14 indicate more difficult births and below 14 indicates fewer difficult births.

How to Use The Data List. First, avoid using hard calving bulls on yearling heifers. You should probably not use bulls with 16 percent or more expected difficult first births on heifers or cows with a history of calving problems. Second, breed yearling heifers to a group of bulls. The probability of getting what you expect is much greater for a group of bulls than an individual, especially when data is limited. Third, if you insist on using a single calving ease bull, don't be surprised if he doesn't solve all your problems.

Summary

Heifer A.I. is an investment in your herd's genetic future that will pay off both economically and practically. Economically, it means more profits from increased production and longevity and from the sale of replacement animals with known genetics.

Practically, it means better breeding records, easier first calvings and more control in your young stock program.

If you follow a sound breeding program in your milking herd, your heifers should possess the best genetics on your farm.

¹P. H. Cole is Extension Dairyman.



Starter formulation is critically important for successful weaning of calves.

Molasses and Fat

Calf Starter Formulas

Foster G. Owen
Larry L. Larson¹

Nebraska has researched early weaning programs for dairy calves for a number of years. For early weaning to be successful it is important that starter rations be palatable as well as nutritious. Dustiness of the starter is thought to be detrimental to maximum consumption.

One ingredient used to help control dustiness is molasses. Surprisingly, research with molasses in starters has not given consistent results. In a few experiments benefits have been noted, but in others no effects were found. One possible reason for the variation in effectiveness might be because of the transient effect of molasses in maintaining the moist condition needed for controlling dust.

In recent years we have used 2% animal fat in our starters and have observed that this ingredient has long-term effectiveness in control of dust. Fat also offers the potential of improving calf-performance by boosting the energy content of starters. It is recognized, however, that above about 5% added fat in the ration of the mature ruminants

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Molasses and Fat

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can have a detrimental effect on ration utilization.

Fat, Molasses Evaluated

Because of the potential energy value and the dust-controlling effect of fat and because of the current wide use of molasses in calf starters, we evaluated these two ingredients both individually and in combination.

Twelve Holstein calves were assigned to each of the starters in Table 1. Calves were put on trial just after birth and fed milk until weaned at three weeks of age. Starter was always available. The effects found on starter consumption were surprising (Table 2). Neither fat nor molasses, when added alone, increased the consumption of starter compared to the control starter without either of these. In fact, the statistical analysis showed that adding molasses to the control starter reduced intake, whereas adding molasses to the starter containing fat improved starter intake. These effects were greatest during the three weeks just following weaning. In the first week after weaning calves ate an average of 42% more of the starter containing both fat and molasses than of the

starters containing either of these alone, and 29% more than those fed the control ration.

More Testing Needed

Calf growth was measured in terms of both body weight and height at withers. Growth was satisfactory on all treatments. The differences among treatments in weight gains and wither heights were too small to be important. However, the data indicated no benefits from including either fat or molasses in these starters. More extensive testing is needed to investigate the possible benefits of fat and molasses in combination.

Until more is learned about fat and molasses in calf starters we suggest including both, as in Ration 4 (Table 1). This is based on the higher level of intake of calves on this ration during the first week after weaning. Such an improvement in intake may help minimize problems of transition to dry feed for certain calves. However, since no long term benefits are known, calves could be shifted to lower cost rations as soon as they are eating as much as 2 lb daily.

¹Foster G. Owen is Extension Dairyman. Larry L. Larson is Associate Professor—Physiology.

Table 1. Starter formulas evaluated.

	Ration 1	Ration 2	Ration 3	Ration 4
	(lb/ton)			
Corn, rolled	593	381	540	328
Oats, rolled	500	500	500	500
Corn cobs, ground	300	300	300	300
Soybean meal, sol.	539	556	553	569
Min-Vit premix	20	20	20	20
Chlortet. sup	3	3	3	3
Limestone	24	18	23	18
Salt	10	10	10	10
Animal fat	---	---	40	40
Molasses	---	200	---	200

Table 2. Value of fat and molasses in calf starters.

	Ration 1 0% fat 0% molasses	Ration 2 0% fat 10% molasses	Ration 3 2% fat 0% molasses	Ration 4 2% fat 10% molasses
<i>Starter intake, lb/day</i>				
22-28 days	1.30	1.18	1.18	1.68
22-42 days	2.38	2.10	2.29	2.29
43-63 days	5.48	4.66	5.13	5.12
<i>Growth</i>				
Body wt, lb				
at 42 days	125	114	120	121
at 63 days	165	155	155	162
Wither height, cm				
at 42 days	79.1	79.0	79.5	79.8
at 63 days	83.2	82.8	82.0	82.8

Dairy Replacements

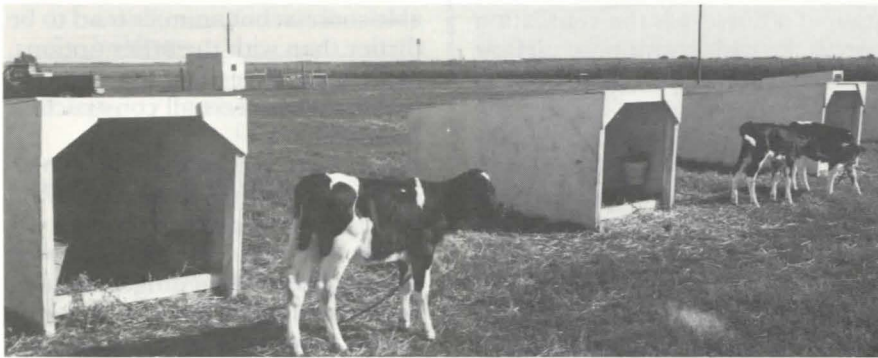
Your Neglected Asset

Gerald R. Bodman, P.E.¹

Easy access to semen from genetically superior bulls and artificial insemination have become commonplace expectations for today's dairymen. Recent improvements in the technique of embryo transplant have allowed marginally productive cows to give birth to calves with superior hereditary capabilities. The result: calves with substantially greater potential for improved high production compared to cows which were the standard of excellence on many dairy farms during the past 10 to 20 years.

Despite these advances, recent studies in two states have reaffirmed that little progress has been made in rearing healthy calves as dairy replacements. The results of these studies are disappointingly similar to results of studies conducted 10 to 12 years ago in four states—25% of our calves are either born dead or die before they are one year old! The death rate among dairy calves in Nebraska is believed to be at least equal to these values and is perhaps even higher.

The reasons calves die vary widely between farms. Despite these differences, close observation reveals many similarities between farms. The most striking is the lack of care most calves receive. Often they're "tucked away" in the corner of an old building long ago identified as unsuitable for mature animals. In other cases they're in open lots with little or no shelter. Lack of a dry resting area, poor ventilation, and belly-deep mud and manure during wet weather are common as are the results—small, poorly developed animals



Calf hutches are popular with many dairymen. Their chief advantages are modest cost and "built-in" disease control.

plagued with a variety of illnesses. Often feeding is done by children who are unable to recognize the early signs of illness. Only conscientious management inputs can overcome this deficiency.

The lack of care is not limited to calves. Heifers also suffer from neglect. The result is dairymen freshening 24-month-old Holstein heifers weighing 900 lb or less. A more appropriate weight is 1,000 to 1,100 lb or more. To compensate for poor growth, breeding is often delayed and heifers are older when they freshen. That's an expensive option in terms of feed, labor, facilities and milk production.

Where to Start

Good dairy replacement rearing begins with a good dry-cow program. The quality of care and nutrition during late lactation and the dry period directly affects the vigor and size of a calf. Although extremely large calves are not desirable due to increased calving difficulties, a healthy and vigorous calf is essential. At birth, a calf has little or no natural immunity and is as susceptible to infection and disease as you were when you were born. Colostrum is necessary to provide early protection.

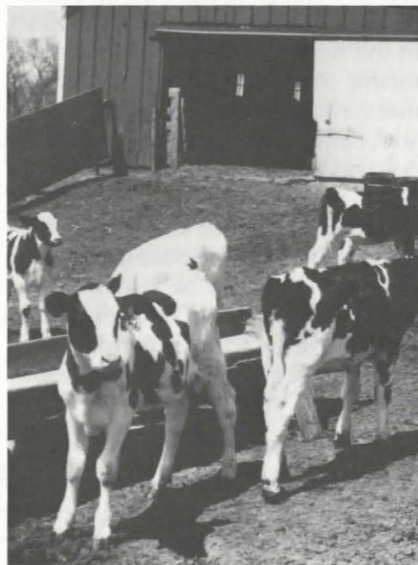
Maternity or freshening areas border on disaster on many dairy farms. Calves born in dirty or poorly bedded box-stalls, bedded-pack or free-stall barns, or an open lot have greatly decreased potential of becoming a profit-producing part of the dairy herd. Such conditions also increase the risk of the cow contracting an infection.

Freshening facilities must be kept clean. Manure, afterbirth, and

other debris should be completely removed and stalls should be thoroughly sanitized after each use.

Stalls should have a rough—but easily cleaned—floor surface to provide good traction for the cow during freshening. Use clean, bright straw or similar materials for bedding. Clean bedding reduces the risk of the calf ingesting debris laden with bacteria. Sawdust, shavings, sand and similar materials should not be used in the freshening area. Such products are easily inhaled and may cause respiratory or digestive track irritation. Dust from dry lots can cause similar problems.

Box-stalls must be of adequate size to provide freedom for the cow to move around without injuring herself or the calf. A minimum box size stall of 12 ft by 12 ft is recommended.



Healthy dairy replacements can be raised in a variety of facilities provided environmental and sanitation requirements are met.

Design box-stalls with easy access for cleaning and access to feed, water and hay for both the new mother and dairyman. An overhead support beam to assist downer cows is desirable. Provide a headgate to facilitate treatment of animals requiring more extensive service. Use gates and position the headgate to allow full access to the front, rear, and both sides of the cow.

Immediately following freshening, wash and sanitize the cow's udder before allowing the calf to suckle. A dirty udder or teat is a prime source of bacteria and infection for the newborn herd replacement.

Calf Housing

From a practical standpoint, dairy calves demand very little from you as a manager. All that most of them require is a clean, dry, and draft-free—but well ventilated—space and good nutrition. A sanitation program to minimize the build-up of disease-producing organisms is essential.

Much research has been conducted during recent years in an effort to identify the "best" housing for dairy replacements. Differences in research results, differences in opinions, and personal biases have led to many discussions among producers and University personnel. The bottom line is that healthy dairy replacements can be raised in a wide variety of facilities provided that basic environmental, nutritional and sanitation requirements are met.

Hutches. Calf hutches are popular with many dairymen. Prime advantages are modest costs and a "built-in" disease control feature due to the hutch being moved to a clean location following each calf. Reported successes have captured the imagination of some individuals to the extent that they believe hutches are the only way to raise calves. As with life in general, some producers have learned that few things are so clearcut. The major disadvantage of the calf hutch is the lack of producer convenience or comfort during adverse weather. There are also reported instances

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Neglected Asset

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of calves freezing to death, ears being frozen and calves suffocating when the front of the hutch was blown full of snow. These occurrences are infrequent and should not be used as the sole criteria in determining whether hutches have a place in your dairy operation.

Hutches are often used as a year-round housing facility. Thus, good construction details to meet varying needs are required. The hutch should be constructed of materials having a reasonable insulation or R-value to reduce temperature extremes. The hutch must be set solidly on the ground to prevent free-flow of air through the hutch under winter conditions. For increased animal comfort during the summer, the hutch should have openable panels at the back. These must be made tight fitting for winter operation.

An exercise space in front of the hutch is desirable. Paddocks are preferred over tethers since the animal is less likely to be injured should the hutch be blown over during windy conditions. The paddock also provides some protection from predators.

Hutches must be located on a well-drained site. Position hutches along the south side of a building during the winter and in a shady area during the summer. Easy access to feed, hay and water by both the manager and the calf is essential.

The recommended size for a hutch is 4 ft wide by 4 ft high by 8 ft long. Avoid closing in the front of the hutch. The damp conditions which result inside are more detrimental to the animal's health than cooler temperatures.

Enclosed Nurseries. Nurseries have been used successfully on many farms. Some are maintained at a preset minimum temperature (usually 45-50° F) while others are operated as cold nurseries. In the latter situation temperatures in the nursery are allowed to fluctuate with outside temperatures and calves must be "insulated" from cold surfaces.

The key in the successful oper-

ation of a nursery is the ventilation system. Provide continuous airflow at the rate of 15 cfm for each 150 lb calf or equivalent during the winter. Additional per calf airflow rates of 30 cfm for spring/fall weather and 105 cfm for summer weather are required. These airflow rates are best provided through a 3-fan bank of single-speed fans and a slot inlet to distribute incoming air.

As with the hutch, good sanitation and good nutrition are essential ingredients of the overall calf rearing program. Sanitation of the feeding equipment is equally important as sanitation of the overall housing facility. Nipple buckets or other utensils used to feed milk or milk replacer should be thoroughly washed and dried following every feeding.

Whether calves are kept in hutches or individual stalls or pens, prevent contact between animals. Separation reduces the risk of animals sucking each other, the risk of frozen ears in cold housing and eased management since animals which are off feed are quickly and easily identified.

Heifer Housing

Reliance on the "survival of the fittest" principle by many dairy-men in their calf rearing program results in heifer rearing being somewhat less of a problem. Nonetheless, heifers still qualify as part of the neglected asset on most dairy farms. As with calves, their primary requirement is a dry, clean, and draft-free but well ventilated resting area and a reasonable ration.

Group pens are the most common method of housing heifers. Resting areas can be provided on a bedded-pack or in free-stalls. Limited work with unbedded concrete sloping areas has had reason-

able success, but animals tend to be dirtier than with the other options, though the investment in bedding materials or free-stall construction is eliminated.

For best performance, group heifers according to size. Provide at least four groups of animals between the ages of 2 months or weaning and freshening or springing heifers at 24 months of age.

Size free-stalls to accommodate the animal being housed in a particular section. Recommendations for free-stall sizes for heifers are listed in Table 1.

In designing heifer facilities, provide sufficient access to the feed bunk for all animals. Bunk height must be matched to the animals to be fed. Design the bunk to limit debris accumulation and associated rodent and insect breeding. For eased management in handling animals, equip pens used for breeding age and older animals with locking headgates. Positioning these along the feed bunk allows animals to become accustomed to placing their heads through the headgate section. Lever activated headgates, in which a complete section is operated simultaneously, allow animals to be easily locked in place for vaccinations, breeding, pregnancy checking, and other activities involving multiple animals.

Ventilation

Calf nurseries are usually mechanically ventilated to allow more precise control of environmental conditions. Heifer and dry-cow facilities are usually non-mechanically ventilated. Recommendations for non-mechanical ventilation systems are given in Table 2.

Manure Management

Manure from nurseries is generally handled as a slurry or liquid. However, in cases where bedding

Table 1. Recommended free-stall sizes for heifers. (Width is center-to-center of partitions and length is from front of the stall to the alley side of the curb.)

Weight (lb)	Approx. Age, large breeds (Months)	Stall Size	
		Width	Length
to 450	2-7	2'-6"	4'-6"
to 650	7-12	2'-10"	5'-0"
to 875	12-18	3'-2"	6'-0"
to 1150	18-24	3'-6"	7'-0"
over 1150	over 24	4'-0"	7'-6"

Table 2. Recommendations for non-mechanical ventilation in dairy buildings.

Feature	Specification
Roof slope	4:12 (4" increase in height per 12" of horizontal distance.)
Ridge opening	2" wide per 10' of building width, continuous full length of building.
Eave opening	1" wide or high per 10' of building width, continuous full length of both sides.
Sidewall opening	6" high per 10' of building width, continuous full length of both sides (Minimum panel height = 2').

is used in individual pens, handling is more as a semi-solid. Similarly, heifer and dry-cow facilities may utilize solid, semi-solid, or slurry type systems. The primary differences between the different consistencies of manure is the amount of bedding or dilution water that is added and the handling equipment required. Storage can be in a slotted dam structure which allows precipitation water to drain away, in an earthen bank, concrete or steel storage as a slurry or in an earthen lagoon as a liquid.

Manure handling is a liability in any livestock operation. A good management program is required to minimize costs associated with handling this by-product of animal agriculture. Include manure management in the total planning process.

Summary

A good calf and heifer rearing program begins with good dry-cow management. Sanitary housing for the calf or heifer helps assure an animal maturing into a valuable part of the dairy operation. Sanitation and ventilation are the two most critical aspects of any housing operation. When coupled with a good nutritional program the result is almost guaranteed to be a valuable asset for your dairy herd.

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Studies with different grain rations show that corn cobs have a higher value than generally realized.

Make Use of Ag Byproducts For Dairy Cow Rations

Foster G. Owen,
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Elizabeth Hawkins¹

During the past 10 years we have experimented with corn cobs and soybean hulls, major byproducts of the two leading Nebraska crops. Most corn cobs at present are left in the field or are used for purposes from which little value is realized. Soyhulls are being produced in greater amounts as the acreage devoted to soybeans in Nebraska increases. During periods of high volume bean processing there is an abundance of hulls—generally inexpensive compared to other feed ingredients.

This report presents data from experiments to determine the potential value of these products in the ration of dairy cows.

Soyhulls

The hull is the outer thin coating of the soybean seed which is removed during processing of the beans for oil extraction. The soyhulls contain 12% protein and 39%

crude fiber. Considering the need for fiber in the dairy ration and that soyhulls fiber is highly digestible, this by-product appeared to offer considerable potential as an ingredient in lactation rations.

Experiment 1. Soyhulls were included in the grain mix at 25 and 50% and compared to a corn-soybean meal control ration for lactating Holstein cows in midlactation. Alfalfa silage was used as the roughage source. It was mixed with the concentrate ration (45% to 55% silage:concentrate ratio, dry basis) and full-fed as a complete mixed feed. The 25% level of soyhulls raised the crude fiber level from 13% (control ration) to 18%. The standard requirement is 17%. It replaced corn grain and some of the soybean meal in the control ration.

Including soyhulls in the ration did not affect milk production or significantly alter milk composition (Table 1). Although none of the performance measures differed significantly among treatments, cows fed the ration containing 25% soyhulls consumed slightly more

(continued on next page)

Use Ag Byproducts

(continued from page 17)

feed and produced more milk. Digestibility of the rations and the efficiency of milk production suggest that the soyhulls were essentially equal to the corn and soybean meal it replaced.

Experiment 2. This study was made to determine the value of including 21% soyhulls in the grain ration. Cows were placed on experiment just following calving and remained on the rations for six months. The control ration consisted of 35% corn silage and 15% alfalfa haylage plus 50% concentrate mixture, on a dry basis. This mixture consisted primarily of corn and soybean meal, which was partially replaced by soyhulls in the experimental ration. The 21% soyhulls raised the crude fiber to the standard requirement level. A deficiency of fiber in early lactation appears to be related to lower feed consumption and possibly other digestive disorders. The addition of soyhulls did not affect milk production or solids-corrected milk yields, neither did it significantly alter the percentage of fat or solids not fat in the milk (Table 2). However, during the first three months the cows fed the soyhulls ration had somewhat higher intakes of dry matter.

Experiment 3. This study further evaluated soyhulls in the ration of cows in early lactation. Soyhulls were introduced into the ration three weeks before freshening to help cows adjust to their postpartum ration. This was intended to promote early intake and minimize off feed problems. Rations consisted of forage and grain in a 50:50 dry matter ratio. The forage was two-thirds corn silage and one-third alfalfa haylage, dry basis, and the

Table 2. Value of soyhulls in early lactation rations.

	1-3 Months		4-6 Months	
	Control	Soyhulls ^a	Control	Soyhulls ^a
	(mean/cow)			
DM intake, lb/day	38.1	40.1	---	---
Milk, lb/day	58.7	59.8	51.5	51.5
SCM, lb/day	59.4	59.6	52.1	50.4
Fat, %	3.87	3.84	3.75	3.64
SNF, %	8.25	8.16	8.44	8.22

^aSoyhulls included at 21% of grain ration.

Table 3. Value of soyhulls fed pre- and postpartum^a

	Fresh—18wk		Fresh—27 wk	
	Soyhulls ^b	Control	Soyhulls ^b	Control
	(mean/cow)			
Peak milk, lb/day	100.8	94.4	100.8	94.4
Milk, lb/day	82.1	77.7	76.6	71.1
Fat-corrected milk, lb/day	72.6	70.0	67.5	64.7
Persistency	.95	.90	.89	.83
Fat, %	3.19	3.29	3.25	3.35
SNF, %	8.43	8.60	8.49	8.60
DM intake, lb	47.3	46.9	46.9	45.8
Milk/DM ^c , lb	1.86	1.72	1.73	1.60

^aTreatments began at three weeks prepartum.

^bSoyhulls made up 40% of the grain mixture.

^cSoyhulls higher than the control ($P < .10$).

grain mixture was basically corn and soybean meal. Soyhulls made up 40% of the grain mix. The rations were prepared as complete mixed feeds, and were fed free-choice.

Mean peak milk yield for cows fed the soyhulls ration was almost 101 lb daily compared to 94 lb for the controls (Table 3). Cows on the soyhulls treatment were numerically superior in milk, 4% fat-corrected milk and lactation persistency, however none of the differences were "significant." Milk fat percent was lower for the soyhulls treatment compared to the control while the yields of fat and solids-not-fat were superior for cows fed the soyhulls ration. These responses were consistent throughout the experiment. Although dry matter intakes were similar for the two treatments, efficiency of milk produced per unit

of dry matter consumed was significantly better for the soyhulls treatment.

Summary. These experiments indicate that soyhulls can be included at up to 50% of the lactation grain ration without reducing milk yields. Possible beneficial effects on consumption and milk yields are suggested by including levels from 21 to 40%. Dairymen and the feed industry should be aware of the potential this feed ingredient offers for reducing feed costs.

Corn Cobs

The high potential value of corn cobs in rations for dairy cows is indicated by considerable data which show ground ear corn to be equal to ground shelled corn for producing milk. We evaluated corn cobs at various levels in the ration and examined their combined effect as an energy and fiber source.

Experiment 1. The purpose of this study was to determine the value of ground corn cobs treated with a mixture of sodium hydroxide and calcium hydroxide. Research with steers indicated that this caustic treatment of cobs increased digestibility and growth performance. The basal ration, consisting mainly of corn and soybean meal, contained sufficient energy for high

Table 1. Value of soyhulls in midlactation rations.

	Control Ration	25% Soyhulls ^a	50% Soyhulls ^a
	(mean/cow)		
Milk, lb/day	40.9	43.1	40.7
Fat-corrected milk, lb/day	41.6	43.8	40.7
Protein, %	3.40	3.21	3.31
Fat, %	4.18	4.09	4.04
DM intake, lb/day	39.8	42.0	40.9
FCM/DM, lb/day	1.04	1.05	.97
DM digestibility, %	63.3	66.3	64.1

^aSoyhulls in grain ration.

Table 4. Value of caustic-treated cobs for cows in midlactation.

	Cobs in grain ration		
	0%	22%	44%
	(mean/cow)		
Milk, lb ^a	46.0	45.3	42.9
Fat-corrected milk, lb ^a	43.6	43.8	40.3
Milk fat, %	3.65	3.72	3.67
Milk protein, % ^b	3.34	3.4	3.11
Day matter intake, lb ^c	44.2	39.6	39.6
FCM/DM, lb	1.04	.97	1.03
DM digestibility, %	56.6	54.8	57.0

^aLinear effect of cobs ($P < .10$); FCM = 4% fat corrected milk.

^bLinear effect of cobs ($P < .05$).

^cLinear effect of cobs ($P < .01$).

Table 5. Value of cobs in high grain rations fed in midlactation.

	Cobs in grain ration ^a			
	0%	14%	29%	43%
	(mean/cow)			
Milk, lb ^b	62.9	62.3	60.1	57.2
Fat corrected milk, lb/day	55.2	55.9	54.8	53.0
Milk fat, % ^b	3.29	3.39	3.46	3.55
Milk protein, %	3.60	3.40	3.54	3.44
Dry matter intake, lb/day	43.8	46.6	48.8	45.1
FCM/DM, lb	1.26	1.20	1.12	1.18
Net energy value cobs/corn, %	- - -	98.4	94.6	96.2

^aGrain ration constituted 70% of ration dry matter.

^bLinear effect of cobs ($P < .05$).

production, but less fiber than generally recommended (15% acid detergent fiber versus 21%). Two levels of cobs were included (22% and 44%) in the grain rations. These grain rations made up 50% of the ration dry matter and corn silage, 50%.

Daily milk yield was similar for the control and 22% cob rations, but was reduced by 3 lb daily when cobs were included at 44% (Table 4). Dry matter intake was reduced about 10% by including treated cobs in the ration. Feed conversions and digestibility results indicated that the treated cobs were equal in energy value compared to the corn they replaced in these rations.

Experiment 2. Ground corn cobs were evaluated at 0, 14, 29 and 43% of the grain mix and were fed in complete rations with alfalfa haylage. The grain portion constituted 70% of total dry matter, in order to determine the value of the cobs in supplying supplemental fiber in, otherwise, very high energy rations fed to cows just beyond lactation peak.

Milk yields declined as the level of cobs was increased, but the milk

fat percentage increased (Table 5). As a result, the fat-corrected milk (FCM) yields were not significantly different for the four rations. Even so, the highest cob ration resulted in 2.2 to 2.9 lb less milk per cow daily than the other rations. Intakes of dry feed were not significantly different. However, cobs appeared to increase intake up to



Soyhulls can be included in the grain rations of lactating cows as replacement for part of the corn or milo.

Table 6. Cobs in high energy, early lactation ration.^a

	Control	18% Cobs ^b
	(mean/cow)	
Milk, lb/day	64.2	60.3
Solids-corrected milk, lb/day	59.4	56.8
Milk fat, % ^c	3.46	3.79
Dry matter intake, lb/day	38.7	41.8
SCM/DM ^c	1.58	1.38

^a60% grain, 40% forage, dry basis.

^bLevel of cobs in grain mixture.

^cSignificant difference between means ($P < .05$).

the 29% cob level. From these data, the energy value of the corn cobs was estimated to be 95 to 98% that of the corn grain they replaced.

Experiment 3. This study was designed to evaluate the inclusion of ground corn cobs in the ration of cows beginning two weeks past freshening. The rations consisted of a 20% corn silage, 20% haylage, and 60% grain mix, on a dry basis. The control grain mix was primarily corn-soybean meal and the experimental ration contained 18% cobs substituted for corn grain. This increased ration acid detergent fiber from 15 to 20%.

Including the cobs in the ration produced an increase in fat test and dry matter intake, but reduced milk yield by 4 lb daily (Table 6). When actual milk yields were adjusted for milk solids, the difference between rations was reduced and was not significant. Efficiency of feed conversion to milk was lower for cows fed cobs in this experiment. This is contrary to most other results in which added cobs, either alone or in cob meal, had little effect on efficiency.

Summary

These experiments demonstrate that 22 to 29% corn cobs can be utilized in high grain lactation rations. Benefits often include increased dry matter intake and milk fat percentage. The energy value of cobs is usually 95 to 100% that of corn grain. Considering these results, dairymen should take greater advantage of the potential economics of including cobs in dairy rations.

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Silage is conveyed into a small batch ration mixer for experimental ration preparation.

Soybeans for Dairy Rations

Joyce Meader
Foster Owen¹

Economics often favor the use of whole unextracted soybeans in dairy rations compared with the more commonly-fed protein supplements. The whole soybean is high in both protein and energy, therefore it is potentially a valuable ingredient in the ration of high producing dairy cows (Table 1). The high energy value of whole soybeans is due to its fat content. In some experiments inclusion of certain fats or high fat ingredients in dairy rations has improved energy intake and both milk and fat yields.

The decision to feed soybeans should be based mainly on its price compared to other protein supplements. The "Peterson's Feeding Values" can be used to help make this decision (Table 2).

If the calculated feeding value of soybeans is less than the price of soybeans, the producer will make more money by selling his beans and purchasing a protein supple-

Table 1. Feed value of soybeans and soybean meal.

	Soybean meal (44% CP, as fed)	Ground soybeans
	(dry matter basis)	
Protein (%)	50	42
Fiber (ADF) (%)	10	10
Ether extract (%) ^a	1.3	19
ENE (Mcal/cwt)	81	98
Calcium (%)	.36	.28
Phosphorus (%)	.75	.66

^aIncludes mainly fat.

ment. When soybean prices are lower than the feeding value, the farmer will usually be better off by feeding his beans.

Cooked Soybeans Compared to Soybean Meal

A midlactation feeding trial at the University of Nebraska dairy facilities found improved average milk production for a ration containing pelleted, roasted soybeans compared to soybean meal (Table 3). The whole soybeans were roasted at 250°F and fed at about 7 lb per day either whole, ground, or ground and pelleted with 19% sodium bentonite (bentonite reacts with protein during the pelleting process and may reduce protein breakdown in the rumen). Daily production of milk and solids corrected milk, as well as intake and efficiency, were highest when ground soybeans were pelleted with bentonite. This study demonstrated that unground whole beans can be fed to lactating cows without apparent problems and that they result in similar yields of milk to soybean meal and ground soybeans.

Table 2. Comparative feed value of soybeans relative to corn and soybean meal at various price combinations.

Price of corn	Price of soybean meal (\$/cwt)						
	10.00	10.50	11.00	11.50	12.00	12.50	13.00
	(\$/bu)						
2.00	5.23	5.45	5.68	5.90	6.12	6.35	6.57
2.50	5.42	5.64	5.87	6.09	6.31	6.54	6.76
3.00	5.61	5.83	6.05	6.28	6.50	6.73	6.95
3.50	5.80	6.02	6.24	6.47	6.69	6.92	7.14

^aDetermined from Peterson's Feeding values (Morrison's Feeds and Feeding, 22nd Ed.).

Raw Beans

Raw soybeans can be fed to dairy cows with good results, within limits and with certain precautions. However, by following these guidelines effective use can be made of raw soybeans:

1. *Do not put soybeans into rations with urea.* If this is done ammonia may be released, reducing both the palatability and protein value of the ration. This is caused by the urease enzyme in raw soybeans.

2. *To minimize rancidity problems,* feed the rations containing ground beans within a week or so after grinding or add an antioxidant such as butylated hydroxytoluene BHT (.04 lb/cwt soybeans) to protect them from oxidizing. Another possibility is to feed whole (unground) beans.

3. *To minimize digestive and nutrient utilization problems,* the grain ration should not contain more than 25-35% soybeans or more than 7 lb/cow/day. Excessive amounts of fat from the beans will reduce fiber digestion and may lower milk fat. Also, increase calcium and phosphorus levels to about 20% above minimum or about 1% calcium and .6% phosphorus in the total ration. This is because the digestive end products of fats combine with some of these minerals causing them to be unavailable to the animal.

Processing of Soybeans

Several processing methods generate heat which reduces protein breakdown in the rumen, destroys the trypsin inhibitor and urease, improves palatability, and may minimize bean molding. The main reason that pelleting, extruding, or roasting soybeans may benefit the beans for dairy rations is that these processes produce heat which changes the protein to a form which is partially protected from breakdown in the rumen. Benefits of

Table 3. Soybean processing and lactation (Nebraska).

	Soybean preparation			
	SBM	Pellet ^a	Whole	Ground
Soybean product in total ration dry matter (%)	8.7	13.0	10.7 ^a	10.4
Milk yield (lb/day)	71.5	76.4	68.5	71.6
Solids-corrected milk (lb/day)	67.3	71.5	65.2	65.7
Fat, %	3.57	3.44	3.60	3.39
Dry matter intake (lb/day)	48.8	49.4	46.7	48.6
Efficiency ^b	1.30	1.40	1.40	1.34

^aContains 19% sodium bentonite and 81% ground soybeans.

^blb milk (adjusted for solids content)/lb dry matter consumed.

these processes are most likely when soybeans are fed to high-producing cows in early lactation. However, excessive heating can reduce digestibility and result in lower performance.

Studies on feeding extruded soybeans have produced highly vari-

able results. The reasons for the inconsistent response appears to be related to the level of beans in the ration and the stage of lactation. The greatest responses are seen near the peak of lactation (4-6 weeks after calving). The increased yield at this stage is probably due

to higher energy content of the soybean ration. Experiments with cows beyond their peak of lactation revealed practically no differences among soybean oilmeal, extruded soybeans and raw soybeans. Rations with high energy containing forages may also show less benefit from the energy of soybeans. Soybeans fed with low quality forage provide more benefits for the high producing cow than when fed with forages such as corn silage, a high energy forage.

Heat treatment does not always produce benefits. When extruded soybeans were fed at high levels (13 pounds per day to Holstein cows), milk yield and fat tests were lowered. Limiting the soybeans to less than 7 lb/day should prevent these negative results.

Recommendations

1. Substitute soybeans, within limits, for other protein supplements when favored by cost comparisons.
2. Grind no more than a week's supply of soybeans in warm weather to prevent rancidity.
3. Limit soybean level to 7 lb/day (Holstein) for maximum palatability and minimal digestive problems. This will usually range from 20 to 35% of the grain ration.
4. Increase the calcium to 1% of the total ration to compensate for reduced availability in high fat rations.
5. Carefully weigh the cost of processing soybeans against benefits (prices vary from \$20 to \$160 per ton).
6. Heat treat soybeans before mixing with urea supplements to destroy urease enzyme activity.
7. Insure that adequate levels of "effective fiber" are fed (over 17% crude fiber) to compensate for any reduction in fiber digestion caused by the high ration fat content.
8. Heat treat soybeans by carefully controlled processing for possible improvement in protein efficiency when used in rations of high producers in early lactation.

Advantages and Disadvantages of Various Forms of Whole (Unextracted) Soybeans for Lactating Dairy Cows

Whole raw soybeans¹

- Advantages — low cost
— will not develop rancidity
— good flow characteristics
- Disadvantages: — limited data on feeding value

Ground raw soybeans¹

- Advantages: — low cost
— equal to soybean meal
- Disadvantages: — develops rancidity in warm weather

Roasted soybeans

- Advantages: — increases palatability
— need not be ground, reducing rancidity problem
— may reduce protein breakdown in the rumen, and improve efficiency
- Disadvantages: — may reduce protein availability if heat treatment is too severe
— cost for treatment

Extruded soybean

- Advantages: — reduces protein breakdown in the rumen
— may improve production in early lactation
- Disadvantages: — most expensive process
— rancidity may be a problem if exposed to oxygen and heat
— may alter soybean oil in a way that harms rumen function when fed at high levels

¹Raw soybeans should not be fed to non ruminants such as hogs and chickens. However, heat treatments such as roasting and extruding destroys the trypsin inhibitor and permits its use in rations for non ruminants. (This inhibitor is destroyed in cattle by rumen microorganisms).

¹Joyce Meader is an Extension Assistant. Foster Owen is Extension Dairyman.



Tie stall barn used for many experiments at the Mead Field Laboratory.

Vitamin A Important

Beta-carotene in Dairy Rations

Larry L. Larson
Jia-Yu Wang
Foster G. Owen¹

The importance of vitamin A for normal reproductive performance in cattle has been recognized for many years. Forage plants do not contain vitamin A, but contain beta-carotene, much of which is converted to vitamin A by the cow's digestive system. Therefore, vitamin A was assumed to be the compound needed by the animal and is commonly added to many rations. German scientists recently reported greatly improved reproductive performance in the Black Pied breed of cattle when they were given beta-carotene supplemental to a ration containing adequate vitamin A.

Benefits reported for supplemental beta-carotene included: shorter intervals to uterine involution in cows after calving, fewer ovarian cysts, higher progesterone one concentrations, increased intensity of estrual symptoms, improved conception rates and reduced embryonic mortality. These German workers concluded that cattle have a specific requirement for beta-carotene that is not satisfied by vitamin A. However, no

improvement in reproductive performance was reported in studies with Israel-Friesian heifers fed supplemental beta-carotene.

Pastures and other fresh forages contain very high levels of beta-carotene. However, most rations that promote rapid growth and high milk production contain feeds, such as grains and corn silage, that are low in beta-carotene. Also, the beta-carotene content of most hays decreases rapidly during storage. Therefore, the importance of beta-carotene to our breeds of cattle used in the United States under our management systems needs to be determined.

Table 1. Effect of feeding supplemental beta-carotene on fertility in Holstein heifers.^a

	Treatment	
	Control	Beta-carotene
No. heifers	56	59
1st service conception (%)	50.0	52.5
Services per conception (no.)	1.7	1.7
Problem breeders (%) ^b	8.9	15.5
Culled open (%) ^c	3.6	1.7

^aOverall summary of seven trials conducted over a 3-year period. Each trial involved 14 to 20 heifers.

^bHeifers bred four or more times.

^cHeifers that failed to conceive after minimum of six services.

Table 2. Effect of feeding supplemental beta-carotene on estrual activity (signs of standing heat) in Holstein heifers.^a

	Treatment	
	Control	Beta-carotene
No. heifers	28	28
Heifers observed in heat, %	82.2	74.8
Interval from PGF ₂ to heat, hour	52.3	52.8
Length of standing heat, hour	13.3	12.7
Number of mounts observed/heifer	8.8	7.6

^aAverage of three trials.

Trials

We have conducted a number of trials with both Holstein heifers and lactating cows to determine the effect of feeding supplemental beta-carotene on reproduction. Seven trials involving 115 heifers were carried out at various seasons of the year during the last three years. Between 14 and 20 breeding-age heifers were assigned to each trial. In each trial half of the heifers received supplemental beta-carotene blended in their concentrate mix while the other half served as controls. The concentrate mix was individually fed via a computer-controlled feeder. In most trials, 300 mg supplemental beta-carotene was fed daily for about 8 weeks, from 4 weeks before heat synchronization and breeding to 4 weeks after breeding. Depending on the trial, all heifers were fed either year-old brome or alfalfa hay, which was low in beta-carotene, plus 5 or 6 pounds of concentrate mix with enough added vitamin A to satisfy their requirements. Analysis of blood samples collected throughout the trials confirmed that heifers fed supplemental beta-carotene had higher blood carotene levels.

An overall summary of some of the results is in Table 1. Fertility was not improved by feeding supplemental beta-carotene. Of the heifers that have calved to date there are no obvious differences in embryonic losses, number of abortions, or the number of calves still-born.

The effect of supplemental beta-carotene on estrous activity (signs

Table 3. Effect of feeding 300 mg supplemental beta-carotene from 3 to 98 days after freshening on reproduction.

	Treatment group	
	Control	Beta-carotene
No. cows	26	25
Incidence of:		
Ovarian cysts (%)	23.1	30.4
Failure to cycle (%)	7.4	16.3
Clinical mastitis (%)	56.5	14.3
Days after freshening to:		
Uterine involution (day)	28	26
First ovulation (%)	26	29
First observed estrus (day)	42	45
First service (day)	59	69
Conception at first service (%)	30.2	38.1
Conceived by 98 day after freshening	41.7	47.6

of heat) after estrous synchronization with prostaglandin $F_{2\alpha}$ was determined in three trials. Heifers were observed for mounting activity for at least 30 minutes at 4 hour intervals from 24 to 96 hours after the second prostaglandin treatment. Results, given in Table 2, indicate that feeding supplemental beta-carotene did not influence estrual activity in these heifers.

Table 4. Effect of feeding 300 mg supplemental beta-carotene from 28 days before expected calving date to 98 days after freshening on reproduction.

	Treatment group	
	Control	Beta-carotene
No. cows	13	13
Incidence of:		
Retained placentas (%)	23.1	0.0
Stillbirths (%)	15.4	0.0
Cystic ovaries (%)	16.7	7.7
Failure to cycle (%)	18.2	7.7
Clinical mastitis (%)	45.5	33.3
Days after freshening to:		
Uterine involution (day)	30	31
First ovulation (day)	39	31
First observed estrus (day)	49	38
First service (day)	63	66
Conception at first service (%)	42.9	54.5
Conceived by 98 day after freshening (%)	30.0	66.7



Much of the carotene in hay is lost during harvest and storage.

We have conducted two trials with lactating Holstein cows. In the first trial 54 cows were used to determine the effects of feeding 300 mg supplemental beta-carotene from 3 days after freshening to 98 days after freshening. Cows were housed in a tie-stall barn and individually fed a complete mix ration consisting of 60% concentrate and 40% forage on a dry matter basis.

By three weeks postpartum blood serum beta-carotene concentration was higher in cows fed supplemental beta-carotene and remained higher throughout most of the experimental period. Feeding supplemental beta-carotene had no effect on the postpartum intervals to uterine involution, ovulation and first observed estrus, incidence of cystic follicles (diagnosed by palpation), ovarian cyclicity (based on blood progesterone patterns), peak progesterone concentrations, first service conception rate, or number of cows pregnant by 98 days after freshening (Table 3). Cows fed supplemental beta-carotene required fewer treatments for clinical mastitis. Therefore, in this trial reproductive performance was not improved by feeding supplemental beta-carotene during the period from 3 to 98 days following freshening.

In a second trial with 26 lactating cows, feeding of 300 mg supplemental beta-carotene was started one month before the expected calving date and continued to 98 days after freshening. Half of the cows received beta-carotene and the other half served as controls. Results are given in Table 4. Cows fed

supplemental beta-carotene had fewer retained placentas and calving problems but the difference was not statistically significant. There was no difference in the rate of uterine recovery after calving, incidence of cystic ovaries, or the number of cows with an abnormal discharge. First service conception rate favored the beta-carotene cows, but the difference was too small to be confident of a benefit. Feeding supplemental beta-carotene did not affect level of milk production or number of cows with clinical mastitis. Additional trials with more cows will be needed to confirm the potential benefits of initiating beta-carotene supplementation during the dry period.

Performance Not Improved

Feeding supplemental beta-carotene under our management system does not appear to influence significantly the reproductive performance of Holstein heifers. Also, feeding supplemental beta-carotene to lactating Holstein cows from 3 to 98 days after freshening did not improve reproductive performance but fewer cows developed clinical mastitis.

Feeding supplemental beta-carotene during both the dry period and early lactation period resulted in fewer calving problems and improved fertility, but these potential benefits need to be confirmed with additional studies to determine whether this practice will give consistent and economical benefits.

¹Larry L. Larson is Associate Professor-Dairy Physiology. Jia-Yu Wang is a graduate student. Foster G. Owen is Extension Dairyman.

Prevention of Retained Placentas in Dairy Cows

Larry L. Larson¹

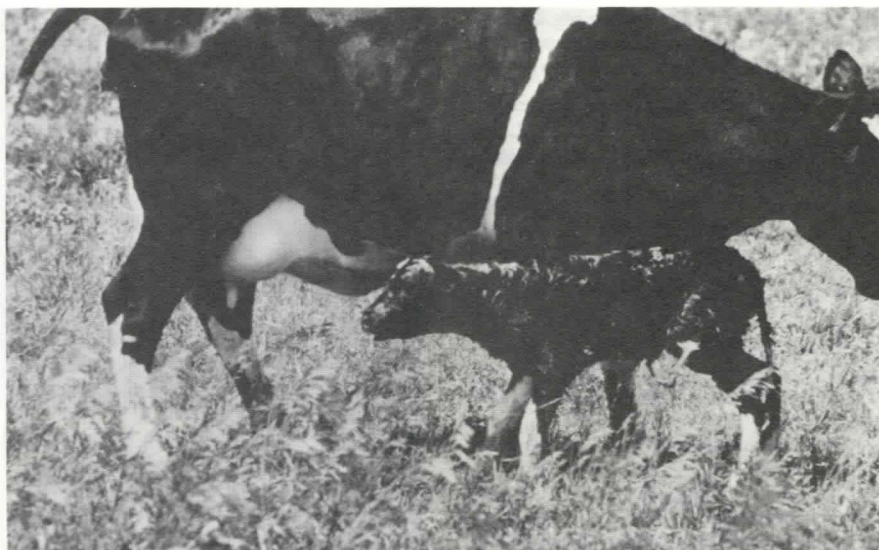
Retained placentas occur in about 10% of the dairy cows, although incidences as high as 50% are found in problem herds. Fetal membranes are considered retained when they are not released by 12 hours after calving.

Retention of fetal membranes in itself is probably of little consequence, however, infections of the reproductive tract that frequently develop following this condition are detrimental to normal reproduction. Therefore, placental retentions are generally associated with a higher incidence of uterine infections, slower post-calving recovery of the reproductive tract, longer intervals after calving to first estrus and first breeding, lower conception rates, longer calving intervals, and more cows culled due to reproductive and health problems. In cows that simply retain, without subsequent infections, fertility is normal.

Extremely Complex Problem

Placental retention is an extremely complex problem with numerous causes. This makes it difficult to identify the specific cause(s) of the problem and, therefore, prevention programs must give attention to many factors. Following are some of these factors.

Sanitation of the Maternity Area.



Attention to many details of feeding and management are necessary to minimize retained placentas.

Several reports indicate that bacteria can move rapidly into the reproductive tract during the calving process. Clean, well-drained grassy pastures are excellent calving areas when the weather permits. Maternity stalls should be cleaned and sanitized between calvings. Cleaning maternity stalls and then allowing them to "rest" for several months during the summer to break the build-up of infective organisms has been beneficial. For bedding, dry straw is recommended rather than sawdust.

Nutrition. Numerous nutritional factors probably are involved. Avoid "fat" cows! Overconditioning of cows during lactation and dry periods results in more retained placentas. Consequently, dairymen must avoid "fat cows" by preventing over-feeding during these periods. Severe deficiencies of vitamin A or beta-carotene (converted to vitamin A by the cow), selenium, iodine, and improper levels of calcium and phosphorus in the diet (which also might cause milk fever), all can increase the incidence of retained placentas. Since many of these nutrients can be toxic when fed in excess, they should not be indiscriminately added to a ration. Analyze feeds and formulate a balanced ration to satisfy the animal requirements for both the *types of nutrients* that need to be supplemented and the *total quantity to be fed*.

Diseases and Infections. Any disease or infective organism that (1) causes infections in the reproductive tract, (2) high fevers, or (3) contributes to abortions or stillbirths will increase the incidence of placental retention. Some of the more common problems include: Brucellosis (Bangs), Bovine Virus Diarrhea (BVD), Infectious Bovine Rhinotracheitis (IBR), and Leptospirosis. A vaccination program is highly recommended, as part of a total herd health program, to help control these problems.

Premature Births, Abortions and Gestation Lengths. Any factor that causes the gestation length to be abnormally short or long also will contribute to placental retention. Disease and nutritional factors are the most common causes. However, treatments to artificially induce early parturition and hereditary defects that prolong gestation also increase the incidence of retained placentas.

Calving Problems. Any factor that contributes to calving problems increases the chances for placental retention. This would include birth of large calves in relationship to the size of the cow, bull calves, multiple births, "fat" cows, abnormal presentations, milk fever and other metabolic disorders.

Season. Seasonal effects vary depending upon the severity of weather. Incidence of retained pla-

centas might increase during the summer due to heat stress. However, higher incidences of retained placentas might occur in the late winter months if it is not possible to maintain a sanitary maternity area or if feed quality has deteriorated during months of storage.

Age. Retained placentas are more common in first calf heifers and in older cows. The cause of placental retention in first heifers is frequently associated with difficulty in calving. The cause in older cows is probably associated with poor muscular contractions and the accumulation of various uterine health problems during previous calvings.

Heredity and Breed. Daughters from cows that retained are more likely to retain than daughters from cows that had a normal calving. Placental retention is also more frequent in high producing cows, cows that give birth to twins and in Holsteins compared to Jerseys.

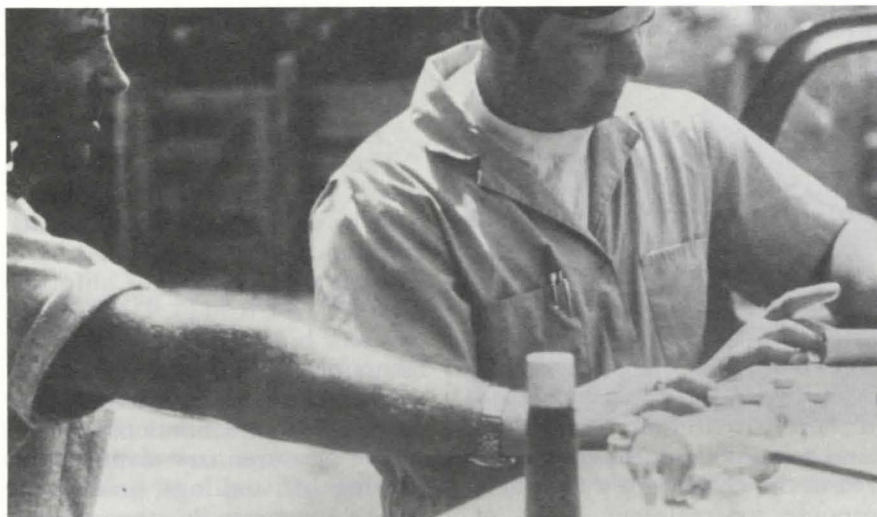
Other Factors. Other factors including general stress, psychological stress, and hormonal imbalances can contribute to placental retention.

Summary

Retention of fetal membranes is a complex problem caused by many factors. A preventive program must consider nearly all aspects of good herd management. A program to prevent retained placentas should:

1. Provide a clean, dry, well ventilated and stress-free maternity area.
2. Feed rations balanced as recommended for late lactation and dry cows and control the quantity feed as needed to avoid overcondition.
3. Follow a complete herd health program of good sanitation with recommended vaccinations.
4. Grow heifers of adequate size to minimize calving difficulties.
5. Consider possible hereditary relationships.
6. Consider concentrating calvings during the less stressful seasons of spring and fall.

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Following label instructions and using approved drugs are extremely important in eliminating drug residues in meat and milk.

Management of Antibiotics In Treatment of Mastitis

Duane Rice¹

Mastitis is a herd problem and prevention by sanitation is very important. Treatments, on the other hand, are only to eliminate or shorten the duration of existing infections and possibly to prevent some in the dry cow treatment. Mastitis on a herd basis cannot be controlled with treatment alone. There are many different direct causes and even more predisposing factors (something that sets the stage for infection). For example, poor milking machine function may increase the chance for staphylococcal infection in a clean quarter when an infected cow is being milked.

Use of antibiotics in mastitis treatment presents problems not encountered when treating other diseases. Treatment selection and procedures for an ordinary disease frequently can be quite simple. However, in the case of mastitis the story is quite different. For treatment to be effective the causative agent must be determined through specific tests. Even with accurate diagnosis, treatment results sometimes can be disappointing.

To control mastitis level a complete program is recommended in

which early treatment of clinical cases is only one of several recommendations. This article will help you decide when and how to use antibiotics advantageously. It is not a substitute for good management—the heart of a total mastitis control program.

Since mastitis is caused by such a wide variety of organisms it is impossible to select a single antibiotic effective against all. Throughout the world 95% of all mastitis cases are caused by four organisms: These are *Staphylococcus aureus*, *Streptococcus agalactiae*, *dysgalactiae*, and *uberis*. Because these cause most mastitis infections, commercial mastitis products are developed and intended to be active against these four organisms but effectiveness can be variable.

Diagnosis of the disease is the first step. The veterinarian draws conclusions from herd history, physical examination, and laboratory tests. Considerations include environment, vaccination status, past treatment effectiveness, and client attitude. The dairyman usually observes only the clinical signs, as in obvious mastitis and its effect on milk yield. If drugs are to be ef-

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Antibiotics for Mastitis

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fective a specific diagnosis is necessary to select the best treatment.

Treating Clinical Mastitis When the Exact Cause Is Unknown

The severity of mastitis in the individual cow and quarter can vary from completely invisible (sub-clinical) to an obvious, extremely painful, life-threatening condition. Early recognition of the disease increases the chance for a favorable response to treatment. Signs of clinical mastitis (showing obvious signs of infection) include a hot swollen quarter (udder), tenderness, abnormal milk secretion, decreased milk secretion, and in many cases elevated body temperature. The cause of the infection at this point is usually unknown, creating indecision on which treatment may be preferred. It is important to consult your veterinarian.

When clinical mastitis occurs collect, aseptically (without contamination), a milk sample from the infected quarter *before any treatment is administered*. If an infected quarter has been treated the chance of culturing the infective organism is greatly reduced. The veterinarian should send this and several other representative herd samples to the laboratory to determine the predominant cause of new mastitis infections. Following collection of the sample the infected quarter should be completely milked out. The aseptic intramammary administration of a sterile commercially prepared lactation mastitis treatment is recommended. Gentle massage of the treated quarter will help disperse the medication. Treatment procedures should be repeated several times as recommended by your veterinarian and continued for at least 24 hours after a definite improvement is noticed. Failing to treat long enough frequently only "knocks down" rather than "knocks out" the infection.

Intramammary treatment as described above is considered the route of choice in most mild clinical cases. In very acute clinical mastitis,

your veterinarian's advice is necessary.

Treating Mastitis When the Exact Cause is Known

The level of mastitis in a herd should be monitored on a routine basis by use of somatic cell counts from your milk market and by a cow side test, such as the California Mastitis Test (CMT). *Detailed records must be kept*. Information from laboratory reports on milk cultures will be incorporated into the veterinarians recommendations for corrective measures, cow management (drying off, culling), and treatment. For example, the mastitis caused by the *Staphylococcus aureus* or *Mycoplasma* organisms may require severe culling and other management procedures with little or no reliance on treatment. In the case of *Streptococcus agalactiae*, however, after infected cows are identified, treatments can be very effective.

Treatment of all cows requires attention to strict sanitation and sterility for administration of medications. There are many herds in which severe secondary mammary infections have occurred because a contaminated product was administered or improper techniques of treatment were used. Disastrous losses can occur when certain bacteria are introduced into the teat canal, primarily from faulty treatment techniques. Poor teat sanitation before treatment is the most common cause of problems.

Dry Cow Treatment

Treat all quarters of all cows at drying off. Dry cow treatments are intended to treat subclinicals that are not evident to prevent dry cow infection and minimize fresh cow infection. Early dry-off and treatment with dry cow medication is recommended on some types of mastitis. Dry cow treatments are formulated to retain activity against common mastitis organisms for prolonged periods, thus should never be used on lactating cows.

Milk from quarters treated with dry cow products may retain drug residues for 30 to 60 days. Due to the prolonged activity, the drug is more effective in "knocking out"

infections. Use the same sterile techniques for administering dry cow treatment as with lactating products. Remember that dry cow treatment is very helpful in mastitis control, however, proper dry cow feeding, housing, and other management is also very important. The *severe, chronic cases* that persist in a herd should be culled.

Approved Drugs and Extra-Label (Unapproved) Drugs

An "approved drug" means that the drug is being used in accordance with label directions. An extra-label (unapproved) drug is one being used in a manner or dosage contrary to label instructions. When a drug is used by a dairyman, whether approved or unapproved, it is his responsibility to withhold milk or meat until the drug has been excreted or eliminated to acceptable levels. If the drug is not among the approved drugs for food producing animals, withholding information is not available and therefore withholding times cannot be known. Therefore, there are only limited numbers of drugs available with labels showing safe excretion and dosage schedules.

There are many extra-label drugs used by both dairymen and veterinarians in food animals. Some are prescribed by veterinarians and some are not. The veterinarian is, however, responsible only for drugs he recommends and he is legally bound to advise his client about the drug. This advice includes dosage, routes of administration, dosage interval, and drug clearance times for both meat and milk. Since extra-label drugs do not have manufacturers withdrawal times established the veterinarian must estimate clearance times. As he is responsible, he will probably project several extra days of withholding, especially if the drug is at elevated dosage for prolonged treatment times.

Why does a veterinarian recommend unapproved drugs? The answer is because the response to the approved drug and dosage sometimes is not adequate. To improve the outcome of the disease and prevent animal loss some drugs are needed at the higher dose for

longer times. The veterinarian is within the law as long as he informs the animal owner of all ramifications involving the drug and it does not jeopardize human health.

Both consumers and the Food and Drug Administration (FDA) are becoming increasingly concerned regarding the potential harm from the presence of drug residues in food products due to what appears to be use of extra-label drugs. We (producers, veterinarians, FDA) cannot allow the public or the Congress to lose confidence in our ability to assure a safe food supply. The FDA has revised its policy relating to extra-label use of drugs in food producing animals.

Although it has been and remains the policy of the Food and Drug Administration not to interpose itself into the practice of veterinary medicine, this policy does not extend to situations where the public health may be adversely affected. The extra-label use of drugs in food producing animals (use for species or conditions or at levels not recommended on the label or failure to observe withdrawal times) may adversely affect the public health because such use may expose consumers to residues that have not been shown to be safe. Both producers and veterinarians may be subject to prosecution under the Food Drug and Cosmetic Act for such extra-label use, particularly when it results in violative residues in edible products of treated animals."

Preventing Tank Milk Residue Contamination

When lactating dairy cows are treated their milk must not get into the tank milk until all residues are at a safe level. Alert producers will identify all treated cows and maintain good records of treatment type, drug administration, and residue withdrawal times to insure only quality milk will enter the tank.

A test is available to determine antibiotic residue levels in milk which can be used on individual cow milk or tank milk. Dairy men and veterinarians should be aware of the "on-the-farm" test called *Delvotest P*. It is used to determine if

the antibiotic level in milk is too high. The test is simple, inexpensive, conclusive, and is available from:

G.B. Fermentation Industries,
Inc.
P.O. Box 241068
Charlotte, N.C. 28224
Ph. (704) 527-9000

Preventing Drug Residues in Meat

The prevention of harmful drug residues in meat is another concern for the dairyman if he is to avoid carcass condemnation.

Following label instructions and using approved drugs are extremely important. Frequent violations have been observed as better testing methods (S.T.O.P Test Swab Test On Premises) detect residues *after* slaughter.

The L.A.S.T. (Live Animal Swab Test) is now available from the USDA. This test is a good tool for "on-the-farm" use in checking for antibiotic residues *before* animals are slaughtered. L.A.S.T. is a urine test indicating when the drug in the live animal is cleared of antibiotics. The tissue levels have also cleared to a level for safe marketing if the urine has cleared. This test can be performed by veterinarians as well as producers or farm personnel.

Conclusion

Antibiotics alone are not a cure-all for bovine mastitis; however they are one of the tools that help reduce the duration of infection. A wide range of antibacterials are available—both approved and extra-label.

The advice of a veterinarian is important in drug selection as he or she is aware of herd history, past drug success in a particular area, probabilities as shown on bacterial sensitivity, significance of clinical signs, and advances of residue ramifications related to human health. Further, the veterinarian has access to information that will help utilize a drug to its full potential.

¹Duane Rice is Extension Veterinarian.

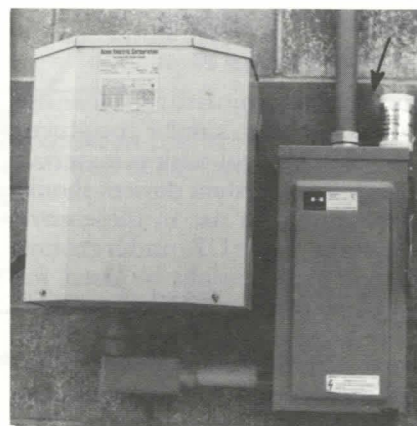


Figure 1. Lightning surge arrester (arrow) installed on dairy barn service entrance.

Dairy Installations

Electrical Systems and Grounding

Gerald R. Bodman, P.E.¹

Electricity functions as an inexpensive "hired hand" on nearly every modern dairy farm. Transport of feed, movement of manure, milking cows, operating ventilation fans, grinding feed, and lighting are but a few of the chores performed by this silent servant.

Unfortunately, the nature of electricity also means that having it on the farm increases potential dangers. In the mildest form, we experience a shock due to current flow through our bodies. In the most severe cases, sufficient current flows through the body to cause electrocution. No system design can ever guarantee complete freedom from hazards. However, the use of electrical system components designed for the on-farm environment and the application of good wiring practices greatly reduces the risk while minimizing maintenance costs.

Electrical System

The environment in most buildings on a dairy farm is corrosive
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Electrical Systems

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due to dust, moisture, cleaning chemicals, and similar products. Consequently, all wiring materials and electrical system devices should be designed for use in these environments. Type UF (underground feeder) cable should be used for general circuits. The more common non-metallic (type NM) or Romex (tradename) cable is unsatisfactory due to lack of resistance to sunlight and moisture. Type NM cable is designed for use in a dry environment; hence it has no application in milk rooms, feeding areas, milking parlors or cattle housing areas.

All electrical conductors should be surface-mounted using non-corrosive fasteners and stainless steel nails. Surface mounting simplifies maintenance, minimizes potential for rodent damage and reduces the risk of moisture migrating into wall cavities or ceiling area. Conduit should be used only where electrical conductors must be protected from physical abuse. Non-metallic conduit is the preferred choice. All boxes, switch and receptacle covers, and similar devices should be of non-metallic materials. Use waterproof switches and gasketed receptacle covers.

Install incandescent lights in non-metallic boxes with shatter-proof globes to reduce risk of breakage. Fixtures with a minimum rating of 150 watts should be selected. Fluorescent fixtures designed for use in a mildly corrosive atmosphere are necessary. They should be equipped with cold start ballasts

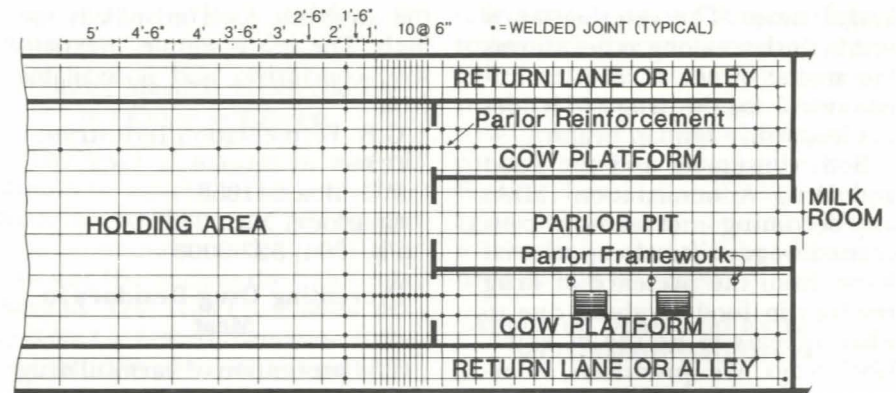


Figure 3. Plan view of milking parlor equipotential plane and voltage ramp in holding area and return lane.

and shatterproof, gasketed diffuser covers.

Service entrance boxes should be installed on inner walls or surface mounted. Do not recess boxes of any kind into outside walls. Minimal insulation between the box and the outer wall results in condensation and accelerated corrosion of electrical contacts in the box.

Installation of all electrical system components should be made in accordance with the minimum standards set forth in *National Electrical Code (NEC)*. Although there are no electrical inspection requirements in rural Nebraska, state law requires that all electricians perform their work in accordance with the NEC. To help assure that the NEC requirements are met, dairymen and other livestock producers should request an inspection of all new installations by a representative of the Nebraska State Electrical Board, 1313 Farnam Street, Omaha, phone 402/554-2127. Inspection fees vary according to the size of the service entrance and the number of branch

circuits. However, the charges are minimal and constitute a very small additional investment to help assure that the electrical system is installed in a safe and efficient manner.

Lightning Protection

Lightning rod systems seem to have fallen into disfavor during the past 20 years. However, their usefulness on modern agricultural facilities has not been diminished. A prime requirement in selecting a lightning protection system is to verify that all components bear an Underwriters Laboratory (UL) seal. Additionally, the installer should have forms available to apply for a UL "Master's Label" indicating that the installation has been made with good quality equipment. Avoid purchasing lightning rod systems from traveling salesmen armed with horror stories. Always verify that the salesman is associated with a reputable company before making a purchase. Your local Better Business Bureau is a good place to start. No safety device should ever be purchased under the veil of fear. Installation of a lightning protection system is best left to a professional. A properly installed system will result in all metallic surfaces being grounded. The NEC also requires that all metallic surfaces within 10 ft of the ground be grounded. Lightning protection system ground cables should not be tied to the electrical system grounding electrodes. Provide separate ground rods.

To control high current surges through electrical equipment, equip all service entrances with a

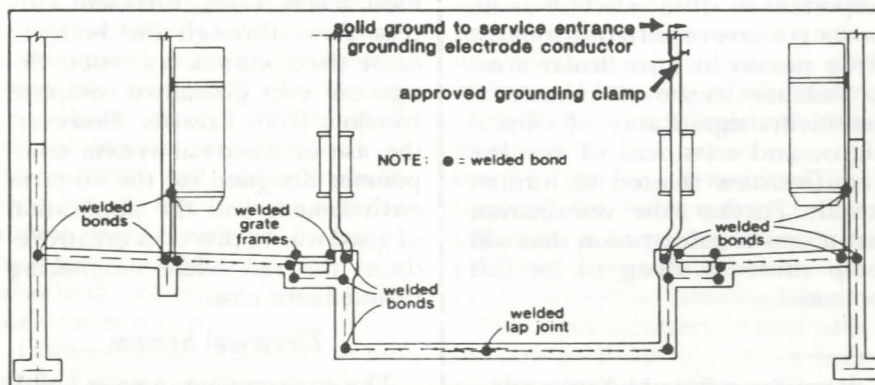


Figure 2. Cross-section of milking parlor showing interconnection of all steel to form equipotential plane.

lightning surge arrestor. These are small, relatively inexpensive devices easily installed in either new or existing installations (Figure 1).

Grounding

Extraneous, or stray, voltage problems have captured the imagination of many people. A survey of Nebraska dairy farms showed that potential problems exist in over 50% of the installations. To reduce the risk of troublesome voltages developing, complete and thorough grounding is required. The recommended procedure is to provide an equipotential plane within the milking center. An equipotential plane is constructed by bonding (welding) all metallic components together. Wired or clamped connections are generally not satisfactory. All parlor framework pipes, reinforcing mesh in the cow platform, reinforcement in the pit walls and floor, grates, drains and similar components must be interconnected (Figure 2). Grounding is completed with a copper conductor attached to the electrical system grounding electrode with an approved clamp. Bolted clamps used to join horizontal and vertical parlor framework pipes do not satisfy the requirements of a good electrical circuit. Consequently, pipes should be interconnected either through spot welding of the clamp or by using approved grounding clamps and copper conductors to bond around the clamp.

An equipotential plane reduces the risk of problem-causing voltages developing between individual cow contact surfaces. However, the equipotential plane can still be at a different voltage from the sur-

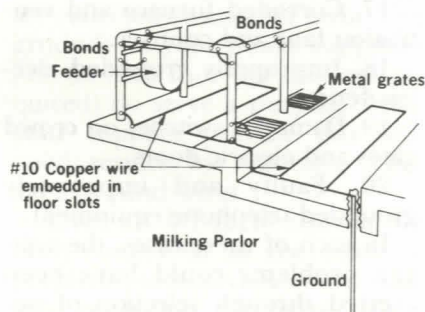


Figure 4. Embedment of copper wire in grooves cut into an existing concrete floor to form an equipotential plane.

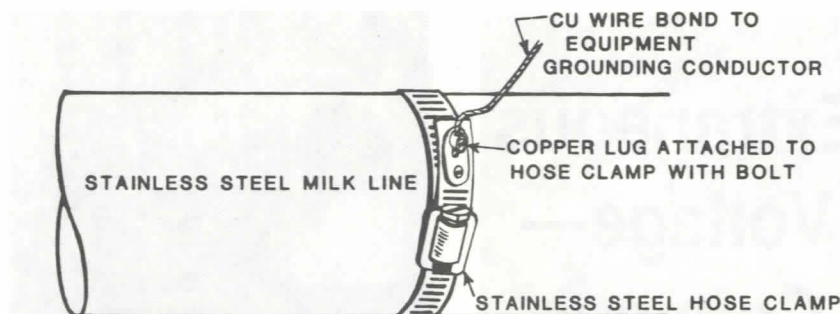


Figure 5. Grounding of stainless steel milkline using hose clamp and wire lug.

roundings. Thus, provisions must be made to allow movement of the cows from the surrounding area onto the equipotential plane. The recommended procedure is to install a voltage ramp (Figure 3). The ramp is constructed by placing steel reinforcing bars increasing distances apart from the parlor entrance out into the holding area. The same procedures must be followed in the return lanes to prevent cows from being shocked as they step across the threshold of the parlor onto the return lane surface.

The procedures described for installation of an equipotential plane are most appropriate in new installations. However, a similar procedure can be employed in existing facilities by installing a cap of new reinforced concrete over an existing surface. Copper wire can also be embedded in grooves cut into existing concrete (Figure 4). The same grounding procedures are followed as with new construction.

When two dissimilar materials are put into contact, a galvanic or corrosive action usually occurs. This is important when grounding stainless steel milklines since with most materials used in grounding clamps, the stainless steel of the milklines becomes the sacrificial metal. That means the stainless steel will gradually corrode due to electrolysis or galvanic action. Frequently the corrosion occurs out-of-sight on the inside of the milkline and is detectable only by a thorough investigation in response to high bacteria problems. To avoid this problem, ground stainless steel milklines by placing a stainless steel radiator hose-type clamp around

the milkline and bonding the ground wire to the end of the stainless steel clamp using a bolt and lug (Figure 5). In this way, if corrosion does occur, it will be noticeable on the stainless steel clamp and replacement will be easy.

In selecting an electrician, choose someone who is currently licensed in accordance with Nebraska law. Do not hesitate to inquire of your electrician, your feeding equipment installer, milking equipment dealer or other servicemen regarding the status of his electrician's license. Such requirements are a good business practice.

Summary

Freedom from hazards associated with electricity begins with good design. Selection of appropriate components and good installation increase safety and reduce maintenance. However, no system is maintenance-free. Adherence to these few guidelines will help assure that your "hired hand" continues to perform safely and efficiently.

Additional Information

For additional information concerning electrical system installation and grounding, contact the University of Nebraska Agricultural Engineering Department, 217 L. W. Chase Hall, Lincoln, Nebraska 68583-0771 and request copies of "Grounding and Wiring Recommendations for New Dairy Installations", EV-1; "Electrical Systems for Livestock Production Facilities—Recommended Procedures", ASAE Paper No. MCR83-124; "Lightning Protection for the Farm", USDA Farmers' Bulletin No. 2136; or the "Agricultural Wiring Handbook" (\$4.00).

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Extraneous Voltage—Common Causes

Gerald R. Bodman, P.E.¹

On-site surveys of more than 300 Nebraska dairy farms have revealed that voltages exceed currently accepted threshold levels within the cow environment in more than 50% of the installations. Some authors of articles regarding extraneous or stray voltage would have you believe that voltages of any magnitude anywhere on the farm are reason for concern. Experiences to date do not verify that conclusion. In many cases the voltage is from a source with insufficient energy to produce enough current to cause cow discomfort. Similarly, voltage differences existing between points outside of the cow environment are of no concern unless they pose hazards to personal safety.

Recently completed and in-progress research at the University of Minnesota and Cornell University has confirmed the appropriateness of the 500 millivolt (mV) (0.5 V) threshold level used in the Nebraska survey work. Still missing from the research data are a comparison between the effects of ac and dc voltages. The 500 mV threshold is appropriate for ac voltages. However, questions still remain as to whether voltages of 500 mVdc are troublesome.

Two purposes of the University of Nebraska—Lincoln extraneous voltage survey were to determine common causes of extraneous voltage and to develop diagnostic pro-

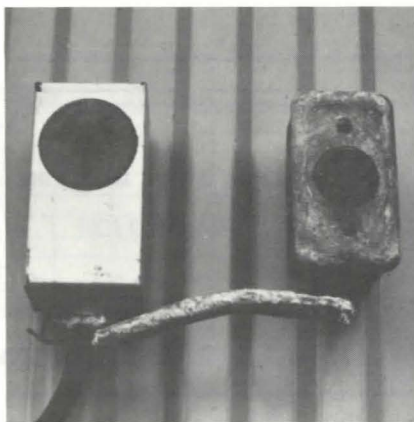


Figure 1. Boxes, switches and receptacles designed for use in dry environments can cause problems when used outdoors due to deterioration from rain and sunlight.

cedures and corrective remedies. Our work revealed that nearly 85% of all voltage sources were located on-farm. The remaining 15% were due to off-farm sources. More specifically, this means most dairymen were causing their own problems. Additionally, we found that 200 to 300 mV is an apparent baseline for Nebraska. That's the "price" we pay for having electricity on our farms.

On-farm Sources

Poor installation and maintenance of the electrical system were the primary causes of voltages from on-farm sources. Since electricity first came to Nebraska farms in the late 1940s, substantial amounts of equipment and electrical system loads have been added. However, in many cases, the wiring which was originally installed is still in place and in use.

Among common problems were:

1. Undersized secondary neutrals.
2. High resistance connections in neutrals.
3. Lack of grounding at service entrances.
4. Lack of grounding conductors between service entrance grounding electrodes and every piece of electrical equipment.
5. Interconnection of grounds and neutrals outside of service entrance boxes.
6. Deteriorated or rodent damaged insulation.
7. Equipment faults or shorts.
8. Use of electrical cables and

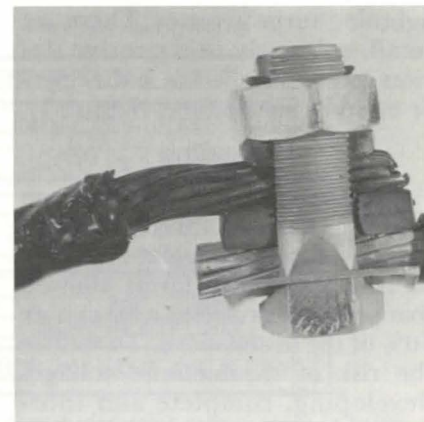


Figure 2. Poor connections on neutral wires increase voltage problems. Connections deteriorate due to improper connector usage, overheating or improper installation.

boxes designed for dry environments in wet, damp and dusty locations.

9. Corrosion of contacts in fuse, circuit breaker and switch boxes.

10. Accumulations of dust, silage debris and other dirt in electrical boxes.

11. Use of residential-style service entrance boxes in damp, dusty locations where water-proof or raintight non-corrosive enclosures are required.

12. Improper installation of receptacles resulting in reversed polarity and the case or shell of electrical equipment being "hot" when plugged in.

13. Non-continuous grounding wires within the electrical system.

14. Missing switch and box covers resulting in dirt accumulating around electrical contacts and causing current leaks under high humidity conditions.

15. Faulty silo unloader motors.

16. Faulty water heaters and electrically heated stock waterers.

17. Corroded furnace and ventilation fans and controls.

18. Improperly grounded electric fences.

19. Damaged switches on crowd gates and electric doors.

20. Faulty and improperly grounded telephone equipment.

In each of these cases, the voltage problems could have been averted through selection of appropriate electrical system components for the environment in which the equipment was to be used and

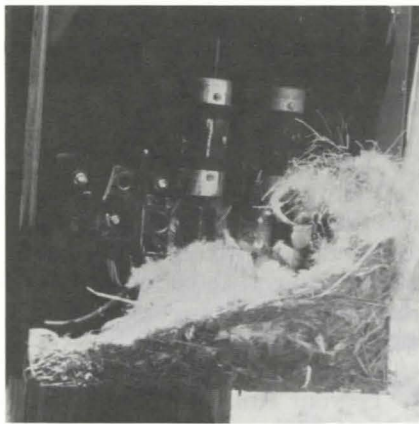


Figure 3. Debris accumulations in electrical boxes can cause extraneous voltage problems under damp or humid conditions.



Figure 4. Unprotected wires passing through metal siding result in extraneous voltage and safety problems when insulation becomes damaged.

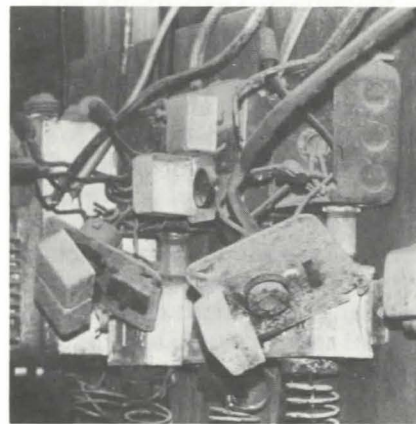


Figure 5. Poorly installed and maintained controls cause extraneous voltage problems due to corrosion, dust and moisture accumulation.

good electrical system installation and maintenance. Don't be your own problem—maintain your electrical system just like you do your new car or tractor.

Off-farm Sources

Off-farm sources include problems on neighboring farms and voltages developing from the power transmission or primary neutral system which are reflected on your farm. Some voltage between the primary neutral and ground is normal and is an inherent part of the electrical distribution system. Reduction of this voltage to zero is not a practical alternative, so long as we insist on having electrical service on our farm. However, in some cases the voltages are increased due to high resistance connections in the neutral or faults on other farms. Improper or poor grounding can result in sufficiently high primary neutral-to-earth voltages being developed that substantial primary current flow and associated voltage are reflected on another farm. The grounds on your power supplier's line (at least four per mile are required) do serve a purpose. Help your supplier provide you with good service by reporting damaged ground wires.

After an off-farm source has been confirmed as the cause of problems, several choices are available regarding corrective procedures. One is to assess the problem as being a matter of fact and installing an isolating transformer at

the milking center to prevent such voltages from being reflected in the barn. Another is to work with your electric utility company and have them verify the quality of their service line. As part of the UNL research project, procedures were developed to quantitatively evaluate connections while in place and under load. The third and most difficult part is to convince your neighbor that perhaps he ought to upgrade his electrical system to eliminate your problem.

Corrective Measures

Some researchers have advocated routine installation of additional ground rods as a solution to the extraneous voltage problem. The UNL work has not confirmed that adding additional grounds are, in all cases, the best solution. In some situations, improving the quality of grounding on a dairy farm actually can lead to increased voltages due to increased current flow at that location. Hence, before you undertake the driving of additional grounding electrodes in an effort to eliminate extraneous voltages, be certain you've correctly identified the problem.

Workshops held during the past year have resulted in nearly 300 Nebraska electricians and utility company employees being trained regarding diagnosis procedures associated with extraneous voltages. The most important diagnostic procedure is to use an orderly, systematic approach. The shotgun ap-

proach using equipment with unknown reliability can result in an expenditure of considerable sums of money with little or no positive effects to show for the effort. An understanding of electrical system safety procedures is essential.

Summary

To help achieve a satisfactory, complete and amiable solution to extraneous voltage problems, a team approach is recommended. The team includes you as the dairyman, your electrician, or an electrician familiar with extraneous voltage phenomena and your electric utility representative. Avoid the temptation to "point fingers" early in the investigation. Identification of the problem source often requires an extensive and thorough investigation. A calm, level-headed approach not only saves tempers but also eliminates antagonism and hard feelings and usually saves everyone stress and money.

Additional Information

As a first step in determining whether extraneous voltage might be a problem on your farm, and whether your electrical system might be contributing to the problem, contact the UNL Department of Agricultural Engineering at 217 Chase Hall, Lincoln, Nebraska 68583-0771 and request a copy of MCP-24, "Extraneous Voltage Problems—Producer's Checklist" and MCP-25, "Data Sheet for Problem Identification."

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Residue Avoidance Update

David D. Nitzel
Stan Wallen¹

The Nebraska RAP (Residue Avoidance Program) is now in its eighth month of data collection. This project is one of more than 30 RAP projects in as many states. In this study, we are identifying and quantifying sources of antibiotic contamination of milk and meat and developing management practices that will help reduce contamination. This data should help the dairyman save dollars from having to dump a bulk tank of milk or having a carcass condemned at slaughter.

Data collection involves two groups of producers: 1) those who have had antibiotic contaminated milk where the milk was either discarded by dumping from the bulk tank or was loaded into the tank truck, discovered later and then discarded; 2) those producers where there have been no detection of antibiotic contaminated milk. Both groups are being asked to keep records of treated cows to determine management differences.

So far 15 dairymen have agreed to participate in the data collection. Table 1 summarizes how or why bulk milk became contaminated in

their herds. No incidence of antibiotic residues has been reported among herds where treated cows are milked last.

Cooperators Keeping Records

During 1983, 150 Nebraska dairymen agreed to record their antibiotic usage and management for the project. Retrieval of records maintained by these dairymen began in September, 1983.

A slide/tape presentation, "How to Prevent Antibiotic Contamination of Milk and Meat," is being revised for educational purposes. The presentation stresses areas of management that should help prevent the occurrence of drug residues in milk and meat.

Publications

Several publications have been published as a result of the RAP project. Publications available are:

1. G82-619 How to Prevent Antibiotic Contamination of Milk and Meat.
2. An article in Dairy and Food Sanitation 2(10):404-404.
3. An amended article in Hoard's Dairyman 128(5):330-331.
4. An amended article in The Cheese Reporter Vol. 103, No. 45.
5. G83-654—Teat Dips—Selection and Use.

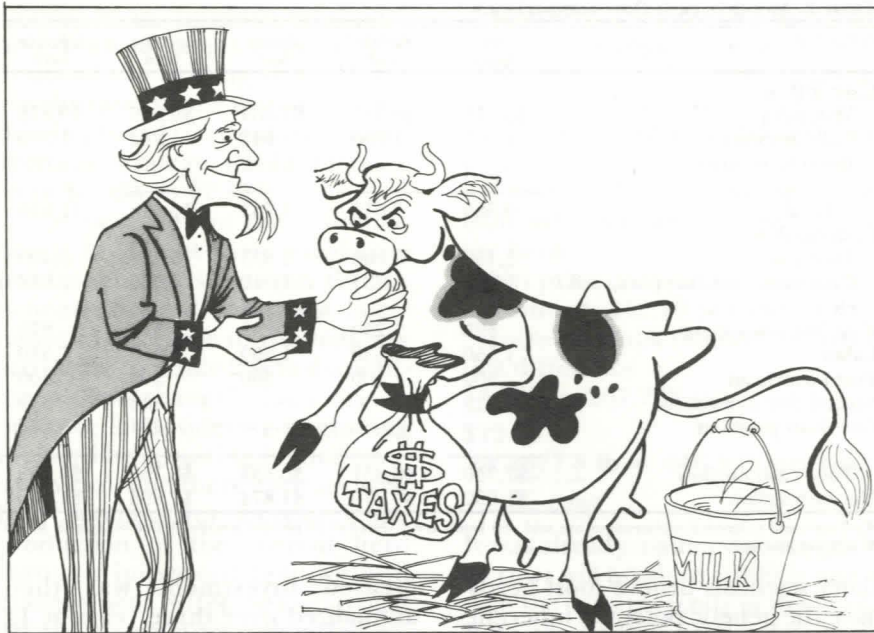
Conclusion

Much data has yet to be collected to quantify the overall "cost" of drug residues in milk and meat. Drug residues cost the individual dairyman as well as the milk market to which he sells, reducing the profit margin of the entire milk market structure. The dairy farmer must also strive to produce a wholesome food. Quality dairy products must start at the production level and retain that quality until it reaches the consumer. If these quality products cannot be supplied on a consistent basis, the consumer may reduce purchases and switch to other products. So the dairy industry MUST supply quality products that are free of antibiotic residues.

Table. 1 Summary of antibiotic contamination cases

1. One case involved improper use of wormer, which showed up as an inhibitor on the Delvo P test.
2. Two cases occurred when a cow was "accidentally" milked into the bulk tank—cows were not properly marked.
3. One case occurred where a dry cow crossed through a fence and then was milked.
4. Six cases where another person milked other than the individual who treated.
 - a. In three cases milker did not check written record.
 - b. One case due to lack of communication—no written record.
 - c. Two cases due to lack of communication—milker did not look for mastitis treated cows identified with leg bands.
5. One case—weigh jar not properly rinsed after milking a treated cow. Treated cows are not milked last in this herd.
6. One case—improper handling of antibiotics. Antibiotics were spilled on the milker's hands, hands were not washed, and then a good cow was milked.
7. Two cases—not sure what happened.
8. One case—vet prescribed a uterine flush, did not give the proper withholding time.

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Economics of the "Milk Tax"

H. Douglas Jose
Roy Frederick¹

A federal dairy price support program has been in place since 1949. For many years, a parity-based formula in the program assured the price of milk would increase at about the same rate as inflation. An integral part of the program required the Federal government to buy sufficient dairy products to bring milk prices to the support level.

The historical trend of fewer dairy cows has been reversed with cow numbers increasing slightly each year since 1979. Average production per cow has also been increasing each year. These two developments have produced larger and larger surpluses and by April, 1981 the costs of this excess production forced several changes in the dairy support program. A scheduled upward adjustment in support prices was waived at that time and later in 1981, the omnibus "farm bill" shifted support prices away from a specific percentage of parity specified in the formula. Then, in September, 1982, the Omnibus Budget Reconciliation Act gave the Secretary of Agriculture authority to imple-

ment producer assessments to help finance the support program. Initially, this assessment was 50 cents per cwt, but the assessment was later increased (September, 1983) to \$1.00 per cwt. The assessment is not made against farmers who reduce production by 8.4 percent from their historical base.

Despite these initiatives, milk production continues to increase faster than consumption. During 1981 and 1982 production exceeded consumption by about 10 percent. Excess production may be even greater in 1983.

The cost to the federal government of buying excess dairy products exceeded \$2 billion in the 1981-82 marketing year and is expected to do so again in 1982-83. The assessment program is intended to reduce the costs by requiring producers to, in effect, pay for a portion of the government's purchases. But the disincentive has been only marginally successful. There has been a succession of court challenges, and some producers may also be trying to maintain the returns to their fixed factors by increasing output.

The Alternative Government Program

Two other options are being considered to deal with the problem of excess dairy products.

The first is a "Compromise Dairy Bill", which is now before Congress. A \$10 per cwt. payment would go to those producers who reduce their marketings 5 to 30 percent from their base. The base is the amount of marketings for the period of October 1, 1981 to December 31, 1982, or the average of the two periods of October 1, 1980 to December 31, 1981 and October 1, 1981 to December 31, 1982. The bill would require a 50 cent per cwt. assessment against all milk marketed to help finance the paid incentive program. This would expire on December 31, 1984. In addition, the support price would be reduced from \$13.10 to \$12.60 and a mandatory 15 cents per cwt. check-off would be used for advertising and promotion.

The second option involves a straight cut in the support price of \$1.00 to \$1.50 per cwt. That is, the support price could be reduced to \$11.60 per cwt.

Each option would have a different impact on the dairy industry and individual producers. The incentive for individual producers to reduce production depends on their unique situation, their production costs, their debt situation, and their production levels. And although the national goal is to reduce total production, each producer will evaluate the program in relation to the alternatives that are feasible for their operation. Regardless of the option selected by legislators, it is clear dairymen will receive less for their milk in the future and producers need to plan accordingly.

It may not be economically feasible for some producers to reduce production. An example would be a producer who is highly leveraged and has a high capacity milking system with high fixed costs. This producer will maintain or increase production as long as the added returns from the milk produced exceeds the penalty for producing it.

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"Milk Tax" Economics

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Case Farm Animals

A case dairy farm situation is analyzed in the following example to determine the impact of the \$1.00 assessment for various alternative actions the operator could take. The case dairy farm is a 60-cow herd in Eastern Nebraska. This follows the situation used in our "1983 Estimated Crop and Livestock Production Costs for Nebraska". In this analysis, grain concentrate mix was valued at \$6.17 per hundred weight and alfalfa hay at \$55.00 per ton. The base situation used in the analysis is an annual average production of 13,000 lb per cow. The livestock investment is valued at \$2,234 per cow unit which includes .39 dairy heifers and .39 of a calf. The costs of raising these replacements are included in the costs. The base milk price of \$13.10 per hundred-weight was used in the calculations.

The basic premise of the analysis was that the dairy farmer must maintain the operation cash flow. Farmers have fixed obligations such as family living costs, debt payments, and taxes which must be met. The goal is to select the best positive cash flow alternative action.

These are the operating plans considered for the government program now in place:

1. No change. Maintain the present situation with the same 60-cow unit.
2. Reduce feed. Production can be reduced to meet program goals by reducing the feed per cow.
3. Reduce herd size by 10 percent.
4. Increase herd size by 10 percent.
5. Upgrade to higher quality cows.

A sixth possible alternative is a modification of plan five. That is an improved feeding and management program with the same cows.

Table 1. Situations analyzed.

	No change	Reduce feed	Reduce herd	Increase herd	Upgrade herd
Herd size in no. cows	60	60	54	66	60
Avg. annual prod. lb per cow	13,000	10,000	13,000	13,000	15,000
Herd monthly prod. in cwt	650	500	585	715	750

Table 2. Monthly cash flow comparisons.

	No change	Reduce feed	Reduce herd	Increase herd	Upgrade herd
Cash inflow					
Milk sales	\$8,515	\$6,550	\$7,664	\$9,366	\$9,825
Culls & calves	1,165	1,060	1,048	1,282	1,200
Interest income ^a			50		
Total	9,680	7,610	8,762	10,648	11,025
Cash outflow					
Feed cost	3,150	2,800	2,835	3,465	3,400
Cash cost: (vet, supplies, util., etc.)	1,900	1,731	1,710	2,090	2,088
First 50¢ assessment	325	250	293	358	375
Labor	1,550	1,550	1,550	1,550	1,550
Fixed overhead	500	500	500	500	500
Second 50¢ assessment	325	----	----	358	375
Cow loan payment	----	----	----	431	1,077
Total cash outflow	\$7,750	\$6,831	\$6,888	\$8,752	\$9,365
Net cash inflow	\$1,930	\$ 779	\$1,874	\$1,896	\$1,660

^aCull cows and unneeded replacements are sold and funds are invested at 10 percent interest. Value of animals sold is \$1,000 per cow unit.

Dairy scientists believe most herds have the genetic potential inherent in the existing cows to increase production by 2,000 lb per cow per year. The use of superior sires through artificial insemination has built up a genetic potential for increased production that is constrained only by environmental factors. The five basic plans are summarized in Table 1 and the analysis of each is presented in Table 2.

Comparison of Cash Flow

Table 2 shows the expected cash inflow from milk and livestock sales. The cash outflows including the two 50¢ assessments are shown in the bottom of the table.

The net cash inflow line shows the amount available to cover depreciation, return on equity, and income taxes.

Table 2 shows that three strategies have similar net cash flows. "No change" has the highest expected cash inflow of \$1,930 per month. "Reduce herd" and "increase herd" have cash flows of \$1,874 and \$1,896 per month, respectively.

Upgrading quality of the herd was fourth. For this strategy it was assumed an investment of \$500 per cow unit would be required to purchase higher quality cows. This in-

creased investment was then annualized over three years at 14 percent to get the monthly loan payment of \$1,077 shown in Table 2. It should also be noted from Table 1 that these cows would produce an average of 15,000 lb per year as opposed to the 13,000 lb for the base or current situation. The feed costs assumed for the "upgrade herd" situation should be similar to the feed costs for cows producing 15,000 to 16,000 lb of milk per year.

Let's go back and look at the possibility of an improved feeding and management program with the same 60 cows. The cash inflow will be the same as for the "upgrade herd" situation. There will not be a cow loan payment in cash outflow. We could assume cash costs associated with such things as feed, veterinary, and labor costs would be higher for this improved feeding and management situation. If the cash costs were 10 percent higher than the "upgrade herd" situation the cash outflow would be \$8,992 and the net cash inflow would be \$2,033 as opposed to \$1,660 for the "upgrade herd" situation presented in Table 1. Also, the cash costs excluding feed costs should not increase by 10 percent. The argument is based on the premise that cows possess the genetic ability to increase production by 2,000 lb exclusively through improved feeding and management. The feed costs for the "upgrade herd" situation which assumed

15,000 lb of production should have been sufficient to get 15,000 lb out of the existing cows. If this was the case the net cash inflow for this improved feeding and management strategy would increase from \$2,033 to \$2,373.

The next step in the investigation is to look at some breakeven production levels between the situations analyzed. The best alternative in response to the milk tax according to Table 2 is to do nothing or "no change". Let's say an operator is considering upgrading the herd by acquiring higher quality animals and there appears to be little potential for increasing the production of the current herd through improved feeding and management. After the loan is paid off, the monthly net cash inflow becomes \$1,600 + \$1,077 (loan payment) or \$2,737 and hence is the superior strategy to follow. If an operator upgraded his herd what production level is necessary to break even in the short run, that is, during the three year loan payment period? This is calculated as follows:

Monthly cash flow for "no change" strategy \$1,930
Monthly cash flow for "upgrade herd" strategy \$1,600
Difference \$270 or \$3,240 per year.

The \$3,240 figure represents the total net cash flow difference for the herd.

Net price received for milk after assessment, \$12.10 per cwt.

Increased milk required to cover this difference =

$\$3,240 = 267.768 \text{ cwt.}$

\$12.10

or $\frac{2677.8 \text{ lb}}{60 \text{ cows}} = 446.3 \text{ lb per cow}$

It was already assumed these quality cows will produce 2,000 lb more than the cows presently in the herd. With the 15,000 production level the net cash flow was projected to be \$1,660 per month. The above analysis says that if this produced an additional 446 lb per cow or a total of 15,446 lb, the net cash flow will be \$1,930 per month, the same as the "no change" strategy, assuming all production costs remain the same.

Implications

The analysis shows there has been little incentive to reduce total milk production. In fact, there has been incentive to increase milk production and the recent approach of assessing a tax of \$1.00 per cwt. is *not* going to be sufficient incentive for many operators to reduce production.

For many producers with above average production levels, there is little incentive to reduce production under the current government program provisions. The analysis shows the producer would be about as well off to maintain current numbers as to reduce the herd size by 10 percent. It would appear a stronger incentive is needed to convince dairymen to liquidate the substantial investments they have in cows and facilities.

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Brief Reports on Current Research

Foster G. Owen
Larry L. Larson¹

B. Subtillis as an Additive in Dairy Rations

B. subtillis is a mold in a spore form. It has been shown to exert various effects on the microflora within the intestinal tract of certain animals, including chickens and swine. Field observations from use of this additive in the ration of dairy cows in eastern Colorado and in Michigan suggested that it may also be beneficial in maintaining high milk production.

Therefore, an experiment was recently conducted at the University Field Laboratory at Mead to evaluate this additive in a conventional corn silage-alfalfa haylage based ration, fed along with a corn-

soy type grain mixture. The forage mixture was fed free-choice and the concentrate mix was fed according to level of production.

The intake of forage dry matter was about 22.5 lb daily and was practically the same for the control and additive-fed cows. Daily milk production averaged 60 lb and was not different between treatments. Milk fat content averaged 3.5%, resulting in fat-corrected milk yields of about 55 lb per day for both the control and treated cows. Neither was protein, lactose, or solids not fat different between treatments. We concluded that the additive had no positive or negative effect on milk yields or efficiency of production.

Branched-chain VFA's

Branched-chain VFA's (volatile fatty acids) are being researched as additives in dairy rations. These compounds are known to be required by microorganisms within the cow's rumen for effective ration utilization and optimum protein synthesis. In certain rations it appears that these VFA's may be deficient in amounts required for optimal performance. Therefore, this product is being evaluated at several universities for its possible benefits to high producing cows. Most of our work in this area has been concerned with palatability of the product in different forms. One concern has been its effect on rate of intake. This is of considerable

Reports on Research

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importance for those who feed grain to cows being milked in a parlor type facility where eating time is limited. Results are still incomplete.

Corn Cobs in Calf Starters

In earlier experiments we found that calf performance was improved by adding ground corn cobs to calf starters to serve as a "built-in" roughage. The improvement with cobs was greater in a previous experiment with pelleted rations than in another experiment when unpelleted (meal) starters were fed. Therefore, an experiment is now being conducted to compare a pelleted starter without cobs and a pelleted starter with cobs with our standard unpelleted starter, containing no cobs. This study may have special application to the feed industry, since most commercial starters are pelleted.

Lactobacillus for Milk-Fed Calves

Research with various species indicates that lactobacillus plays a role in relation to the microflora in the intestine, producing favorable effects. Field evidence reported to us suggested that the baby calf may also benefit in terms of reduced diarrhea and possibly other health problems. An experiment now in progress is evaluating the possible value of commercial lactobacillus products administered daily through the milk feeding period. Results are being summarized.

By-pass Proteins

Protein sources highly resistant to breakdown in the cows rumen are called by-pass proteins. Since protein is a high cost item in many dairy rations there is strong interest in the possibilities that such proteins could reduce the cost of feeding dairy cows.

High amounts of supplemental proteins are often needed in the ration of high producing cows. Research has suggested that when feeding soybean meal as the source of supplemental protein much of its protein is wasted because of excessive breakdown in the high pro-

ducing cow's rumen. Therefore, we conducted an experiment with lactating cows to compare soybean meal with blood meal and corn gluten meal, which are by-pass type proteins. Results indicated that these by-pass proteins were not superior to soybean meal when both were supplemented to provide a total ration protein of 14%. Average daily milk yield (65.0 lb) was nearly identical in cows fed the two by-pass protein rations containing 14% protein which was similar to the average yield (65.7 lb) of cows fed the control diet containing 18% protein. Daily intakes of dry matter, however, were highest for the high protein ration, but efficiency of feed protein conversion to milk protein was lower. Percentages of milk fat, protein, lactose and total solids were similar among treatments. These cows were all at, or past, peak milk yield when the protein percentage needed in the ration is expected to be somewhat less than in the early stage of lactation. Recent studies indicate that at high levels of feed intake soybean meal is not degraded as extensively as it is at low intake levels. Since the high producing dairy cow will often consume twice as much, or more, as a non lactating animal, considerable more soybean meal may escape rumen breakdown than has been assumed. This may account for the lack of difference seen in this experiment between soybean meal and the mixture of blood meal and corn gluten meal, which are classified as bypass proteins.

Beta-carotene

Studies are continuing with both heifers and lactating cows to determine whether beta-carotene supplementation affects reproductive performance or health of cows in early lactation.

Level of Grain Feeding in Late Lactation

A trial is now in progress to examine the effect of the amount of grain ration fed to cows in late lactation on milk yield, calving difficulty and health problems soon after freshening. We hope to learn whether feeding moderate or low levels of grain ration rather than

heavy levels will reduce health problems at calving and the effect of such feed reduction on milk yields. Economic effects will be evaluated.

Artificial Insemination Techniques

An experiment has been started to test the following procedures which seem to offer promise for improving conception: breeding with a covered AI gun, giving a vaginal douche, and treating the cow with GNRH, a hormone.

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