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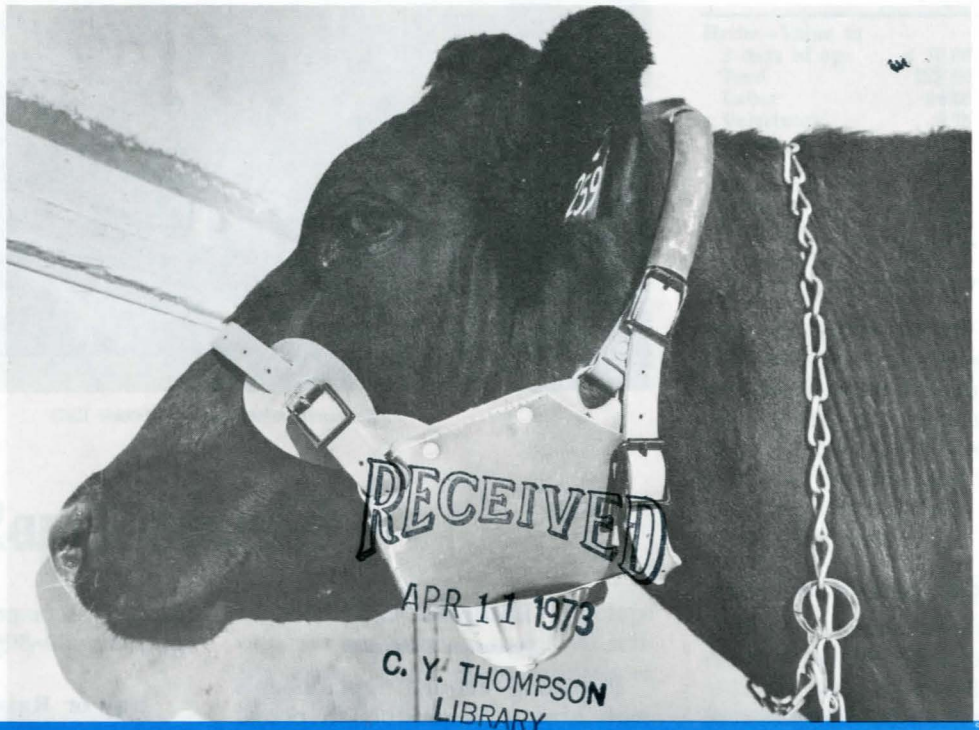

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1972 DAIRY REPORT

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Issued March 1973, 3,600

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

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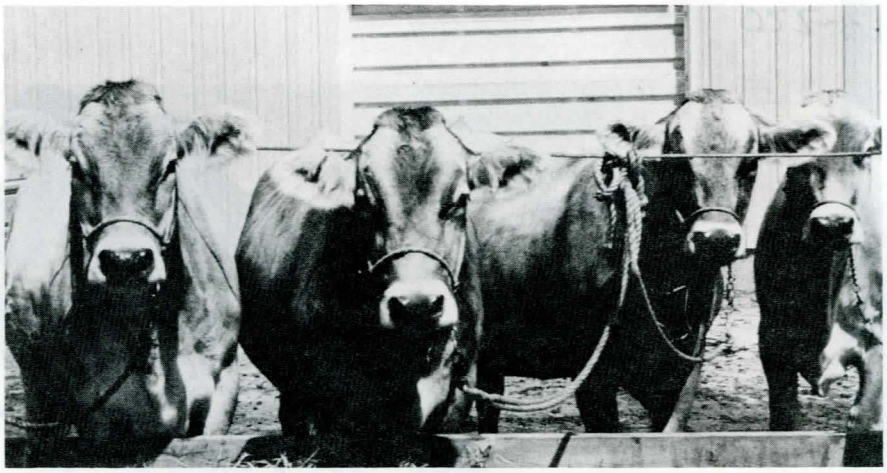


Brown Swiss heifers.

Should You Buy or Raise

Philip H. Cole
Extension Dairyman

Providing enough replacements with high milk production potential is one of the most important jobs a dairyman has to perform. Improvement of any herd is possible only when cull cows are replaced by well-fed and well-bred replacements.

One of the surest ways to improve herd production is to mate cows to sires of known transmitting ability, then feed and manage the resultant heifers in a manner which enables them to express their inherent potential for high milk production.

The number of calves dairymen need to raise each year to maintain herd size depends largely on herd management and herd health. Dairy Herd Improvement Association results indicate that 20–30% of the milking herd must be replaced each year.

Not all calves born will live, develop properly or reproduce well. Calf losses during early life run as high as 30% on some farms. Table 1 indicates the number of replacement heifers available under good, average and poor management when calving intervals are 12 and 15 months. It is obvious that when management is average or less, little, if any selection of replacement heifers can be made to replace the 20–30% animal turnover.

Buy or Raise Replacements?

Dairymen should raise their own herd replacements. However, it is no longer true that all dairymen benefit from this practice. Many commercial herd owners have found it necessary to buy part or all of their replacement heifers.

With the specialization found in dairying, dairymen should consider raising replacements as a separate enterprise. This means a careful analysis of the cost of producing replacements must be made. Some dairymen would then realize that it is costing more to raise heifers than the animals are worth as springers or young cows.

Some will conclude it is best to buy their replacements—a good decision if based upon present information, conditions and experience.

If you are going to do an average to poor job of raising replacements you will probably be better off buying them than raising them.

From a disease prevention standpoint it is better to raise your own replacements than to have them contract raised. Contract raising is preferred to buying heifers; buying open heifers is preferred to buying bred heifers; and buying bred heifers rather than adult animals is

ACKNOWLEDGMENTS

Appreciation is expressed to the following firms and organizations for their support of the dairy research and extension programs:

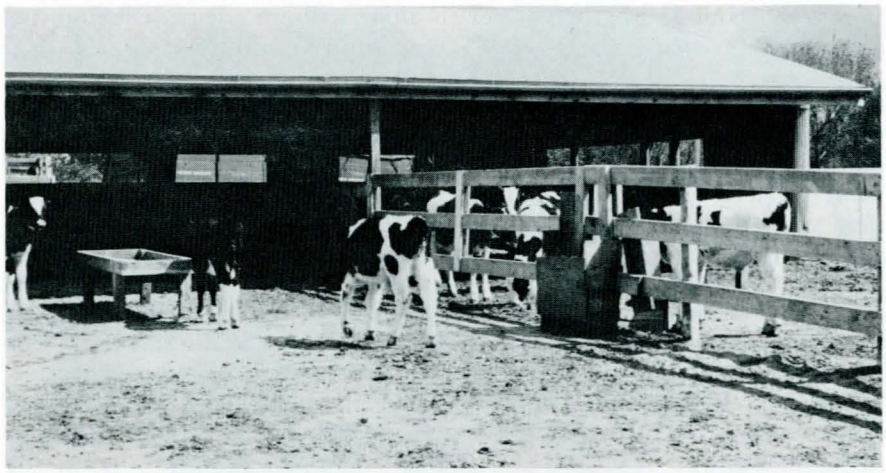
American Dehydrators Association
Mission, Kansas

BZD Livestock Products
Lincoln, Nebraska

Chas. Pfizer and Company
Terre Haute, Indiana

MaNuVa Products, Inc.
Salinas, California

Mid-America Dairymen
Omaha, Nebraska



Calf shed for replacement raising.

Dairy Herd Replacements?

preferred. Advantages and disadvantages of raising your own replacements:

Advantages

1. You have a better knowledge of animals coming into your herd.
2. You can avoid some disease problems that might exist when animals are contract raised and particularly when animals are purchased and brought from other herds.
3. It is not likely you will be able to get the top animals in a herd when buying replacements.
4. Everything being equal, it offers replacements at a minimum of cost.
5. There is pride in having a breeding program that develops outstanding animals and even selling some of your excess animals to other dairymen.

Disadvantages

1. It complicates the management of a specialized dairy farm. It is frequently necessary to keep as many head of young stock of various ages as you have cows in the milking herd.
2. Replacements frequently compete with the dairy herd for labor, space, forage and capital that might return more profits through the milking operation.
3. Everything is seldom equal, consequently some dairymen have more skill in buying replacements than in raising calves. Some have little sensitivity for conditions that will keep calves healthy and mortality losses at a minimum. Some have little sense of direction for a breeding program and have no desire to merchandise animals to other dairymen.

Table 1. Potential yearly calf crop and heifer replacements per 100 cows with cows calving at various intervals under various management conditions.

Potential calves per 100 cows per year	Predicted loss percent			12-month calving interval: 100 potential calves			15-month calving interval: 80 remaining after loss		
Management conditions	Good	Av	Poor	Good	Av	Poor	Good	Av	Poor
Loss due to:									
Sterility	3	7	10	97	93	90	77	74	72
Abortion	3	6	11	94	87	79	75	69	63
Stillbirth	3	7	12	91	80	67	72	63	53
Death before 23 months of age	5	12	17	86	68	50	67	53	40
Males	50	50	50	43	34	25	34	27	20
Potential female replacements	....	....	....	43	34	25	33	26	20

Table 2. Cost of raising replacements to 24 months.

	Amount	Percent
Heifer—Value at 3 days of age	$ 70.00	16.9
Feed	229.50	55.5
Labor	34.00	8.2
Veterinary	9.75	2.4
Breeding	10.00	2.4
Misc.	11.90	2.9
Mortality	9.36	2.3
Housing	19.42	4.7
Interest	19.49	4.7
Total:	$413.42	100.0

Cost of Raising Replacements

Two elements are required to make a budget meaningful:

1. A history or record of past performance or experience.
2. An accurate estimate of costs that will apply to the items or ingredients as they are performed or purchased during the 24 months of the replacement raising program.

The major items or ingredients are not difficult to enumerate, but to specifically include all charges is impossible. Further, the individual manager must make decisions as to whether investment in a particular ingredient of production can be justified by the probability of a profitable return, or by the avoidance of a probable loss if the investment is not made.

Feed—For large calves, assume they will be off milk or other liquid feed by the time they are two months old. Calves of small dairy breeds should require about the same amount of milk or replacer, and starter as large breed calves, but they require this amount over a longer period. Therefore, three months or 90 days are required for the first period for small calves.

The use of silage and pasture is not indicated. Certainly a wise manager will make frequent substitution of silage for hay and pasture for hay where it fits into his pro-

(continued on next page)

Dairy Herd Replacements

(continued from page 3)

duction scheme, but these substitute feeds will not greatly change the cost unless the operator is willing to provide these forages at greatly reduced prices.

Labor—Estimating time involved in raising replacements is difficult and labor per calf can vary depending upon facilities and equipment. If an accurate survey or record keeping program was instituted to determine the labor requirement, the amount of time spent on raising would be the "charge per hour."

Morbidity and mortality rates are both possible causes and effects of the labor used in raising heifers. If calves are kept healthy and alive, less time is required to take care of them. On the other hand, if time required to care for them is shortened, more sickness and probably a higher death rate will occur.

Veterinary Medicine and Breeding—Estimates of veterinary expenses and breeding include drugs. It is expected that many of the simple procedures and treatments will be done by the herdsman.

A pregnancy examination at 45–60 days may save sufficient time to pay for its cost. If a highly competent veterinarian performs this service, the addition of this cost will probably be returned many times over by less delay in time the heifer comes into production; reduced feed consumption before she comes into production, and, if sold as a bred heifer, a higher reliability and a greater trust in the integrity of the producer on the part of the purchaser.

Miscellaneous Charges—Charges included here are mainly for bedding, taxes and insurance. During the first two months of the calf's life some heat and electricity will be used.

Housing Costs—The most expensive part of the housing costs comes during the first 60–90 days. It is assumed here that a nursery building with pens 3′ by 4′ or smaller tie stalls will be used. Considering alleys and feed storage and preparation area, about 25 square feet per calf will be needed.

This area will need concrete floors, pens, insulated walls and ceiling, some supplemental heat, fans for ventilation, lighting, equipment for feed preparation, sanitation and probably water under pressure.

A one-third to one-half occupancy would be maximum for a dairyman who has most of his calves dropped in early fall and winter, and who doesn't purchase other young calves to be raised for replacements.

Open housing will suffice for calves two months old and over. Thirty five square feet per heifer should be adequate.

Other housing might be used during the nursery period—calf hutches, for example, might be cheaper to construct per calf but their life would likely be less than 10 years.

Mortality—A herd owner should strive to keep calf mortality below 5 percent. Those that have losses as high as 15 percent probably should buy their replacements. Anyone losing more than 15 percent of the heifers produced by the herd will find it necessary to purchase some replacements if any culling for improvement is to occur.

Interest on Investment—On any enterprise that involves a long period of time, (in this case, two years) interest becomes an important cost factor. The fact that interest on investment represents a higher charge than anyone of four other charges—veterinary, breeding, miscellaneous costs, or mortality at the 10% level—seems at first hard to believe. Further, in this budget the cost of labor, mortality and housing were not included. Calculation of interest is made on the investment at the mid-point in a growth period at a rate of 6 percent per annum.

Management, 6 Months to One Year

After heifers reach six months of age, good growth without fattening can be achieved by feeding an abundance of good quality forage along with an adequate amount of a simple grain mixture (14–16% crude protein). Often, the same mixture being fed the dairy herd is satisfactory. The hay (or hay equivalent if pasture and/or silage is fed) to grain ratio should be limited to a 2 to 1 ratio.

If high quality forage is fed, heifers of the large breeds can be limited to four pounds of grain per day and those of the smaller breeds to three pounds per day. When forage is of poor quality or in limited supply, grain levels may need to be increased. When available, the roughage can be good quality silage or pasture.

Heifers on pasture should have free acess to fresh water, iodized salt, a high phosphorus mineral mixture (steamed bone meal, dicalcium phosphate are examples), and adequate shade and protection from flies. Heifers on pasture and those receiving silage should also be fed some hay.

Management, 12 Months to Freshening

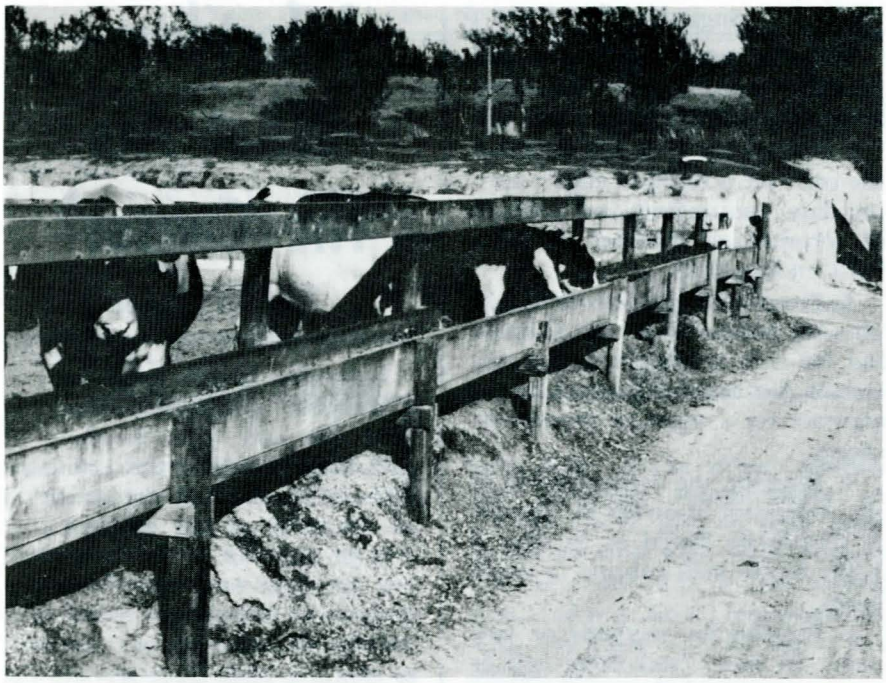
Heifers that have made normal growth as calves through 12 months of age can be grown to freshening age by feeding maximum amounts of good quality forage and a minimum amount of a simple grain mixture. Improved pasture, good quality hay and silage are all suitable forages for yearling heifers when fed alone or in combination with each other.

If heifers are to reach good size as 2-year olds, they should be kept growing continuously from birth to freshening.

Effects of Over-conditioning

The effect of plane of nutrition during early life upon the performance of Holstein dairy cows was studied by Cornell workers. Calves were assigned at random to three groups and fed at low (65%), medium (100%) and high (140%) levels of nutrition from birth to first calving. Nutrition levels were based upon Morrison's energy standards for growth and maintenance.

From first calving to second calving, those grown at low, medium



Replacements sometimes compete with the herd for labor.

and high planes of nutrition to first calving received 118%, 109% and 100% of Morrison's standards, respectively. From second calving on, each group was fed at 100% of Morrison's standards for production, maintenance, growth and reproduction.

Services required or first conception were not significantly different. Heifers raised on the low plane required 1.55 services, those on the medium, 1.41 and those raised on the high plane of nutrition required 1.48 services per first conception.

This is a longtime experiment, but results to date indicate that heifers raised on a high plane of nutrition to first calving fail to produce as well as those fed at either the medium or low plane (Table 3).

Tennessee workers, using identical twin Jersey heifers, obtained similar results. In this study, heifers fed according to Morrison's standards (100%) outproduced those fed at a high level of nutrition (153%) for the first two lactations by giving nearly 12.5% more milk.

Though the reasons for this are not fully understood, it has been theorized that (1) fatty deposits in the udder prevent development of some of the secretory cells; (2) possibly over-conditioning reduces the ability of the cow to produce an adequate supply of the lactogenic hormone (the one responsible for initiation of production and persistency of production), thus preventing her from being able to express her true inheritance; and (3) the resulting additional body weight requires a greater amount of feed for maintenance. Some workers have also observed that the udders of cows overconditioned as calves and heifers have a more meaty texture. As a result, the circulation or blood flow to and from the udder may be somewhat reduced.

Table 3. Average lactation yield of milk by nutrition level.

Lactation	Low (65%) lb	Medium (100%) lb	High (140%) lb
1st	8,840	9,083	9,226
2nd	10,450	10,450	9,752
3rd	10,932	11,438	10,777
4th	11,827	11,223	10,713
5th	13,225	12,966	10,887
6th	13,385	11,772	11,322
Total of averages for 6 lactations	68,659	66,932	62,677

Table 4. Age and size to breed.

Breed	Age (months)	Normal weight (pounds)
Ayrshire	16–17	730–780
Brown Swiss	17–18	860–910
Guernsey	15–16	640–690
Holstein	16–17	850–900
Jersey	15–16	580–630
Milking Shorthorn	16–17	740–790

When to Breed Heifers

In general, heifers of each of the major dairy breeds that have made normal growth may be bred at 15 months of age. Dairymen may want to breed some heifers at an earlier age and others beyond 15 months to comply with fall calving schedule.

Heifers bred to calve early (less than 24 months of age) should have feed intake restricted during the last 6–8 weeks before they are due to calve. This could aid in reducing the size of the calf and help prevent difficulty at calving.

Early breeding of well grown heifers should make it possible to gain lactation, shorten the "boarding" period and increase the overall efficiency of dairy production (Table 4).

Feeding, Care of Bred Heifers

The bred heifer can be fed and handled in the same manner as other yearlings until the last two or three months of pregnancy. The last three months is the period in which the unborn calf makes nearly two-thirds of its growth. Therefore, during this time a bred heifer may need extra grain for condition, growth of the fetus and her own growth. Heifers may require as much as 8–10 pounds of grain daily a few weeks before calving. On the other hand they may need very little, if any, grain. The main precaution is not to get them fat.

At least two months before calving, it is good practice to introduce

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Dairy Herd Replacements

(continued from page 5)

the bred heifer to the milking herd. This permits her to become accustomed to the other cows and the new premises. Some dairymen run heifers through the milking parlor for a period before they calve. All these practices are aids in training the heifer in good milking habits.

Life-long milking habits are often formed by the way a heifer is trained and milked at first calving. First calf heifers should be handled gently and properly prepared for rapid milking.

After lactation has begun, keep in mind that first calf heifers are still growing. They should therefore be given an extra allowance of protein and energy (grain) above the requirements for maintenance and milk production so that they can milk to capacity and finish growing at the same time.

Contract Heifer Raising

Dairymen with limited facilities who wish to expand their milking operation can do so by having their replacements grown under contract. Contracts may be those with an option-to-purchase, or direct contracts. Contracts should be equitable to both the dairymen and the growers and flexible enough to accommodate cost changes and desires of the parties involved.

Drawing Up a Contract

Contracts may be either option-to-purchase owner sells the calf but reserves the right to buy the springer that results at market price) or direct contracts (dairyman retains ownership and pays the grower a fee). Regardless of the type contract, it may be advisable for dairymen to keep their calves until they reach at least three months of age, since the grower may not have an available supply of milk. This eliminates bucket feeding of milk or a milk replacer thus reducing some of the risk of scours and high death losses.

Contracts should protect both the dairyman and grower.

Suggestions

1. Specify what the grower shall provide: feed, water, electricity, housing, pasture, management, etc.
2. Specify the period of time that the contract is to be in effect: starting date, ending date and a means of terminating contract at other than ending date.
3. Provide for the grower to take physical possession of the animals, but for title to remain in the contractor (list animals covered by the contract on a separate description sheet).
4. Describe the responsibility of the contractor as owner of animals. It should be stated as to who is liable for animals injured or death losses.
5. Provide for methods of payment. In many cases there will be prepayments to help pay the grower's out-of-pocket costs, as well as final payment.
6. A minimum rate of daily gain per heifer should be stipulated plus the provision that failure to provide management to achieve this gain will result in termination of the contract or in adjustment of the compensation for raising.
7. Provide for repossession.
8. Provide for adding animals to the contract.
9. Provide for disposal of non-breeders.
10. Provide for disposal of poor dairy prospects.
11. State who shall pay the cost of vaccination, worming, dehorning, breeding and similar items. Specify the various vaccinations that must be given and specify the ages at which they must be given.
12. Stipulate who is to pay for transportation. This should also include a stipulation for the place of weighing the calves and springer heifers.
13. Provide for taxes and assessments.
14. Amendments to the contract.
15. Consider arbitration. Statutes have been passed in most states which require certain arbitration procedures to be followed if the parties agree to arbitration.

Infertility— What Are The Causes?

Larry L. Larson
Asst. Professor (Reproductive Physiology)

Infertility in the dairy herd is a common complaint. Increasing herd size and mass handling of cows together with the economic squeeze has focused the attention of dairymen on this problem.

Infertility can be an individual cow problem or a herd problem. The top milk producer in the herd receives more attention. If she fails to conceive after three services the dairyman may feel he has a reproductive problem although several average cows might be repeat breeders and not be considered a real problem.

Approach

1. Determine if an infertility problem exists.
2. Note what aspect of reproductive efficiency is affected and determine what factors could be involved.
3. Eliminate as many factors as possible.

An infertility problem cannot be solved until it and the factors involved can be identified.

Identifying the Problem

To determine if a herd reproductive problem exists, it is necessary to know the level of breeding efficiency you can expect to achieve. This should be done by systematically comparing your herd average with the expected normal range for each criterion of breeding efficiency. A New York study (1970) examined some criteria and determined the average frequency of occurrence for each (Table 1).

These are averages and some variation should be expected from year to year. There is no herd infertility problem if these goals are attained, even though there might be an individual cow problem. A

Table 1. Goals for good reproductive efficiency.[a]

Criterion	Expected range (herd average)
Abortions (%)	1– 2
Retained placentas (%)	5–10
Metritis (%)	5–10
Cystic follicles (%)	5–15
Anestrus after 60 days postpartum (%)	2– 5
Postpartum interval to first estrus (days)	30–40
Postpartum interval to first breeding (days)	70–75
Breeding efficiency	
Services per conception (no.)	1.3– 1.5
30-day nonreturns (%)	70–75
60–90-day nonreturns (%)	65–70
Repeat breeders (%)	8–10
Calving interval (months)	12–13

[a] Cornell University (1970)

reproductive problem in about 10% of the cows is to be expected. This may involve one or more of the criteria noted in Table 1. By noting which criteria are affected you can obtain a general indication whether the problem is disease, general hygiene, infertile semen or management.

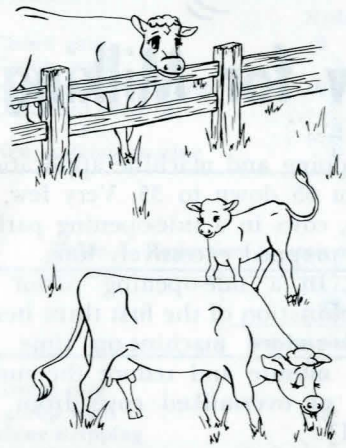
Abortions: Primarily this is a disease and poor sanitation problem. Also, it can be caused by improper nutrition, molds, endocrine imbalance, stress and physical injury.

Retained Placentas (afterbirth): This is a rather common occurrence in cattle where the snap-like attachments between the membrane surrounding the fetus and the uterine wall fail to separate.

The incidence of retained placentas is increased following twinning or where there are calving problems, disease, uterine infections and poor nutrition. The maternity area should be as clean and free of bacterial contamination as possible. Sunshine will destroy most bacteria in areas that are dry and do not have an accumulation of manure and old bedding.

Metritis: Primarily a sanitation and hygiene problem. Usually occurs after retained placentas or other calving problems. It may be an indication of poor hygiene at calving. The infection can be spread between cows in poorly maintained free-stalls where the cows' vulvas are against the retaining boards at the back of the stalls. If it occurs after natural service it may indicate an infected bull.

Cystic Follicles: Primarily an endocrine dysfunction. These occur most often in the winter months and following complications at calving. Cystic follicles have been associated with high milk production probably due to the added stress and nutritional requirements. This condition may be somewhat hereditary.



Anestrus After 60 Days Postpartum (failure to cycle): Either a health or management problem. A Minnesota study found that 90% of reported anestrus cases were due to failure to observe heat. It is recognized that "silent heats" do exist. However, 93% of the cows in a New York study had shown visual signs of heat by 90 days after parturition.

Common causes of true anestrus are pyometra (uterine infection), cystic follicles and stress (nutritional inadequacy). Pregnancy should be considered if it is possible that the cow was bred.

Postpartum Interval to First Estrus: Same as above. Calving and sanitation problems will lengthen this interval. Silent heats are more frequent during the early postpartum period. Close observation is necessary to detect heats.

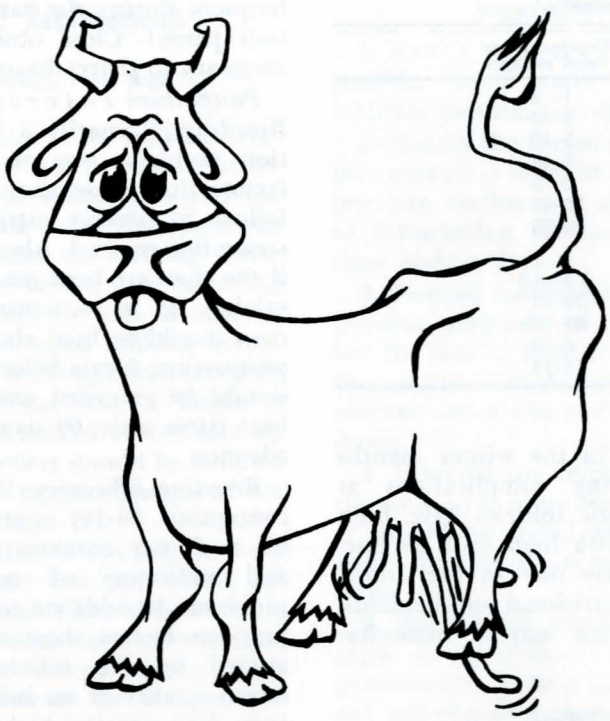
Postpartum Interval to First Breeding: Primarily a heat detection problem. Any of the above factors that cause anestrus or the failure to observe estrus will increase this interval. Also a problem if the cows are bred too soon after calving. It is recommended that cows should be bred about 60 days postpartum. Heats before this time should be recorded and expected heat dates after 60 days noted in advance.

Breeding Efficiency: Services per conception, 30-day nonreturns and 60- to 90-day nonreturns are general indicators of reproductive problems. In addition to all of the previous factors these criteria are altered by the following: poor semen quality or an infertile bull, poor insemination technique, improper time of breeding, abnormal egg, abnormal uterine environment and anatomical abnormalities. A 60- to 90-day nonreturn rate that drops more than 10–15% below the 30-day percentage would suggest too many early embryonic deaths or repeat breeders or both.

Repeat Breeders: Factors that could be involved in regular repeat breeders (cycle every 17–24 days) include: poor quality semen or infertile bull, bred too early or late in the heat period, abnormal egg, low grade infections and anatomical abnormalities. Factors that might cause irregular repeat breeders (cycles 1–16 days or greater than 25 days in length) include: cystic ovaries, early embryonic death, pyometra and silent or missed heats.

Calving Interval: This is the best overall indicator of a reproductive problem. If any of the criteria of reproductive efficiency are abnormally high the interval will be increased. Therefore, all of the factors discussed can alter this criterion.

If the nature of the reproductive problem can be identified by examining and determining which criteria are involved one has taken the first big step toward solving the problem.



Preparing the Cow for Milking

Robert D. Appleman
Professor (Dairy Production)

Milking practices could be improved on most Nebraska dairy farms.

University of Nebraska animal scientists arrived at this conclusion when, with the aid of a computer, they simulated several different combinations of milking parlors and milking routines using motion and time study data.

A recent study by C. F. Micke and R. D. Appleman has led to these conclusions (when milking 100 cows):

1. A mechanical crowd gate saves 55 hours of labor yearly.
2. A group-washing system saves 140 hours of labor daily.
3. The absence of machine-stripping saves 249 hours of labor daily.
4. The combination of these will reduce the percent of time the man is busy in the parlor from 88% to 60%.
5. In a herringbone parlor, a group-washing system and the abscence of machine-stripping will reduce the number of cows having an excessively long interval between prepping and machine application from 65 down to 35. Very few, if any, cows in a side-opening parlor are prepped excessively long.
6. In a side-opening parlor, a combination of the first three items will reduce machine-on time by one minute and reduce the number of overmilked cows from 49 to 11.
7. In a herringbone parlor, a combination of the first three items will reduce machine-on time by one-half minute and reduce the number of cows overmilked from 17 to 0.
8. In a side-opening parlor, the combination of mechanization, no stripping, and milking more cows to make up for the time saved can increase net returns by $5,000 yearly.
9. The same combination in a herringbone parlor can increase net returns by $7,000 yearly.

Assumptions

In this study, the side-opening parlor was a double-2 equipped with pneumatic, positive action entry and exit gates. A single milker handled four units. The herringbone parlor was a double-4, with a single milker handling four units.

The crowd gate was mechanized and equipped to stop automatically from pressure against the remaining cows. The group-washing system employed irrigation sprinklers in the holding pen floor that thoroughly washed the underside of all cows simultaneously.

"No machine-stripping" was defined as the absence of machine-stripping other than a one-time massage of each quarter while simultaneously adding weight to the unit claw. Based on previous studies, a 3% drop in annual milk production per cow is expected when the machine-stripping of each cow is dropped from the milking routine.

Results

There are two primary measurements of efficiency, one dealing with parlor efficiency (time required to milk 100 cows) and the other associated with the milker's performance (percent of time the man was busy). Results are listed in Table 1.

A crowd gate resulted in a five minute savings in milking time. Group-washing saved 12 minutes of time while the absence of machine-stripping saved over 20 minutes. These three combined would appear to save 37 minutes per milking or 444 hours per year. However, because each function is not completely independent of the other, the computer tells us that we can expect only a 29 minute savings or about 350 hours yer year.

The no-machine strip routine lowered the percent of time the milker was busy by 13 percentage units. Group-washing lowered it about 8 percentage units while a crowd gate had little effect. When all three are combined in one system, again because of the interaction, the percent busy time is expected to drop from 88%, which is too high, to a very acceptable 60% figure.

In terms of how well a milking system and routine performs, there are two phases of the cow response

that should be studied. One is the proper preparation of the cow for milk letdown; the other in how much overmilking occurs. In these respects, the side-opening and herringbone parlors are quite different.

Proper preparation of the cow is necessary to obtain maximum milk letdown and fast milking. It requires about 45 seconds after the initiation of stimulation before milk letdown occurs; thus, the milking unit should not be applied too quickly. However, the effect of the milk letdown hormone, oxytocin, decreases with time, so milking time increases materially if the machine is not applied within 2½ minutes after initiation of letdown.

At the other end of the milking process is the timing of machine removal. Research results do not clearly demonstrate that overmilking is a predisposing factor in causing more mastitis. However, overmilking does result in a longer machine-on time and lowers the cows-per-hour capacity of a milking parlor.

Side-opening Parlor

In the typical side-opening parlor, cows are prepped individually and the milking unit applied immediately—before the milker moves to another stall. This results in an average 15 second prep-time, considerably less than the recommended 45 second average. Group-washing tends to lower this another 5 seconds, while a crowd gate and no-machine-stripping routine have little or no influence (Table 2). Since cows in a side-opening parlor rarely go 2.5 minutes after initiation of letdown, adding mechanization or the cessation of stripping will not improve this characteristic.

Machine on-time, due to more overmilking, averages about 45 seconds longer in the side-opening parlor than it does in the herringbone parlor. In the typical side-opening parlor, a unit is removed from cow A in stall 1, cow B then enters stall 1, is prepared for milking and the unit attached before the milker leaves to give attention to one of the cows in stalls 2, 3 and 4. Any or

(continued on next page)

Table 1. Reduction in time required to milk 100 cows and percent of time the man is busy.

	Time required to milk 100 cows		% time man is busy	
	Side-opening	Herringbone	Side-opening	Herringbone
	(min)	(min)		
No crowd gate No group wash Machine stripping Old routine	188	169	89	89
	Reduction in time		*Reduction in %*	
1. Crowd gate	5	4	1	2
2. Group wash	11	12	6	10
3. No machine stripping	19	22	12	14
4. Combined effect of 1 + 2 + 3	29	29	27	29
5. New milking routine	0	0	0	0

Table 2. Reduction in stimulation time and percent of cows prepped too long.

	Av. stimulation		% cows prepped > 2.5 min.	
	Side-opening	Herringbone	Side-opening	Herringbone
	(min)	(min)		
No crowd gate No group wash Machine stripping Old routine	.4	3.2	0	65
	Reduction in time		*Reduction in %*	
1. Crowd gate	0	0	0	0
2. Group wash	.1	.5	0	10
3. No machine stripping	0	.6	0	16
4. Combined effect of 1 + 2 + 3	.2	1.0	0	30
5. New milking routine	0	1.7	0	41

Table 3. Reduction in unit-on time and percent of cows overmilked.

	Unit-on time		% cows overmilked > 1 min. + strip time	
	Side-opening	Herringbone	Side-opening	Herringbone
	(min)	(min)		
No crowd gate No group wash Machine stripping Old routine	6.3	5.5	49	17
	Reduction in time		*Reduction in %*	
1. Crowd gate	.2	.1	2	2
2. Group wash	.2	.2	9	6
3. No machine stripping	.8	.6	20	16
4. Combined effect of 1 + 2 + 3	1.0	.6	38	17
5. New milking routine	.2	.4	12	8

Table 4. Evaluation of sideopening parlors with various levels of mechanization and routines.[a]

	Conventional		Highly mechanized[b]	
	Stripping	No-stripping	Stripping	No-stripping
Economic value[c]				
Option I	$0	–$2080	+$ 840	–$1530
Option II	$0	+$2680	+$2970	+$5080
Man comfort[d]	Fair	Good plus	Good	Excellent
Cow health[d]				
Prep	Fair	Fair	Poor	Poor
Overmilking	Poor	Fair	Poor	Fair to good

[a] The side-opening parlor with no mechanization and with stripping practiced is the base parlor.
[b] With group-washing and crowd gate.
[c] Annually, Option I is labor savings only; Option II is net returns from milking additional cows (25% net return of gross).
[d] Rating is relative to "ideal" standards.

Preparing the Cow

(continued from page 9)

all of these three cows have an increased probability of being overmilked.

Machine on-time is lowered by the addition of a crowd gate, group wash, or cessation of machine-stripping by .2, .2, .8 minutes, respectively (Table 3). Similarly, the number of cows in the milking herd overmilked more than one minute plus stripping time (if any) is lowered 2, 9 and 20% respectively (Table 3). Again, because of the interrelationship of these items, if all three were instituted simultaneously, machine-on time would be expected to drop by one full minute and the percent of cows overmilked would be lowered from 49% to only 11%.

Herringbone Parlor

The herringbone parlor differs from the side-opening parlor primarily because cows are handled in small groups—four in the case of the double-4 parlor evaluated in this study.

One problem observed in our motion and time studies was the tendency to have too long an interval between initiation of letdown and machine application (Table 2). Two-thirds of the cows milked had an observed prep-time exceeding 2.5 minutes. The average prep-time was 3.2 minutes. A crowd gate, group-washing and the absence of machine-stripping lowered the percent of cows with excessively long stimulation times by 0, 10 and 16%, respectively. The addition of either a group-washing or no-stripping routine lowered the average prep-time to 2.2 minutes with 35% of the cows exceeding the 2.5 minute interval.

Machine-on time averaged 5.5 minutes in a herringbone parlor and as many as 17% of the cows were overmilked for more than 1 minute. The addition of either a group-washing or the cessation of machine-stripping reduced the number of cows overmilked excessively down to the 11% and 1% level, respectively. When both were incorporated simultaneously, the average milking time was reduced to 4.9 minutes.

Table 5. Evaluation of herringbone parlors with various levels of mechanization and routines.[a]

	Conventional		Highly mechanized[b]	
	Stripping	No-stripping	Stripping	No-stripping
Economic value[c]				
Option I	+$ 330	−$1460	+$1240	−$1020
Option II	+$1090	+$5340	+$4610	+$7630
Man comfort[d]	Fair	Good plus	Good plus	Superior
Cow health[d]				
Prep	Poor	Poor	Poor	Poor
Overmilking	Poor to fair	Excellent	Fair	Excellent

[a] The side-opening parlor with no mechanization and with stripping practiced is the base parlor.
[b] With group-washing and crowd gate.
[c] Annually, Option I is labor savings only; Option II is net returns from milking additional cows (25% net return of gross).
[d] Relative rating.

High Producers vs. Low Producers

One hundred high producing cows required 15 minutes more milking time than 100 low producing cows. Because the unit-on time was one-half minute longer for the higher producers, (which was not sufficiently anticipated), average stimulation time was .3 minute longer in the herringbone parlor and 6% more of the cows were prepped excessively long.

In a side-opening parlor, only 24% of the high producing cows were overmilked while 31% of the lower producers had the machine on too long.

Milking Routine

Two different simulated milking routines were studied. In the first, the milkers tended to keep the stalls full at all times at the expense of proper machine application. In the second, the computer was programmed to place a higher priority on attempting to attach the unit at the proper time than on keeping the stalls full of cows.

The first routine was thought to be the one commonly practiced on the farms studied, possibly due to the desire to obtain maximum grain intake, while the latter routine was thought to be the one more likely to result in improved milking practices.

The results indicated that the second routine had no influence on either total milking time nor the percent of time the man was busy (Table 1). It did, however, reduce the number of cows in a side-opening parlor that were overmilked considerably from 49% to 37% (Table 3). In a herringbone parlor, it reduced the number of cows that had an excessively long prep-time from 65% to 24% (Table 2).

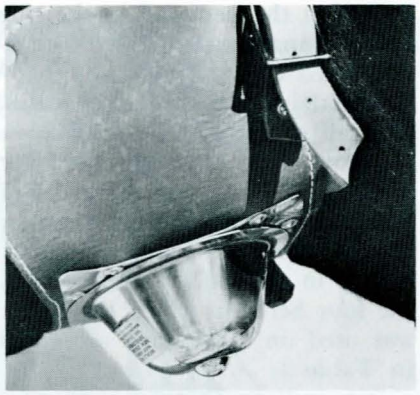
Economic Impact

The economics of mechanization and no-machine stripping practiced in side-opening parlors are given in Table 4. Option 1 assumes a 3% loss of production when there is no stripping and the time saved is not used to milk more cows. In this case, even with mechanization, net returns would be expected to be some $1,500 lower annually.

In Option 2, the time saved is used to milk more cows, up to the previous level of labor employment. It is assumed that additional feed supplies and cattle housing facilities are available. Net returns were calculated at 25% of the added milk income. No-machine stripping, even without added mechanization, is expected to improve income by nearly $2,700 annually. The addition of a crowd gate and group-washing system would add another $1,400 to the annual realized income.

Similar calculations for the herringbone parlor are shown in Table 5. Again, Option 1 results in an annual loss in income of about $1,000, even with mechanization. Option 2, without mechanization, would increase annual income by $5,300; with mechanization, net income would go up another $2,300.

KAMAR detector is glued to back.



Chin-Ball Mating Device.

Mechanical Devices

Detecting Cows in Heat

Larry L. Larson
Asst. Professor (Reproductive Physiology)

A recent California study indicates that failure to detect cows in heat soon enough after calving is a major cause of prolonged calving intervals.

Increasing herd size, higher milk production, crowding, slick floors, automation and less time taken by the dairyman to observe each cow individually contribute to this problem.

In most cases, the problem of heat detection can be solved if the dairyman is willing to devote the necessary effort. The percentage of cows detected in heat is proportional to the time and effort spent observing them.

Economics

Milk production per cow per day increases as the average days open decreases. Therefore, it is economically desirable to maintain a 12–13 month calving interval. This means that a cow must conceive by 90 days after calving to meet this objective. In a California study of 7,977 gestations and reproductive failures, it was found that almost 40% of the cows had not even been bred by 90 days, primarily because they had not been detected in heat.

A good heat detection program is essential for utilizing artificial insemination. Nebraska ranks relatively low in both the percentage of cows bred by AI and in average milk production per cow. Bulls whose daughters would be expected to produce 1,000 pounds more milk than their herdmates are available to all dairymen through the use of AI.

Estrous Cycle

Most cows come into heat every 21 days. However, a few cows might have cycles as short as 18 days or as long as 24 days and still be normal. Cows will continue to cycle throughout the year unless one of the following conditions exist:

1. Pregnant.
2. Pyometra (uterine infection).
3. Mummified fetus.
4. Cystic ovaries.
5. Stress (nutritional inadequacy, disease, etc.).
6. Freemartin heifer.

Of 556 heats recorded by three dairymen, about ⅔ of the cows were first observed in heat in the morning and ⅓ of the cows were first observed in the afternoon. The dairymen were able to detect signs of heat in about half of the cows for as long as 12 hours but very few cows exhibited heat signs for as long as 24 hours.

Signs of Heat

The most common method of determining estrus in cattle is by visual observation. The number and intensity of estrual signs manifested varies greatly between animals. Estrual signs that can be visually observed include:

1. Standing to be mounted (standing heat).
2. Attempted mounting of other cows.
3. Clear mucus discharge from the vagina.
4. Moist, swollen and reddened vulva.
5. Nervousness, restlessness and bellowing.
6. Reduced milk production.

A bloody discharge is noted from approximately 40% of the cows, particularly younger cows and heifers. The discharge is normal and does not indicate whether the cow conceived or not. This bloody discharge occurs about 2 days after the cow was in heat so she can be expected to be in heat again in 18 days.

It is generally agreed that the average duration of heat is 15–18 hours. However, some cows may be in heat only 3 hours while others may be in heat for 30 hours. It is obvious that animals showing estrual signs for a short period could go undetected even if you follow the recommended procedure of observing cows at least twice a day for heat. We have not been able to do much to solve this problem except to suggest that the dairyman should do a better job of observing his cows for heat. Presently there is no foolproof, practical method of detecting heat other than visual observation.

Mechanical Aids for Detecting Heats

1. *KAMAR Heatmount Detector.* One heat detection device is the KAMAR Heatmount Detector which is glued to the back of a cow about even with the hip bones. When the cow in heat is mounted, the pressure from the brisket of the mounting cow on the detector releases a dye and turns it red. These would be put on each cow being watched for heats.

Five dairymen with herds of 60–120 cows in size used these detectors in a field trial. Two dairymen found the detectors to be valuable aids in detecting heats and plan to continue using them on all their

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Detecting Cows in Heat

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cows. Two other dairymen reported numerous apparent "accidental" triggerings and felt they were a waste of time and effort.

It was not possible in this study to determine how many of the recorded accidental or false positives were actually missed heat periods. The number of accidental positives did vary between herds. This is attributed to differences in stall construction, crowding of animals and to the degree the dairyman used them properly.

The proper positioning of the Heatmount Detector on a cow's rump is extremely important. If they are too far forward the dye will not be released by the mounting cow, and many will be triggered accidentally if they are too far back. Many accidentals were reported when first put on the cows. Perhaps they itch and the cows try to scratch them off.

The major problems with the Heatmount Detectors include: accidental triggerings, the problem of seeing and replacing detectors in the milking parlor, and the extra time and effort required to use them properly. However, all dairymen thought the detectors could be of some practical value, particularly on problem cows. Detectors might be limited to only those cows due to be bred and just bred.

2. *Chin-Ball Mating Device.* The other heat detection aid is called the Chin-Ball Mating Device. It is a halter with a container of marking fluid attached to it. There is a spring-loaded valve on the bottom of the container which works like a large ballpoint pen.

The halter is placed on an aggressive animal that is likely to seek out and mount cows that are in heat. The animal wearing the halter will leave a mark on the cows it mounts.

Six dairymen have tested the halters in herds of 60–150 cows in size. Four used the halters on cows with cystic ovaries; two used them on surgically altered bulls. The bulls were prepared by surgically deflecting the penis off to the side at a 45° angle so that the bull cannot breed the cows he mounts.

The dairymen were asked to record all detected heats as follows: (1) cow was observed but not marked; (2) cow was marked but not observed in standing heat; or (3) cow was both marked and observed in heat. Data for each of the four herds in which the halter was used on cystic cows are given in Table 1.

Data indicate that visual observation is still essential but that about a fourth of the heats would have been missed without the aid of the halter. The number of cows detected in heat by being marked but not observed varied with season and the activity of the animal wearing the halter.

For example, one dairyman (Herd D, Table 1) during silo filling time observed very few heats although numerous cows were marked and subsequently bred. Later he was spending a great deal of time in the barn and the cow wearing the halter was not very aggressive, so that he observed many more cows than were being marked.

Sufficient data to establish the efficiency of surgically altered bulls as heat detectors are not available but preliminary results from two dairymen (Table 1) are encouraging. The young bulls still do not mark every cow that comes into heat but they are certainly marking many that the dairyman would have missed. The length of time that these bulls will remain active and the number of cows which can be handled by one bull is not known. For safety reasons and carcass value it seems desirable to sell the bulls by three years of age. This would require that a new young bull be prepared each year or two for replacement.

The Chin-Ball Mating Device is relatively convenient since it only requires refilling about every two weeks, although it should be checked daily. One filling will mark about 20 to 30 cows. Every dairyman stated that the halter was helpful. Several reported that some of the previously hard to find cows were detected in heat by this method. Again, it is not possible to know the number of heats that were observed *after* the dairyman's attention was drawn to the cow because she had been marked.

The major disadvantage of the halter is that its success depends on the efficiency of the animal wearing it and that these animals may change from day to day. The animal must be active and aggressive. The dairymen report that any cow found in heat should be taken out of the herd so that the marker animal will seek out others that might be in heat. Also, if it is extremely cold the ink carrier may freeze.

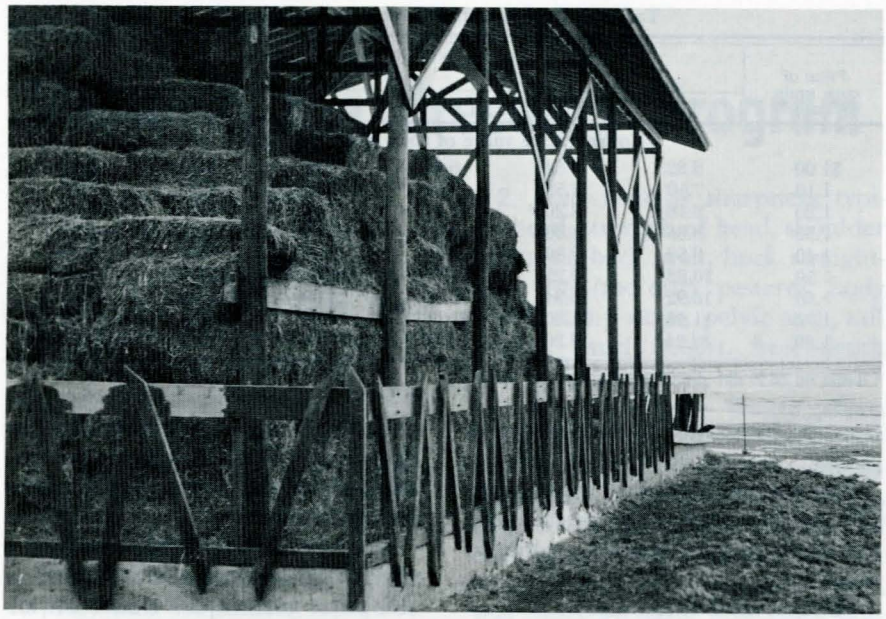
Summary

It appears that both of these mechanical devices can be of some practical value in helping identify cows in heat. Each has certain disadvantages and each requires some special attention from the dairyman to make it work properly. It will still be essential for the dairyman to closely observe his cows for heat.

Table 1. Efficiency of the Chin-Ball Mating Device in estrus detection.

Herd	Number of heat cycles detected	Method heat was detected: Observed only	Marked only	Observed & marked	% of heats observed only	% of heats marked only	Bred by mark[a]
Cystic cows							
A	102	38	24	40	37.3	23.5	12
B	66	21	15	30	31.8	22.7	5
C	73	11	29	33	15.1	39.7	27
D	147	52	31	64	35.4	21.1	18
Total	388	122	99	167	31.4	25.5	62
Surgically altered bulls							
E & F	121	24	57	40	19.8	47.1	53

[a] Number of cows bred after being marked but not observed in heat.



Alfalfa hay as roughage source.

Alfalfa Hay or Corn Silage?

Foster G. Owen
Professor, Dairy Nutrition

In Nebraska, the principal roughages available on dairy farms are alfalfa and corn silage.

Some dairymen use only alfalfa hay as a source of roughage; others use mostly corn silage. Research has shown that equally high milk yields can be obtained while feeding either high quality alfalfa hay or corn silage as the primary roughage. Therefore, the choice of roughage should be based largely on the comparative economics of feeding these roughages to a particular individual herd.

This article will discuss techniques for making economic comparisons of hay and silage. One method involves formulation of complete rations with an electronic computer. Another utilizes "feed factors" developed by the late Dr. Bill Peterson at Minnesota.

The "feed factor" method provides values for calculation of a comparative price for nearly all the common feedstuffs based on their protein and estimated net energy value relative to that in No. 2 corn and soybean meal (44% crude protein).

The method requires first that the "feed factors" for a given feed be located in special tables. (Morrison's *Feeds and Feeding* Textbook is one source of these tables). For each feed, its factor for soybean meal is multiplied by the current price of soybean meal and its factor for corn is multiplied by the price of corn. The two values are then totaled, yielding the current dollar value of that particular feed. This value represents the combined worth of the protein and net energy of that feed relative to the cost of these nutrients in soybean meal and corn.

This method admittedly is not perfect, giving no credit to the mineral and vitamin values of feeds. This is not a serious limitation, however, since the energy and protein value of feedstuffs accounts for *practically* the total worth of a feed for dairy cows. In addition, corn and soybean meal may not be the most appropriate bases for comparison. But since they are the most common energy and high protein sources available in Nebraska, neither is this a serious objection to the method.

Therefore, we consider the "feed factor" method to be a simple and practical means for making economic comparisons. By use of this method we have developed two tables and outlined procedures for making price comparisons for corn silage and alfalfa hay.

Feed Factor Method

You can determine the worth of alfalfa hay for specified prices of corn and soybean meal by using Table 1. For example, when corn is $1.40 per bushel and soybean meal is $200 per ton, the value of alfalfa hay is $61 per ton. If the price of soybean meal dropped to $120 per ton and corn remained the same, then hay would be worth only $42 per ton.

The feed which has the highest value relative to its cost is, of course, the most economic feed. Whenever the most economic roughage is priced lower than its calculated value it should be included at maximum levels relative to the corn-soybean meal mixture. In contrast, when a feed's calculated worth is lower than its cost, this feed should be used at minimum levels.

Use Table 2 to determine worth of corn silage. For example, with corn at $1.30 per bushel and soybean meal at $140 per ton, corn silage is worth $8.90 per ton. If the established price for corn silage is $10, then it should be used at minimal levels.

Table 2 is based on 28% moisture silage. If the moisture level is not at 28%, adjust the table value. The following factors can be used:

Silage dry matter %	Factors to multiply by price
25	.89
26	.93
27	.96
28	1.00
29	1.04
30	1.07
31	1.11
32	1.14
33	1.18
34	1.21
35	1.25
36	1.29
37	1.32
38	1.36
39	1.39
40	1.43

Example: If the silage contains

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Hay or Silage?

(continued from page 13)

31% dry matter with prices of $1.30 per bushel of corn and $140 per ton of soybean meal the value of the silage is $9.88 ($8.90 x 1.11).

From these tables you can determine whether corn silage or alfalfa is the most economic roughage.

For example, let's assume corn is $1.40 per bushel and soybean meal is $120 per ton. The current price at which hay can be delivered to the farm is $30 and the cost of producing corn silage is $10 per ton.

Step 1. Find the economic values of alfalfa and corn silage from Tables 1 and 2.

alfalfa = $42

corn silage = $9.56

Step 2. Calculate the price: value ratio

$$\text{hay} = \frac{\$30 \text{ (price)}}{\$42 \text{ (value)}} = .71$$

$$\text{silage} = \frac{\$10 \text{ (price)}}{\$9.56 \text{ (value)}} = 1.05$$

Step 3. Calculate comparative values. When hay price is $30, silage value is $6.78 (.71 x $9.56); when silage price is $10, hay value is $44 (1.05 x $42).

Step 4. Conclusion. With the prices given in the above illustration alfalfa hay is a much better buy than corn silage. Its cost is only 71% of its value, whereas corn silage costs more than its value. If corn silage is fed it should be fed at minimum levels since it costs more than its economic value. However, if alfalfa hay is fed it should be fed at maximum levels. This is because its value is more than its price.

For another example, if hay were $50 per ton and other prices were the same as in the above example then:

Price: value ratio for:

$$\text{hay} = \frac{\$50}{\$42} = 1.19$$

Comparative value:

when hay is $50, silage value is $11.38 (1.19 x $9.56)

Then silage is the best buy because it is worth more than it is priced, whereas, hay is worth less than it costs. Silage should be maximized in the ration, because it cost less than its economic value.

Computer Method

The computer can also be used to determine the most economic forage—corn silage or hay. With this technique all known nutrients in these or any available alternative feeds will influence the outcome. In addition to this advantage the computer will calculate the most economic total ration. This ration may have varying proportions of hay and silage or possibly only one forage. Prices of all feedstuffs will be utilized by the computer in calculating rations.

With prices prevailing last spring (1972) in Nebraska we found by computer techniques that corn silage at $10 per ton would not appear in least cost rations until the alfalfa hay price reached $27.20 per ton; corn silage reached about 50% of the roughage at $29.60 per ton for hay, and completely replaced alfalfa hay only after hay reached $42.60 per ton. It is acknowledged that supplemental protein sources and grain were much lower priced than today.

Summary

Present prices of soybean oil meal (about $200/ton) and corn (about $1.40 per bushel) indicate the value of alfalfa to be $61 per ton, which is considerably higher than hay is priced at this time. A comparable value for corn silage of $9.60 is near the actual $10 cost which is generally placed on corn silage.

The charts developed for this article show that an increase in the price of corn grain and especially a decrease in the price of soybean meal would improve the relative value of silage compared to hay.

The "feed factor" system of comparative price evaluation should help many of our dairymen in determining which roughage is the more economic source of nutrients and in deciding whether roughage should be full fed. Computer techniques can be utilized to give more precise information and should be of special value to medium and large herd owners.

Table 2. Comparative value of corn silage.

Price of corn grain ($/bushel)	Price of soybean meal (44%) (per ton)					
	$100	$120	$140	$160	$180	$200
	Comparative value of corn silage ($/ton)[a]					
$1.00	6.82	6.84	6.86	6.88	6.90	6.92
1.10	7.50	7.52	7.54	7.56	7.58	7.60
1.20	8.18	8.20	8.22	8.24	8.26	8.28
1.30	8.86	8.88	8.90	8.92	8.94	8.96
1.40	9.54	9.56	9.58	9.60	9.62	9.64
1.50	10.23	10.25	10.27	10.29	10.31	10.33
1.60	10.92	10.94	10.96	10.98	11.00	11.02
1.70	11.58	11.60	11.62	11.64	11.66	11.68
1.80	12.24	12.26	12.28	12.30	12.32	12.34

[a] Based on 28% dry matter corn silage

Table 1. Comparative value of alfalfa hay.

Price of corn grain (per bushel)	Price of soybean meal (44%) (per ton)					
	$100	$120	$140	$160	$180	$200
	Comparative value of alfalfa hay ($/ton)[a]					
$1.00	33	38	42	47	52	57
1.10	34	39	43	48	53	58
1.20	35	40	45	49	54	59
1.30	37	41	46	51	55	60
1.40	38	42	47	52	56	61
1.50	39	43	48	53	57	62
1.60	40	44	49	54	58	63
1.70	41	45	50	55	59	64
1.80	42	46	51	56	60	65
1.90	43	47	52	57	61	66

[a] Based on leafy alfalfa hay (25–28% fiber)

Type Appraisal Data

Value in the Breeding Program

Dale Van Vleck
Visiting Professor, Animal Science

How much emphasis should a dairyman put on traits other than those expressed in production records? Can some indication of a cow's expected production be obtained by measuring excitability, disease susceptibility, body depth, udder shape, teat placement, for example, or other management, body and udder traits?

Some criteria for evaluating the importance of measuring a particular type trait are:

1. If closely related to lactation production or lifetime production, a trait could be used in place of production records in the selection process.

2. The score on a trait may be closely related to herd life and therefore, probably, to lifetime production.

3. A trait may indicate ease of handling (workability) or freedom from disease or physical handicaps which are of economic importance.

4. In addition, if a type trait is to be important in a selection program the trait must show differences among cows (variation) due to genetic differences in the cows.

New York Experiment

A type appraisal project to find traits which satisfy points 2, 3 and 4 was begun in 1961 by New York Extension Dairy Specialists. Holstein cows in 188 herds were rated every two years according to management, body and udder traits. These records were studied together with production and longevity records corresponding to the type appraisal measurements. Type traits studied were:

1. *Management traits* — excitability, feeding speed, mastitis, mastitis from injury, ketosis, milk fever, breeding problems, cystic ovaries, milking speed, milk leak and edema intensity and persistency.

2. *Body traits* — sharpness, typical head, strength of head, shoulder tightness, back arch, hock straightness, legs (toe out), pasterns, body depth, rump slope, pelvic arch, tail setting, thurl height, heel depth and upstandingness.

3. *Udder traits* — length (rear), bulginess (rear), funnelness (rear), length (front), bulginess (front), funnelness (front), quality, depth, forward slope, height, strength of rear attachment, strength of fore attachment, halving, quartering, rear teats forward, rear teats sideways, fore teats forward, fore teats sideways, rear and fore teat spacing, and rear to front teat spacing.

Production records are adjusted for various factors in arriving at genetic evaluations. Should type traits be similarly adjusted? The New York study showed that age differences at appraisal were quite large for only about one-third of the traits. Changes with age were particularly important for mastitis, body weight and udder depth. Production records need not be adjusted for stage of lactation, while type traits may be noticeably affected.

Many udder traits other than halving, quartering and teat placement were affected by the stage of lactation with generally higher scores early in the lactation. The exceptions were udder quality and strength of fore udder attachment which had lower average scores early in lactation.

There were no differences from year to year in average scores. Herd effects were also generally small, accounting for less than 10% of the variability for most of the body and udder traits. Herd differences did account for about 15-25% of the variability for the edema traits, ketosis, body weight and feeding speed, suggesting that for sire evaluation the herdmate level of the daughters could be ignored except for these traits.

One important adjustment in sire production evaluation is for numbers of daughters. The size of the adjustment depends on the heritability of the trait in addition to the number of daughters.

Heritability, briefly, is the ratio of the variation in cows due to the differences in their genetic makeup to the total variation in cows due to both genetic and environmental differences.

A high heritability indicates progress can be made by selection since genetic progress is a product of the accuracy of selection (which is greater with higher heritability), the amount of selection, and the genetic variation.

When heritability is near zero there can be little or no genetic progress since the cows are all genetically alike.

Estimates of heritability for most type traits were so small that genetic progress for those traits would be very slow even if selection were only for one such trait, and would be much slower if selection were for several traits at the same time. A notable exception among the management traits is milking speed. The heritability estimate of about 25% from this and other studies is similar to that for milk production.

Selection for faster milking, if desired, would probably be successful. Some body traits also have relatively high heritabilities, so selection could be effective for body size (weight and upstandingness) and moderately effective for sharpness, height of thurls, depth of body, levelness of rump, tightness of shoulders and height of tail setting. Estimates of heritability were small for all udder traits in this study.

Rapid Improvement Slow

Results from examination of over 16,000 Holstein records, in agreement with other research, suggest that rapid improvement in most type traits by selection would be frustratingly slow. If several traits were to be improved simultaneously the progress in any one trait

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Type Appraisal Data

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would likely be even less exciting, especially since progress for production traits would be markedly reduced. But, are any of the type traits closely related to first lactation or lifetime production?

There were 5,000 Holstein cows with both first lactation production records and first lactation type appraisals with 2,000 of these also having lifetime production information. Correlations of the type traits measured in the first lactation with first lactation milk and fat yield, fat percent, lifetime milk and number of lifetime lactations were calculated.

These correlations were generally small compared to a perfect positive correlation of 1.00 and a perfect negative correlation of –1.00. Values near zero, as most of these were, indicate no relationship. Only a few of the correlations were larger than .10. With first lactation milk these were: feeding speed, the edema traits, sharpness, body depth, rear udder length, udder depth (the highest, .27), height of rear udder, and strength of fore udder attachment (negative). Only depth of udder had a correlation with production greater than .15. Of all the type traits only sharpness had a correlation greater than .10 with lifetime performance.

The joint multiple correlations (considering the best possible combination of type traits) with first lactation production and lifetime production were also relatively small as shown in Table 1.

What is obvious from Table 1 is that even all type traits taken together do not satisfactorily indicate first lactation milk yield, being only 44% as effective in selection for first lactation milk yield as the first lactation milk record. Similarly the type traits are not very good at predicting lifetime performance. Milk alone in the first lactation does a better job of predicting lifetime performance. The management, body and udder traits were about equally poor in predicting lifetime production although the udder traits were better than either management or body traits in predicting first lactation yield.

A more important aspect of selection is whether the genetic correlations between traits are high. Such correlations are difficult to estimate accurately. However, the genetic correlation between first lactation production and lifetime production was nearly perfect, 100%. Similarly the genetic correlation between first lactation production and number of lifetime lactations was high, 80–90%. These high correlations show that selection for high production in the first lactation is very efficient in improving lifetime production. Actually, if the longer generation interval is considered when selecting for lifetime production, selection on the basis of a first record is much more efficient in improving lifetime production than is selection on lifetime production.

The criteria used to judge whether a trait should be selected for were listed earlier as: economic importance, variability (differences in scores), genetic differences (heritability) and correlation with economic traits such as lactation milk yield or lifetime production. Table 2 summarizes traits which satisfy some of these requirements. Deciding whether a trait is economically important is often an individual dairyman's decision so a question mark is listed for many traits.

Certainly milk yield qualifies on all counts. But what other traits might also be considered? Milking speed qualifies directly, being economically important on most farms, variable and with genetic differences in animals. Body weight

Table 2. Traits which meet two or more of the four requirements for inclusion in a selection program.

Trait	Economic value	Variation[a]	Heritability >.15	Related to yield >.10
Management				
Milking speed	Yes	9-41-50	.23	No
Feeding speed	?	3-49-48	No	.16
Edema				
Intensity	Yes	55-41-4	No	.12
Persistency	Yes	62-32-5	No	.11
Body				
Weight	Yes	Yes	.40	No
Sharpness	?	1-41-58	.21	.15[b]
Depth	?	4-48-48	.17	.10
Shoulder	?	2-23-75?	.16	No
Rump	?	5-18-77?	.17	No
Tail set	?	10-81-9?	.16	No
Thurls	?	15-57-28	.19	No
Upstandingness	?	8-43-48	.39	No
Udder				
Length, rear	?	20-63-17	No	.14
Depth	?	8-66-26-1	.15	.27
Height, rear	?	11-63-26	No	.10
Strength of attachment				
Fore	?	0-4-26-70	No	–.10
Rear	?	0-5-36-58	.16	No
Teat spacing				
Rear	?	16-82-2?	.16	No

[a] Percent of cows in each category for that trait—an indication of variability, for example; 9% of cows were classed as slow, 41% as average and 50% as fast milkers.
[b] Correlation with lifetime milk of .16.

Table 1. Multiple correlations of first lactation type traits with first lactation and lifetime production.

Traits	First lactation milk	Lifetime milk	Lifetime No. lactations
All type	.44	.30	.27
Management	.24	.18	.17
Body	.24	.19	.16
Udder	.33	.17	.15
First lactation milk	1.00	.35	.23

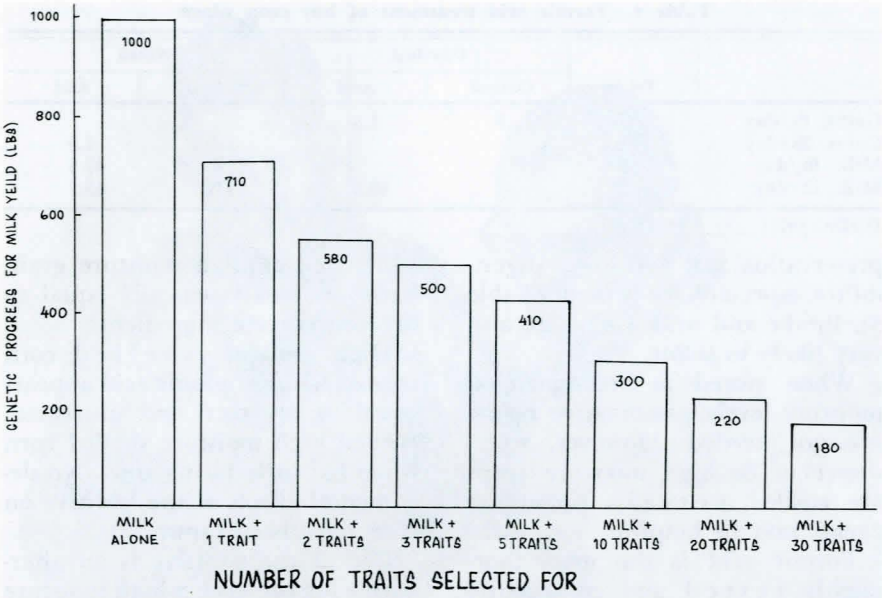

Fig. 1. Relative progress for milk yield if selection emphasis is equal for several traits (assume selection for milk alone gives 1,000 lb progress).

might also qualify since the salvage value of an animal may be economically important and in a dairy-beef operation the weight of steer calves would be important. On the other hand excessive weight would require extra feed to maintain the cow.

Sharpness might be marketable for a registered breeder, there is variation and sufficient heritability for selection. Sharpness was also the only type appraisal trait having a correlation (.16) with lifetime yield or number of lactations greater than .10, but first lactation milk yield has a correlation twice as large with lifetime performance (.35).

Depth of body, upstandingness and udder depth have sufficient heritability and variability to enable progress by selection but the economic values are not clearly important.

The other point to keep in mind is that if selection is for more than one trait, improvement in a single trait is only a fraction of the improvement if selection is for that trait alone ($1/\sqrt{N}$ where N = the number of traits selected for). Figure 1 shows this rule graphically. Improvement in milk yield is shown relative to a 1000-lb increase in milk by selection of milk alone. The chart re-emphasizes traits must be important before they are considered for selection otherwise milk yield, undeniably important economically, will not be improved as fast as possible.

Conclusions Not Encouraging

Conclusions from this study are not encouraging to those who want to improve type traits quickly by selection. The heritabilities of most traits are so low that progress would be slow even with selection only for a single trait.

The small correlations for the type traits with first lactation production indicate type does not provide a satisfactory indicator of production. Taken as a group the scores of the 49 type traits are equally as good as milk production alone in predicting lifetime production or number of lactations.

The high correlation between first and lifetime production suggests that first lactation production should receive most of the selection emphasis in a breeding program for high lifetime production.

Some type traits such as udder attachments should be continually checked, however, to make sure that serious weaknesses do not develop. Similarly some management traits may need periodic monitoring so that acceptable levels are maintained.

Preserving Feeds for the Dairy Herd

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Much of the feed used on dairy farms is produced and stored on the same farm. The profitability of the farm and the performance of the herd may be drastically reduced by a "breakdown" in the job of preserving these crops until fed. Improper preservation may result in loss in nutrients, reduced nutrient availability, lowered palatability and production of dangerous toxins.

In hay, principal losses are from rain damage or from heating of hay which is too wet when picked up from the field.

Research shows that most of the loss during field curing is due to shattering of leaves. This loss can be minimized by windrowing directly after cutting, allowing the windrow to dry without turning—even after a rain if possible—and by picking up the windrow before the dew dries off.

If hay is stored at moisture levels above 35%, retention of nutrients is reduced and digestibility is lowered, especially for protein. Voluntary intake, growth and milk production may be reduced. However, animal performance seems to be affected only to a minor extent in most trials up to 40 or 50% moisture (Tables 1 & 2). Consequently, a major concern with feeding hays preserved at higher moisture levels is the possible danger of mold to both the animal and in the food products produced. Tests have shown that molds can be reduced in high moisture hay by certain chemical inhibitors.

There is evidence that a propionic acid preservative will greatly reduce mold growth and may improve digestibility and reduce losses in storage. However, animal per-

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Preserving Feeds

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formance results have not been consistent. Additional data are needed on effects on nutrient preservation and economics before preservatives can be generally recommended.

The main factors in obtaining good silage preservation are moisture level and the various factors related to good packing. When corn and sorghum silages are harvested at near maturity, few problems are encountered. Hay crops should be left in the field and wilted down to about 65% moisture to prevent seepage and to promote effective fermentation in conventional upright silos. About 70–75% moisture is ideal for most bunkers, stacks and trench silos.

However, if wilting proceeds until moisture levels of 45–55% are reached, extensive oxidative losses may occur unless this forage is stored in "gas-limiting" structures. Extensive oxidation will reduce energy, protein and vitamin A preservation and will lower digestibility, especially for protein (Table 3). Intake and milk yields are also very likely to suffer.

Table 1. High moisture hay for heifers.

Hay preparation	Dry matter intake	Body weight gain
	lb/day	
25% moisture—baled	17.9	1.82
40% moisture—baled	17.7	2.07
40% moisture—stack	17.8	1.56

(Nebraska, 1971)

Table 2. Effect of hay moisture level on lactating cows.

Hay moisture when stored	Feed intake[a]	Milk	Fat
	lb/day		%
22%	41	37.7	3.70
28%	40	34.8	3.78
33%	43	36.9	3.56
42%	40	35.6	3.51
49%	40	33.7	3.46

[a] 60% hay.
(Nebraska, 1972)

Table 3. Protein digestion as affected by moisture level of forage.

Crop	Hay	Wilted silage[a]	Low moisture silage[b]
	%	%	%
Alfalfa	75	71	60
Oats		47	39
Sudan		54	41

[a] 60-75% moisture
[b] 35-50% moisture

Table 4. Formic acid treatment of hay crop silage.

	Trials	Unwilted		Wilted	
		Control	Acid	Control	Acid
Gains, lb/day	4	.8	1.3		
Gains, lb/day	2			1.4	1.8
Milk, lb/day	2			45.8	47.5
Milk, lb/day	2		46.6	44.0	45.3

(USDA, 1971)

When stored at recommended moisture levels, preservative agents are not needed. However, when direct-cut or high moisture crops are ensiled, certain preserving agents may be helpful.

Formic acid is the most thoroughly tested and consistently effective additive. When .5% formic acid is added to direct cut hay crop forage, preservation of dry matter is increased from about 5–10%, gains and efficiency of gains by heifers are increased about 50%. Milk production is also improved to a small degree when the additive is included in wilted silage. Treated, unwilted silage has produced even higher milk yields than wilted silage (Table 4). Unfortunately formic acid is too expensive to recommend at this time.

Fermentable carbohydrates—molasses and ground grains—may provide benefits with high moisture silage. Except for improved aroma and color, the benefits are not large or consistent. Other additives may provide benefits also.

Certain enzyme cultures have shown benefits, especially in protein preservation, and in one Nebraska trial improved efficiency of milk production resulted. Before purchasing additives one should compare the possible economic benefit with the cost.

Most grains can be preserved as dried whole kernels, ensiled or preserved with acids. Results of experiments show that on a dry basis, ensiled high moisture corn, high moisture ear corn and dry corn are essentially equal for lactating cows. However, milk fat test is sometimes depressed with high moisture grains. A reduced intake of forage is associated with this problem. When fed as high moisture grain barley is also practically equal to dry concentrate ingredients.

High moisture shelled corn treated with propionic acid appears equal to dry corn and untreated, ensiled high moisture shelled corn when fed to lactating cows. No detrimental effects of the additive on cows have been shown.

Use of the additive is an alternative for preserving high moisture grains when drying is not possible or when good ensiling facilities are not available. Treated grain can be stored in cribs on barn floors or even outside if covered to protect it from moisture. In most storage methods, plastic under the pile is recommended.

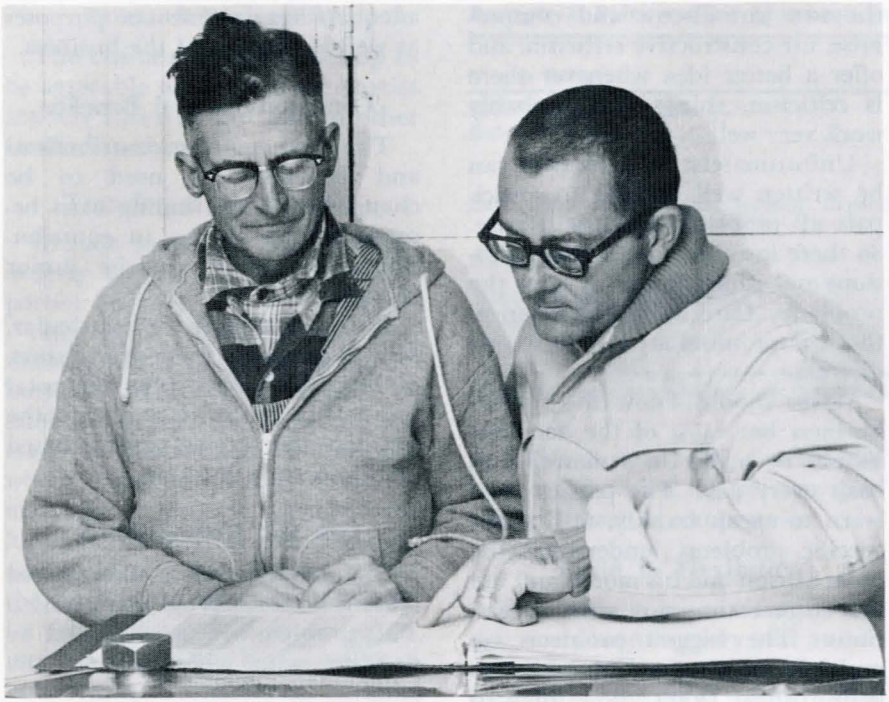
Cost is a primary consideration. This can be minimized with lower moisture grains and by feeding chemically preserved grains before warm weather.

For example, storage of 35% moisture grain from November to March requires only half as much preservative as storage from November to July. Also, grains with 35% moisture require about 1.5% propionic acid and with 25% moisture only 1.0%. So if chemical preservatives are used, the grain should be permitted to mature and dry as much as practicable before harvest.

Summary

Present knowledge for harvest and storage of feedstuffs suggests addition of preserving agents only in special circumstances.

Recent research results indicate that preservative agents can effectively reduce molding of high moisture hay and grains and that certain additives will reduce silage losses and improve feeding value. Additional research and developments are needed to define the conditions required for economic benefits.



A working agreement is necessary in multiple man operation.

Multiple Man Dairy Operations

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In the Midwest the family dairy farm is still the backbone of the dairy industry. However, one of the big changes on our dairy farms is the increase in the number of multiple man operations.

Many of these multiple man operations are being set up as partnerships or corporations, while others are being set up on the basis of a working agreement. A working agreement is similar to a partnership but retains more flexibility in that there is no joint ownership of property. The working agreement is often used as a trial arrangement before entering into a partnership or corporation.

Two situations normally lead to multiple man operations:

1. Replacement of hired help with a junior partner. This may be a working agreement or partnership.

2. A second party is added and the business is rapidly expanded to accommodate the additional party. Animals added with rapid expansion may not be as good as those in the original herd, and they may crowd present facilities. New experiences at the larger herd size require adustments that need to be made over a period of time.

The focal point of this discussion—the working agreement—is an arrangement where both parties have an interest in the business but little or no joint ownership is involved.

The same basic principles apply for the partnership or corporation. Both of these arrangements are more permanent as they involve joint ownership.

Let's examine some of the reasons why a young man might be interested in a working agreement as a stepping stone to a partnership or corporation.

A working agreement provides an opportunity for a young person to get started, be it a son or a nonrelated person. It gives the young man a means to build some equity before entering into a partnership or corporation. Under some arrangements, the junior party owns his own cows and so it gives him time to build his equity in them and build their production. It also allows the young man an opportunity to trade his labor for the investment of the senior party.

A working agreement provides a period of time for exploration, a time for the two to build and test the relationship. It gives the young man an opportunity to try dairying on a new basis. It also gives the junior party a chance to evaluate the total operation, including buildings and equipment as well as people involved.

A working agreement provides for some relief of labor problems on dairy farms today. Time off can be provided with the knowledge that good labor will be maintained since both parties are interested and knowledgeable in the business.

The working agreement provides a chance for expansion of volume on the investment already there on the dairy farm. The milk parlor and some of the other facilities are necessary for 20 or 120 cows and many times a few cows can be added with very little, if any, additional investment.

Incentives can be built into a working agreement. Where cattle run together, they have to be cared for similarly and so anything that is done for one cow or one group of cows also has to be done for the others. There are some problems where there are individually owned cows, such as the "your cow and my cow" problem, and possible preferential treatment, although normally this is insignificant.

A working agreement retains maximum flexibility, as there is no joint ownership of property or equipment, and provides an excellent trial period for a partnership or a corporation.

Let's examine some of the necessary elements or considerations for a multiple man operation to work.

Volume of Business

The business must be large enough to provide adequate net income for all families involved. Adequate income and good living quarters will make adjustment by

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Multiple Man

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families a lot easier compared to one or both families under the pressure of making ends meet.

Room for growth within the business is necessary so the junior party, in particular, will see that he can grow and develop a business.

In the first year or two of the operation, the senior member in the business arrangement may have to subsidize the junior member and may have to help him with credit by co-signing or selling to him on contract.

Good Personal Relationships

The parties involved must be able *to work together.* Time should be set aside for planning, management, record keeping and outside activities. The parties need to establish a business relationship.

In a father-son situation, this must be a new relationship, replacing the old father-son relationship. There should be no boss or dominant person. Instead, the individuals should pool their credit, muscle and ideas. The two parties must be sensitive to each other's moods and want to make the arrangement work.

Decision making must be shared. It's a real advantage to have another competent person to help make decisions. The parties should consult, compromise and decide all major items within the business. There should be a willingness to try new ideas with the understanding that ideas take time and that there will be mistakes made.

There must be a mutual respect and confidence between the parties involved, including faith in the junior party's ability and judgment. It should also be understood that what the parties want and what the parties can do may be two different things.

Be tolerant of others' mistakes. It is important that neither party lose his temper; that they understand mistakes are human.

Communication is probably the most important consideration. If the two can discuss and compromise, use constructive criticism, and offer a better idea whenever there is criticism, things will probably work very well.

Unfortunately, no agreement can be written well enough to anticipate all problems which will arise. So there must be open communications and compromises to solve the problems. Care should be taken so that compromises are not all in one direction.

Wives should know the overall business but most of the decisions should be made on a man-to-man basis every day. The parties must learn to speak frankly, talk about specific problems, understand the other person and his moods and use the correct time to make suggestions. The biggest problems on multiple man operations are the little things. Don't allow them to build up. Discuss them as soon as they arise and settle them as soon as possible.

Parties should live apart if at all possible. It's probable that if the parties live in the same house, success will be difficult. Hopefully, parties will be housed over 100 feet apart, if they are going to live on the same property. It is important that the two are able to get away from the business periodically and that the two are involved in different outside activities.

Avoid rigid rules. Parties involved should make the decisions as to what should be done but not as to how things are done. Each person should be allowed the freedom to approach particular jobs and do them the way he sees fit.

The *families* of the parties involved *must be considered.* Unless family members are happy, there is little chance for success. Unhappy wives, in particular, can put extreme pressure on the business relationship.

Record Keeping

The kind of record keeping system is not important but the system should be adequate in analyzing the business and showing contributions and benefits from the parties involved. A breakdown should be adequate for income tax purposes as well as analysis of the business.

Contributions and Benefits

The agreement on contributions and benefits will need to be changed on a continuing basis because of the change in contributions, particularly by the junior party.

In a partnership, in particular, he will probably want to put some of his profits back into the total business to build his equity in the business and receive benefits based on those contributions.

Jobs and Responsibilities

One major problem where hired labor is involved is too many bosses. This problem can be alleviated by deciding who will supervise the labor.

Adjustments should be made for any special interests the parties have. Normally, one person is more mechanically inclined and will take the primary responsibility for the equipment, while the other may be a better cowman and will assume responsibility for the dairy animals. It isn't critical how this division is made, it is just critical that it is made so each person has his job and the responsibility for that job within the operation. This is by far the most workable arrangement.

Protection of Investments

When added capital investments are made in the business, there should be protection for all parties involved. Each party should be able to recover his interest in the business should the agreement be terminated or the business go into an estate because of a death of one of the parties.

Definite identification of individually owned items should be written into any agreement. Methods should be spelled out for the continuation of the business should something happen to one of the parties, and for disposal of any joint ownership items, whether it be farm improvements, equipment, or cows.

Fair and Businesslike

The business should be set up to be agreeable not only to the parties actively involved but also to other family members.

Transfer of the Business

Include provisions leading to an orderly takeover by any surviving parties involved in the business.

Any active party or parties should have the first option on the business. The value should be established and the terms of the takeover determined — a measure which prevents an heir from demanding immediate payment for his share of the real estate, for example, forcing one partner out of the business to meet this demand. In the absence of such an agreement, a sale might be forced, thus breaking up the business.

There should be a real effort to *know and appreciate the goals of* the other party although there may be differences in time they wish to spend with their families, involvement with community activities such as church, local organizations or leisure time.

Time should be allowed for things each party sees as important, and time for these activities should be set up so that the other party involved does not feel guilty about time he spends doing things he and his family see as important. The resultant system should be adjusted so that each party can be involved in the things he feels important.

Guide to the Heirs

By putting in writing all items discussed here, a guide for heirs is established and peace of mind is ensured to the active parties.

Settling Disputes

Consider having a third party, agreed upon in advance, for settling disputes. This might be a lawyer, banker, accountant, or another producer within the area depending on the kind of question involved.

The person chosen needs to be one who has the mutual trust and confidence of the primary parties. He probably won't make any decision but instead will provide the basis upon which the primary parties will reach a compromise.

Example 1. Dairy working agreement, junior partner adds 10 cows to a 60-cow-herd.

Monthly budget	12,000 lb milk per cow per year
Milk income less hauling	$ 600.00
Bull calves sold	25.00
	$ 625.00
Expenses (insurance, tax, interest, depreciation, breeding, veterinary)	100.00
Cash income[a]	$525.00
Benefits—house and utilities	$ 150.00
Equity in heifers	50.00
	$725.00

[a] From his cash income he must pay the principal on his cattle note.

Build in Flexibility

Things are going to change every day, every month, every year and so there should be room for changes, including a means of adjusting for inputs, such as improvements, capital, tax considerations and emergency situations.

Everything in Writing

The agreement should be in writing to provide orderly continuation in case of death or agreement termination, and should be signed by all parties involved. The entire family should be aware of the agreement. All parties involved should be protected. The written agreement is also a good basis for beginning discussion on any business considerations.

Following are three examples of effective working agreements now used in Nebraska.

Example 1 is designed for a young man who wishes to have his own cows and has only labor for his contribution. The present operation of about 60 cows requires hired labor and will allow only minimum expansion.

The senior party furnishes all feed costs, overhead and operating expenses for the total operation.

Under these conditions only 10 cows are added by the junior party.

At 12,000 pounds of milk, his monthly income would be $625 less $100 for his cows' expenses, for insurance, taxes, interest, depreciation, breeding and veterinary. This then puts his cash income at $525 per month from which he must pay equity on his note for his cows.

With this arrangement, house and utilities valued at about $150/month are furnished and he gets to keep the heifer calves from his cows. Again, the feed expense is covered by the senior party. His equity in his calves should be $50/month the first year and $100/month each year after that.

This, then, means a real income of about $725 per month. (1,000 lb variation in production per cow per year means plus or minus $50 income per month.)

Example 2 is designed for a 100-cow operation where the junior party is interested in developing his own herd and is willing to furnish the labor for the dairy unit.

Under this agreement, the senior party furnishes all overhead and operating expenses plus the first $150 feed cost per cow per year. The junior party pays any feed costs over $150. This is set up to protect the senior party from increasing his milk production without regard to the feed cost.

All of the expense for insurance, taxes, interest, depreciation, breeding and veterinary on the junior party's cows are borne by him.

Shown here are four different production levels and a projected income. One of the problems when buying cows is the rapid pay back. This is illustrated by the large—$340/month — equity payment required. At 10,000 pounds of milk per cow per year, the junior party's cash income will be about $315 per

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Multiple Man

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month and cash income plus equity $655 per month.

Each additional 1,000 pounds of milk per cow per year adds $100 per month to his cash income and total income.

The senior party may or may not furnish house and utilities under this agreement.

Example 3 is again a 100-cow herd where the junior party is furnishing labor and some management and the senior party is providing the overhead.

The difference here is that there is no individual ownership of cattle and the two share in all contributions and income from the dairy enterprise.

Notice that the senior party is charging an annual cost for buildings and equipment of $8,565. The junior party charges $8,000 for his labor and the senior party charges $1,000 for his labor. Management is shared equally and a charge of $1,250 is made for it.

Again in this example, an increase in production per cow would increase returns considerably.

Example 3 applies to the whole farm business as well as the dairy enterprise.

These examples are meant only as guides and should be changed to fit the needs of persons wishing to enter a working agreement.

Example 2. Dairy working agreement, junior partner adds 25 cows to a 75-cow-herd.

			Out of pocket	
			Cost	Equity
Cow payment	Prin.			$190
	Int.		$38	
Dep. 450 cost	250 salvage		100	
Vet.			26	
Breeding @ $8			26	
Young stock				150
Feed cost (over 150)	270 Total		250	
			$460	$340
			$800.00	
Production	10,000 lb	11,000 lb	12,000 lb	13,000 lb
Net (–hauling)	$1,040	$1,140	$1,250	$1,350
– Expenses	800	800	800	800
	240	340	450	550
Bull calves	75	75	75	75
Cash	315	415	525	625
Equity	340	340	340	340
Total income	$655.00	$755.00	$865.00	$965.00

Example 3. Dairy working agreement, junior partner owns 25% of a 100-cow herd.

	Senior party	Junior party
Cows-depreciation	$ 7,500	$ 2,500
Interest	2,550	850
Taxes	217	72
Death loss	900	300
Buildings & equipment	8,565	
Feed	24,000	3,000
Breeding	600	200
Prod. testing	1,125	375
Veterinary & medicine	900	300
Hauling & marketing cull cows	375	125
Labor	1,000	8,000
Management	1,250	1,250
Total contributions	48,982	16,247
% contributed by each party	75.1%	24.9%
Income		
Milk	$45,000	$15,000
Calves	6,075	2,025
Total income	51,075	17,025
	75%	25%

Value of Dehydrated

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Dehydrated alfalfa (DEHY) is available across the United States for use in preparing dairy rations. One of the major reasons for its inclusion in dairy rations in earlier years was its Vitamin A value.

Today, however, it is much more economical to use synthetic Vitamin A. Consequently, the use of dehydrated alfalfa in dairy rations must be justified on other bases.

Since alfalfa is an important Nebraska crop, we have been conducting research on the value of DEHY in dairy rations.

There is frequently some confusion about the role of DEHY because, nutritionally, it is essentially a forage, and yet it is generally included in the ration as a part of the grain mixture. This article will discuss the use of DEHY as a roughage substitute and also as an ingredient of the grain mixture.

DEHY as a Roughage Replacement

Conventional ¼" DEHY pellets are made from finely ground alfalfa and do not contribute the coarseness needed to maintain normal milk fat test, so DEHY can only partially replace other roughages.

We know that the dairy cow needs a minimum amount of coarse roughage equal to about 1% of her body weight daily to maintain normal milk fat test.

We also know that the high-producing cow must have a certain level of grain in the ration to maintain a high level of production. The total roughage intake of high producers should be limited to about 2% of body weight, so that the cow can consume sufficient grain. Then the level of DEHY should be limited to not more than 1% of body weight daily.

To be *assured* of both ample coarse roughages and a high energy level in the ration, we suggest about ½% of body weight as a

Alfalfa in Dairy Rations

practical limit to use. In two experiments, Kansas workers produced increased milk yield by supplementing daily rations with ½ lb of DEHY/100 lb body weight. The benefit was more for cows fed prairie hay than for those receiving alfalfa hay and sorghum silage. However, about 4 lb additional intake as DEHY was required for the 1 lb of improvement obtained in milk yield,

Connecticut workers supplemented timothy hay with levels of DEHY up to 1.5% of body weight. DEHY at 1% of body weight produced about 7 lb more milk daily from 9 lb additional dry matter consumed.

These results as well as others indicate that feeding high levels of supplemental DEHY will increase intake of roughage and total feed consumption. However, the efficiency of conversion of the additional dry matter to milk is generally below that for comparable levels of unground roughages. Grinding roughages reduces digestibility and undoubtedly accounts for at least a part of the loss in efficiency.

It is not very practical to limit roughage intake under conventional programs of feeding. Therefore, using *maximal* levels of DEHY in the ration, practically necessitates feeding complete type rations in which the roughage and grain is blended into a single feed. This method provides absolute control of the coarse roughage level in the total ration.

DEHY as a Substitute for Hay

Several experiments in the past few years have revealed various nutritional deficiencies and unexplained disorders from feeding corn silage as the sole roughage for prolonged periods. Including with corn silage even 5-10 lb of alfalfa hay per cow daily appears to generally avoid such problems and yield normal performance over several lactations of continuous feeding.

If the value of alfalfa in such rations related to its nutritional composition rather than its coarse texture, then DEHY should serve as effectively as hay in high corn silage rations. DEHY has the advantage over long or chopped hay in terms of adaptation to mechanical handling and mixing into the grain portion of the ration. We have a long term experiment underway at present to test the value of DEHY rations containing corn silage as the only roughage. In these rations, 10% DEHY replaces an equal amount of corn silage dry matter.

Results of the first lactation are shown in Table 1. Thus far milk and fat production are not being maintained as well on the DEHY ration as on the control. The reason for this is not clear. Should DEHY produce long-term benefits, then such a preparation could play an important role in modern mechanically handled rations.

Table 1. Effect of 10% DEHY in corn silage-based rations.

	Milk persistence[a]		
	1st 10 week period	2nd 10 week period	Av. persistence
	(%)		
Control	98	82	90
DEHY	89	74	82

	Fat persistence		
	1st 10 week period	2nd 10 week period	Av. persistence
	(%)		
Control	91	79	85
DEHY	81	68	80

[a] Production as a percent of that during base period.

Coarse-cut DEHY as Total Roughage

We have recently completed a series of experiments with coarse-cut DEHY (about ½″ chop) included in wafers and pellets. The purpose was to evaluate complete type rations with potential for being self-fed. We included the 50% DEHY in a wafer (1½″ x 1½″ x ⅝″) with 50% grain.

Consumption and lactation performance were excellent. However, fat test dropped 19%. Even so, this ration maintained milk fat test better than a mixture of 50% ⅜″-grain pellets and 50% ⅜″-DEHY pellets which reduced the fat test from 3.9 to 2.1%.

The pellet mixture was also very palatable and resulted in a very good response in milk production. Even though these rations were full-fed, no off-feed or digestive problems were noted during several short-term trials. Our following trials showed that when the level of grain in such rations exceeded about 30%, the milk fat test was lowered considerably.

We concluded that pelleted or wafered complete rations containing coarse-cut DEHY have good potential in terms of milk producing value and adaptability to mechanical handling, but additional testing is necessary before such rations can be recommended.

DEHY in the Concentrate Ration

Many commercially produced grain rations and supplements contain a low percentage of DEHY. We conducted experiments to evaluate the inclusion of 10% DEHY in pelleted and unpelleted grain rations and in grain rations fed at high and normal levels. Each experiment ran from the peak of lactation to mid-gestation. Corn silage was full-fed as the basal rough-

(continued on next page)

Dehydrated Alfalfa

(continued from page 23)

age with 5-8 lb of alfalfa hay fed in the first two trials and no hay in the last trial.

DEHY did not appear to have beneficial, or detrimental, effects when included in grain rations fed at normal levels (16 lb/day). However, when included in high grain rations (24 lb/day) 10% DEHY reduced milk yields (4% fat adjusted) in one trial involving high-producing cows, but had no effect in one trial with lower producers. The reduced milk yields (3.5 lb/day) were apparently due to lowered intake of productive energy by cows fed the high-grain rations containing DEHY.

In another trial milk yield was lowered about 4 lb/day when DEHY was added to a meal type ration, but affected very little by DEHY inclusion in pelleted grain rations.

Milk yields were excellent in these trials with several cows exceeding 100 lb of daily milk. However, under the conditions of these tests, DEHY did not yield practical benefits to lactation performance. The only advantage noted related to reproduction as discussed below.

DEHY-Urea Pellet for Supplemental Protein

Research shows DEHY to have special value in combination with urea. Ohio workers made a pellet containing about one-third urea and two-thirds DEHY and compared the protein value of this product with soybean meal. Milk yields were essentially equal for cows fed the urea preparation and the natural protein ration, and averaged over 17,000 lb per lactation.

We compared this same DEHY-urea product with a ration containing an equal amount of urea, but without DEHY. Cows averaged 3.3 lb more milk daily when fed the DEHY-urea pellet. This improved yield could have resulted from the 2.2 lb greater daily intake of dry matter.

These results indicate that DEHY may offer an important means of reducing the cost of protein supplementation of the dairy ration.

DEHY and Reproduction

In one of our experiments we found a considerably higher conception rate for cows receiving DEHY. However, such an effect was not observed in the two other experiments in which reproductive performance was measured. The experiment in which reproduction was improved involved corn silage as the entire roughage; whereas, cows received small amounts of alfalfa hay in the other two experiments.

Our present experiment will provide additional data on this subject.

Conclusion

DEHY can be used to replace a part of the roughage of dairy rations. However, it will not satisfy the coarse roughage needs for maintaining milk fat test. Whether DEHY is included in the grain ration or fed separately, its nutrient contribution should be credited to the roughage portion of the ration. When included supplemental to low quality roughage, DEHY may be helpful at levels up to 1 lb/cwt daily for improving milk yields; however, unless total roughage is restricted to 2 lb/cwt or less, milk yield of high-producing cows may be reduced.

In addition to its nutrient value, DEHY appears to have special value for improving urea utilization, its adaptability to mechanical handling, and possibly for unidentified factors related to rumen metabolism and reproduction.

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