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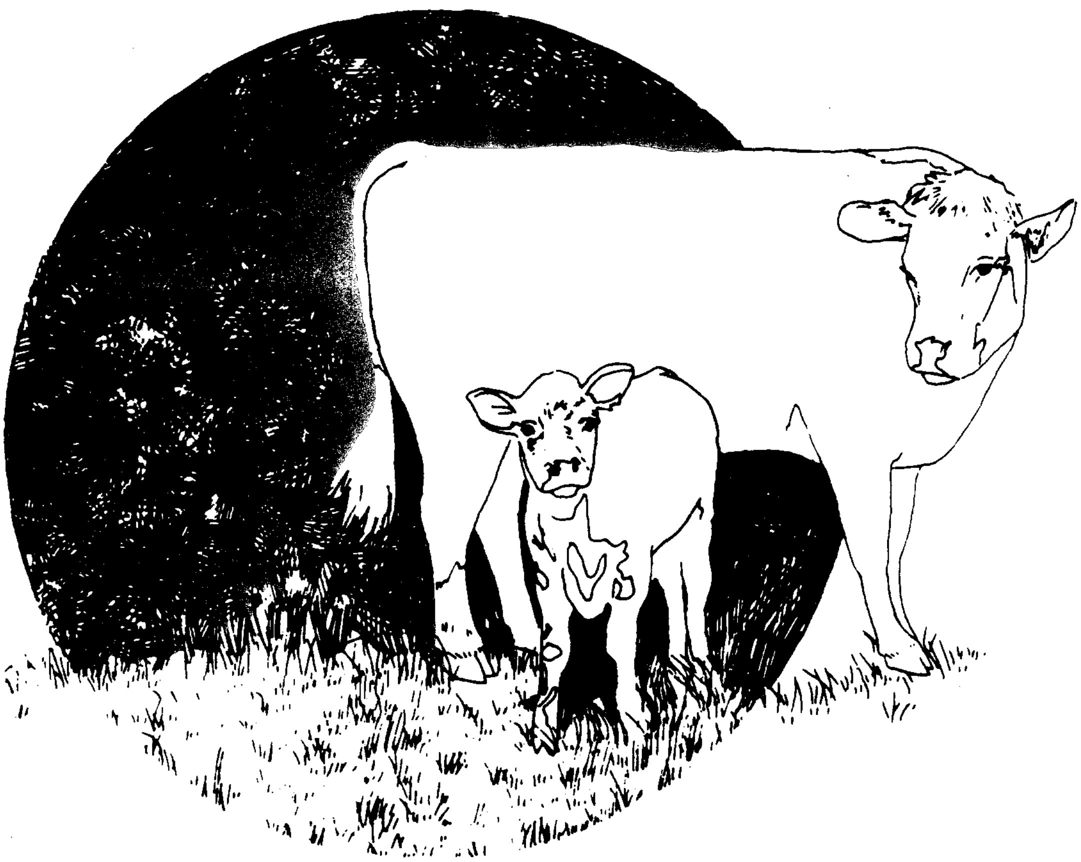
COW-CALF PRODUCTION



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COW-CALF PRODUCTION

Raising livestock is one of the oldest industries in North Dakota. Beef cattle are found in every part of North Dakota with concentration in the western two-thirds of the state. Beef cattle are the major agricultural enterprise in the extensive rangelands of southwestern North Dakota and tend to be a supplementary enterprise on crop farms in all parts of the state.

North Dakota currently ranks 12th in cow-calf production (Figure 1) in the United States. North Dakota is a net exporter of feeder calves and is known as an important source of feeder cattle for feedlots throughout the midwest, western corn belt and south central states.

Nationally, cattle numbers reached a record high of 132 million head in 1975. North Dakota's beef cow numbers followed the national trends and peaked in 1975 with 1.2 million head and currently number 958,000 head (Figure 3). Cattle can be found on 17,800 North Dakota farm and ranches.

Backgrounding calves through the winter is a common practice for utilization of additional forages and off-season labor. Feeding cattle for slaughter, on the other hand, has not been a strong industry in North Dakota. For most areas of the state, beef cattle have provided North Dakota producers with a means of utilizing forages produced on land unsuitable for raising cash crops.

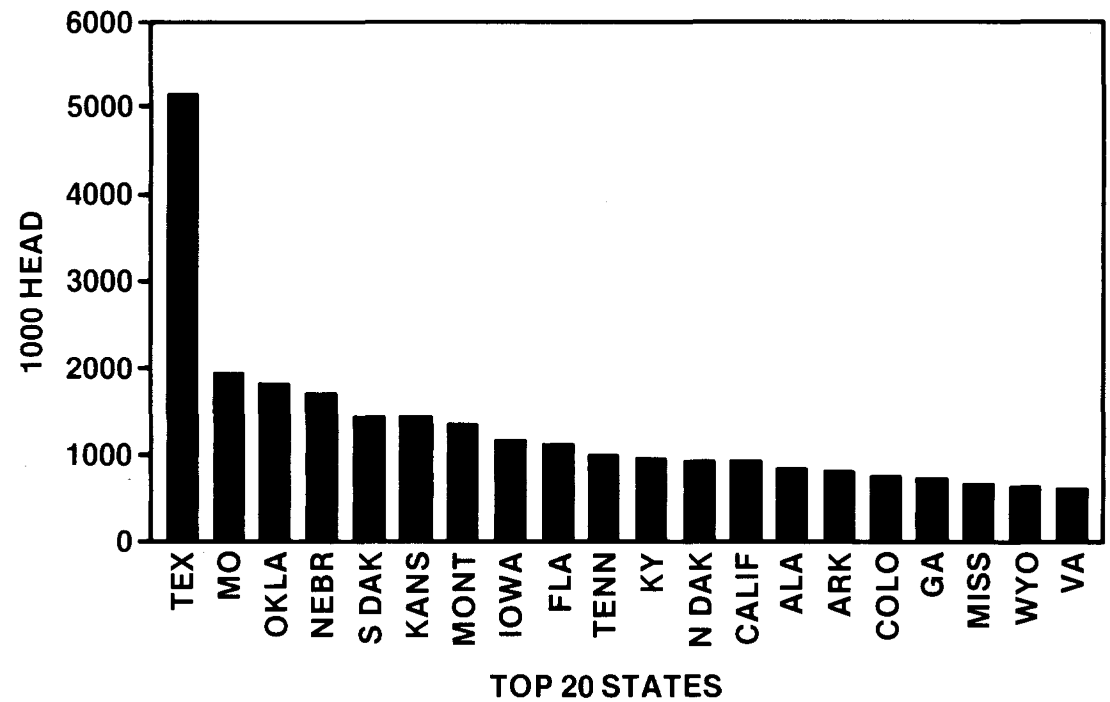


Figure 1. Beef Cow Numbers in Top 20 States, January 1986 Inventory.

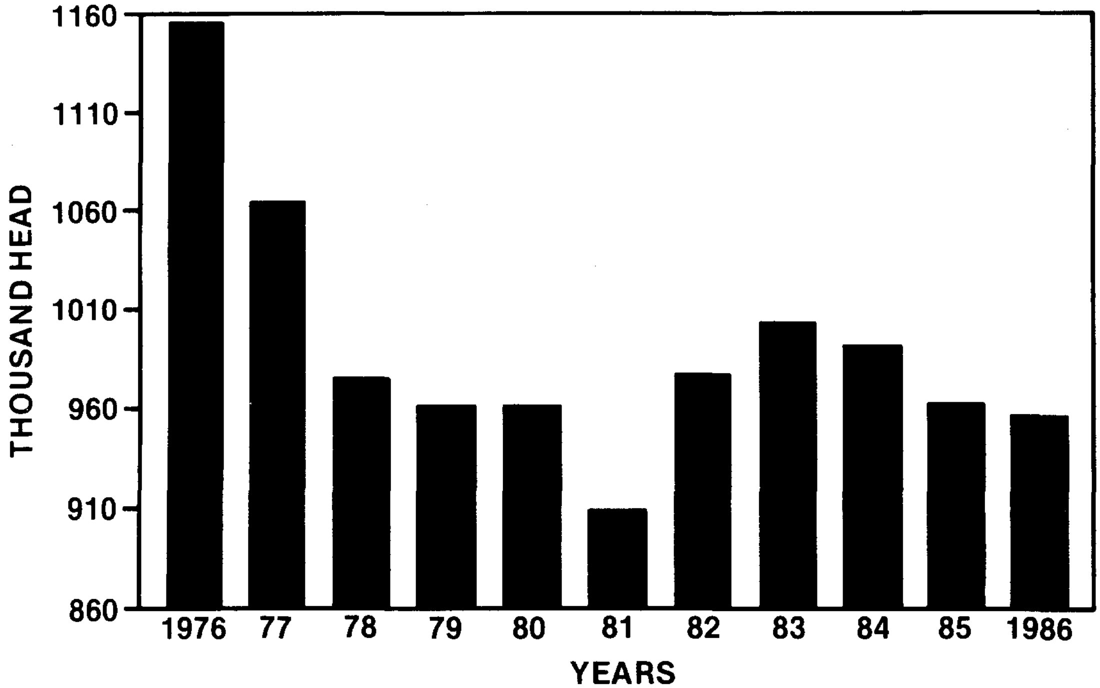


Figure 2. North Dakota Beef Cow Numbers.

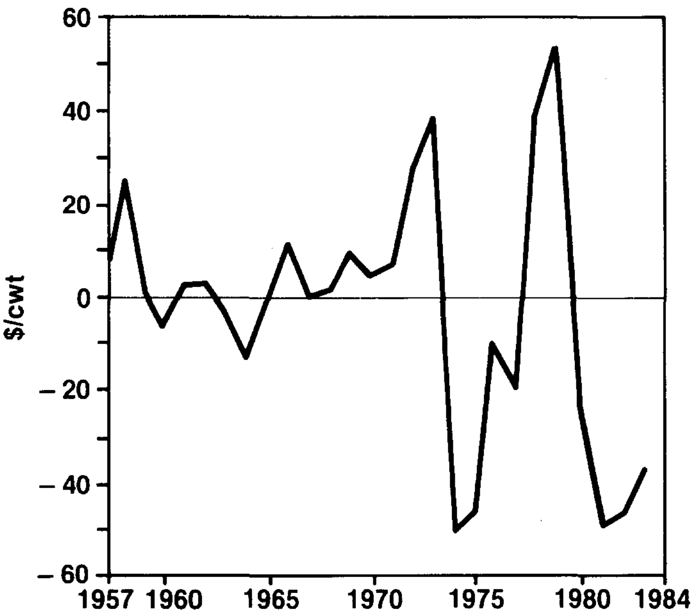


Figure 3. Simulated Cow-Calf Profitability, 1957-1983.

Livestock Income

Livestock income exceeds crop income in 16 of the 53 North Dakota counties and accounts for 25 percent of all agricultural income in the state (Table 1). Beef cattle cash sales are second only to wheat sales in North Dakota. In 1983, livestock income for the top ten counties in North Dakota were: (1) Morton, $40.4 million; (2) Stutsman, $32.0 million; (3) Dunn, $29.1 million; (4) Stark, $27.2 million; (5) Emmons, $25.3 million; (6) McKenzie, $23.3 million; (7) Grant, $23.2 million; (8) Kidder, $23.6 million; (9) Burleigh, $23.0 million; and (10) McHenry, $23.0 million.

Table 1. Income from Livestock and Meat Animals in North Dakota.

Year	Livestock Income	Meat Animals
	(thousand dollars)	
1981	$598,003	$443,227
1982	606,259	446,633
1983	662,654	493,836
1984	660,099	N/A

NORTH DAKOTA'S BEEF COW HERDS

Beef cow herds are typically found on two general types of North Dakota operations - ranching, where most or all of the land is only capable of producing forages and farming, where the cow herd primarily utilizes forages and grain by-products produced on land that can be farmed.

Two Important Economic Characteristics

The beef cow enterprise has two unique economic characteristics that potential producers should take into account. First of all, gross income in a typical beef cow herd selling weaned calves today ranges from $200 to $250 per cow; therefore, a ranch with 250 cows selling weaned calves should gross from $50,000 to $62,500 per year. A typical 50-cow herd in farming areas should generate from $10,000 to $12,500 gross income.

The beef cow enterprise is a relatively low income-generating enterprise when calves are sold at weaning. Backgrounding in North Dakota is increasing in popularity because of the potential for increasing gross income through utilization of additional forage and off-season labor.

The second characteristic of a beef cow enterprise is to keep production costs to a minimum.

CATTLE CYCLES

What Causes Cycles?

Cattle cycles are caused by: (1) the economics of the beef cow enterprise, (2) producers' collection production decisions in response to the economic signals, and (3) the biological time lag between the time that producers make the decision to buildup the herd and the actual time that more beef is ready for sale. Historically, cattle cycles have run for nine to 12 years from peak to peak.

Over the long run, beef cow producers should expect to earn the fair market value and/or opportunity cost for all resources employed in beef cow production. If the beef cow enterprise continues to earn an additional economic profit, producers will expand their cow numbers. The expansion of cow numbers will increase until supply is greater than demand for replacement animals which, in turn, will drive profits down. When profits are negative, producers will decide to reduce cow numbers and decrease supply. As cow numbers go down, increased profits will motivate producers to again increase cow numbers. The stage is now set for the next cattle cycle.

The biology of the beef cow is such that once producers receive the economical signal to expand the beef cow herd, it takes two to three years from the time the decision is made until producers actually market more cattle. This time lag from the economic signal until more beef is on the market is the driving force behind cattle cycles.

Current Cattle Cycle

U.S. cattle numbers reached a peak of 132 million cattle in 1975. Record economic losses in 1975 set in motion the end of the 1970s cattle cycle and stimulated the rapid reduction of cattle numbers in the 1975-1977 era. High porfits in 1978 and 1979 set the stage for the lagged expansion in the early 1980s. The last cattle cycle peaked in 1982 and cattle numbers have decreased each year since. The 1975-1985 period has been one of bust and boom for cow-calf producers (see Figure 3).

Table 2 presents some recently published gross income, expense, and economic profit projections for North Dakota beef cow herds. Out of the last 14 years, seven have been positive and seven were negative. Seven out of the last nine years profits were negative. If producers study the profit projections in Table 2 and compare it to the cattle cycle chart (Figure 3), they will see a relatively strong relationship between the simulated economic profits and cattle number increases and decreases.

Table 2. Simulated Economic Returns from Beef Cow Herds (1975-1984).[2]

Year	Gross Income	Expenses	Economic Profits
	----------dollars per cwt----------		
1970	$90.80	$ 30.34	$ + 60.46
1971	95.40	31.68	+ 63.72
1972	59.25	19.80	+ 39.45
1973	58.81	19.65	+ 39.16
1974	79.40	28.35	+ 51.05
1975	32.58	78.49	− 45.91
1976	36.44	46.84	− 10.41
1977	43.47	62.85	− 19.38
1978	70.58	32.01	+ 38.57
1979	91.21	37.49	+ 53.72
1980	78.77	101.05	− 22.28
1981	63.10	112.71	− 49.61
1982	63.25	110.13	− 46.88
1983	58.93	96.14	− 37.21
Average	$52.71	$ 57.68	$ + 8.18

[2]Randall Little and David Watt, "The Changing Profitability of Beef Production in North Dakota." North Dakota State University, Agricultural Economics Report No. 203, July 1985, page 4.

It is important for beef cow producers to note three things about the current cattle cycle. First, this is the first cycle on record to peak at a lower level than the previous cycle. Second, it was the shortest cycle on record; third, we are currently reducing cattle numbers. These three factors should clearly alert producers that something is now different in the 1980s than it was in the previous decades.

North Dakota is following the national trend and is also reducing cow numbers (see Figure 3). The current replacement heifer numbers and the number of cull cows being sent to slaughter is sufficient reason to believe that North Dakota will continue to decrease cow numbers for at least two more years.

With this information, readers should be able to understand the impact the rapid build-up of cattle numbers during the first half of the last decade had and why profits have been so volatile in the last 10 years.

Before North Dakota's beef cow producers will collectively again increase beef cow numbers, long run economic profits will need to return to the beef cow enterprise. If the cattle cycle does turn around in the late 1980s as some are suggesting, now may be the time for an individual producer to counter the cycle and increase beef cow numbers.

TOP MANAGERS IN NORTH DAKOTA ARE MAKING MONEY WITH BEEF COWS

Tables 3 and 4 summarize the published farm record summary for 1985 commercial beef breeding herds in North Dakota. The farms summarized in this report are members of the Adult Farm Management Program located throughout North Dakota. The participating farmers in this program are divided into three groups - (1) the 20 percent least profitable farms, (2) the average of all beef cow farms, and (3) the 20 percent most profitable farms. Only farms and ranches with commercial beef cow herds are included.

Table 3 summarizes the production, marketing, and feed consumption averages for these farms. The high profit farms sold heavier calves, sold them at a higher average price, and grossed $120 more per cow on the average than the low profit farms. Return over feed costs is an indicator of feeding efficiency in this enterprise. The high profit farms had the lowest feed cost per cow and netted $187 per cow more returns over feed costs than the low profit farms. Feed efficiency is the difference.

Table 4 summarizes beef cow enterprise economics for these participating farmers. Non-feed costs were the highest on the high profit farms. The numbers suggest that the low profit farms did not spend enough and this suggests that beef cow producers may need to spend a minimum amount of money on health maintenance programs and livestock facilities to be able to properly manage the herd.

Table 3. Farm Record Summary of North Dakota Beef-Cow Herds (1985).[1]

Item	Low Profit Farms	Average Farms	High Profit Farms	Your Farm
	----------per cow----------			
Production:				
Number of farms	n/a	n/a	n/a	
Ave No. of beef cows	56	70	50	___
Ave No. other beef animals	39	53	46	___
Percent calf crop	97	96	98	___
Percent calf death loss	7.3	5.8	8.3	___
Ave weight per calf sold	507	539	600	___
Cwts of beef produced	254	371	297	___
Marketing:				
Ave weight per head sold	585	613	680	___
Price per CWT sold	$52.81	$54.62	$55.18	___
Total value produced	$223	$283	$342	___
Feed Consumption:				
Grain (lbs)	326	362	408	___
Protein, salt, & mineral	22	29	21	___
Legume hay (ton)	1.11	.59	.49	___
Other hay & dry roughage	2.66	2.25	2.40	___
Silage	.56	.56	.79	___
Total Hay Equivalent	3.99	3.06	3.20	___
Pasture cost	$52	$60	$41	___
Total feed cost	$224	$188	$156	___
Returns over feed costs	$ – .73	$95	$186	___

[1]Source: "North Dakota Vocational Agriculture Farm Business Management Education 1985." Published in cooperation with the North Dakota State Board for Vocational Education.

Table 4. North Dakota Beef Cow Herds (1985) Continued.

Item	Low Profit Farms	Average Farms	High Profit Farms	Your Farm
	per cow			
NET VALUE PER COW	$223	$283	$343	___
TOTAL FEED COSTS	224	188	156	___
OTHER DIRECT COSTS:				
Veterinary expenses	4	6	11	___
Grinding, Hauling, etc.	4	6	9	___
Miscellaneous livestock exp.	5	5	8	___
Total	13	18	27	___
ALLOCATED COSTS:				
Power & Machinery	12	11	16	___
Livestock Equipment costs	6	10	16	___
Building & Fence	6	5	7	___
Total	24	26	38	___
RETURNS TO LABOR, MGT, AND CAPITAL[1]	$ – 38.48	$51.10	$121.40	___

[1]Reported in the Farm Record Summary as "Returns Over All Listed Costs," Line 34, Table 15a. It is this author's interpretation that this can be defined as Returns to unpaid family labor, management, and all capital. All capital was used as it appears that no interest charges (either for equity capital or borrowed capital) were included.

The complete story is summarized in the bottom line of table 4. The high profit farms had an average return to labor, management, and capital of $121 per cow while the low profit farms had a return to labor, management, and capital of a minus $38 dollars per cow. Clearly, some beef cow producers are making a good economic return while, at the same time, other beef cow producers are losing money.

FOUR IMPORTANT MANAGEMENT VARIABLES DETERMINE THE BOTTOM LINE

Operating a profitable beef cow herd requires considerable management expertise. It is generally difficult to concentrate on all of the possible management factors associated with managing a beef cow herd. It is important, however, that a beef cow producer concentrate his limited management time on those management factors that: (1) make a big different in profitability of the beef cow herd and (2) can be influenced with management.

Four management factors that appear to make a major difference in operating a beef cow enterprise are: (1) percent calf crop, (2) weaning weights, (3) costs of production, and (4) price received. Two of these are production factors and two are economic factors. The rest of this publication is directed toward the production, management and marketing practices that have a major impact on these four management factors.

ESTABLISHING A COW HERD

Profits from the breeding cow herd depend largely on the fertility and milk producing ability of each female. A top herd of cows that calve regularly, wean heavy calves and stay in the herd as long as possible is the goal of every operator.

One the the first considerations in establishing a herd is the breed. Each breed has some outstanding advantages as well as some deficiences. It is up to each individual operator to decide which traits he wishes to emphasize and which breed - and animals within the breed - best fit his preferences. A producer should fit his cow herd to the resources he has available.

Selection and Management

Generally, three classes of females are available to the commercial producer, (1) heifer calves between 7 and 12 months of age, (2) bred yearlings or young cows ready for production, and (3) mature cows that may sell either bred or open. Each class has distinct advantages as well as drawbacks.

Growing into the beef cow business by buying young heifers is a safe way to start. If beginners buy into the business with mature cows, management problems like disease, slow breeders, poor doers and strung out calving seasons may arise. An operator starting out with heifers has a chance to keep more production factors under control.

Less cash investment is involved with heifers, and heifers will grow to maturity on roughage without much grain or supplement. However, more time is required before there are any returns from heifers.

Mature beef cows will produce more pounds of calf and yield a quick return, but there is more danger of disease and unsoundness. Many old cows are on the market because they are poor producers, so buying older females in small lots can be hazardous. On the other hand, buying all or part of an existing herd that is being dispersed or reduced could be the ideal way to get started.

Use performance records to select females. The same standards are used when choosing females or herd bulls, but the cattleman usually can't be quite as choosy about females. Performance records are most valid in selecting cattle within the herd. Comparing records between herds is not as valid due to differences in management practices and feed.

Weights of heifers will vary depending on the breed, but, in general, replacement heifer calves should weigh 490 pounds and up, and yearlings should weigh between 700 to 900 pounds at breeding. Well-grown heifers should be bred to calve as two-year-olds. Research has shown that heifers bred to calve at two will raise an average of .7 more calves during their lives than heifers bred to calve first at three.

Heifers should be bred one heat cycle, about three weeks, before the rest of the herd. This will permit more attention to the first-calf heifers at calving time and allow heifers more time to get into condition for rebreeding so they will calve with the cow herd the following year. A cow that calves late once is likely to calve late the rest of her productive life.

A bull known to produce calves with birth weights similar to those of calves currently being produced by heifers in the herd is best to use on first-calf heifers.

Aim for 100% Calf Crop

The only income a beef cow produces each year is the value of her calf, so if she fails to produce a calf the feed she has eaten is largely wasted. Nonbreeders and slow breeders should be removed from the herd as soon as they can be identified. Pregnancy testing is a good practice.

Culled cows can usually be marketed to advantage before being turned out to graze, unless they are very thin. The end of the pasture season usually brings hurried shipments of cull cows and relatively low prices.

Keep only females that conceive readily and deliver strong calves with little assistance at calving. Plan to keep sure breeders in the herd for about 10 years or until their teeth fail or other unsoundnesses develop.

Mature cows usually perform better than heifers at calving, with heifers requiring more assistance. A cattleman can tolerate calving difficulty with first-calf heifers, but not with mature cows. Heavy culling for non-performance will, in time, help to raise the calf crop percentage, the most important single factor in herd profitability.

Selecting the Herd Bull

There are probably as many ideas on how to select a herd bull as there are cattlemen. Every situation is different, and every operator must have his own goals, ideas, limitation and requirements when selecting a bull for his herd.

The modern beef bull must be built well off the ground, well-balanced, thickly muscled, have a strong back and stand correctly on a set of feet and legs that are free from defects. The old saying that the bull is half the herd is actually an understatement. The bull leaves so many more offspring in the herd than a single cow that he makes a much greater impact on type and production. Research shows that a change in type can be accomplished three to five times as fast through bull selection as by culling and selection within the cow herd.

When selecting bulls, the question of type, conformation and size naturally comes up. There has been a general trend toward larger, growthier beef cattle. Size and growthiness are important, since cattle are sold by the pound, but rate of gain and development to choice grade at weights of 1,050 to 1,300 pounds are important in the production of a modern beef steer. Nearly 80 percent of the economic value of a beef carcass comes from the cuts along the top line and in the rear quarter, so these should be emphasized when selecting for type.

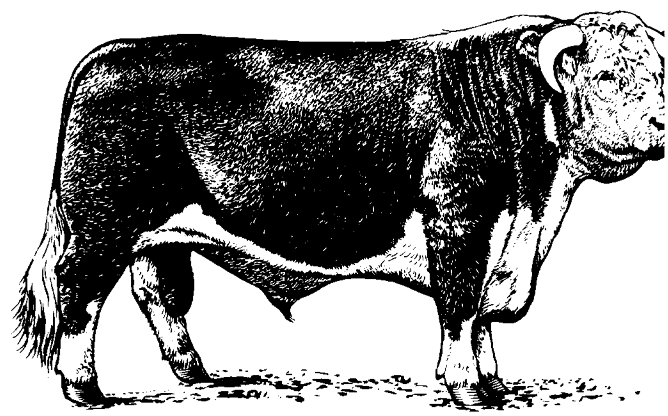
Performance testing records are one of the most valuable tools in selecting a herd sire. These records are most meaningful when selecting among the bulls in one herd. Breed sire summaries are an excellent source of genetic information on prospective herd bulls or his relatives. As a guide, producers should select bulls that have adjusted weaning weights over 100 pounds greater than their present herd average adjusted weaning weight. Well-grown young bulls should be ready for breeding by 15 months of age. Be cautious about buying over-conditioned bulls.

Buy bulls at least 60 days before breeding season to allow the bulls a chance to adjust to new surroundings. Virgin bulls are more likely to be disease-free than bulls that have been in service. Check the bulls' fertility before the breeding season.

Management of Bulls

Because the breeding efficiency of the bull contributes so much to the productivity of the beef herd, the subject of management of bulls merits more attention than it often gets. Too often, bulls are poorly housed, get only the leavings for feed and get little that could be described as care.

The best breeding condition for bulls is described as lean and hard. Without suitable exercise, this condition is often not possible. Bulls should always be provided with suitable shelter, have access to a good-sized yard with summer grazing, and are generally better off with another animal or two for companionship.



Feed for breeding bulls should be complete from a nutritional standpoint. Bulls cannot perform satisfactorily if they must subsist on a ration of poor roughage. If pastures are short or bulls are in poor condition, some additional feed can be fed previous to and during the heaviest part of the breeding season.

Use enough bulls to get cows settled promptly. On large range units, four or five bulls per 100 cows may be needed, but in a limited pasture a bull may service 25 to 30 cows. A yearling bull probably should not breed more than 20 cows. A breeding pasture for each bull and his group of cows is most desirable from the standpoint of both efficient breeding and sound range management.

Small breeding pastures will improve the chances of mating and conception by insuring closer contact between the bull and cows. Use of a tame grass pasture such as brome or crested wheatgrass will permit a maximum number of cows per acre of pasture. These tame grass pastures are especially valuable for breeding first calf heifers and early-calving cows during May and early June.

Cows mated on native range during July and August will also have chances of improved conception when pasture size is kept small. This can be done with adequate water development and by cross fencing large pastures into smaller units. Here again, more cows can be serviced by a bull due to increased herd contact.

Separate the bulls from the cow herd after a 60 day breeding season to eliminate stringing the calf crop out over a long period.

Artificial Insemination

Another possible breeding method is artificial insemination (A.I.). A.I. has some advantages. It is possible to obtain semen from desirable bulls that would not otherwise be available. For a small operator with very few cows, obtaining A.I. service may be more practical than buying bulls.

There are some drawbacks, however. A.I. requires much more labor and a higher level of management than natural breeding. During breeding, it's necessary to check the herd for cows in heat at least twice a day. Once detected, cows in heat must be brought in and inseminated, which requires suitable handling facilities. A skilled technician must be obtained, or the operator himself or one of his employees must learn the A.I. procedure and estrus synchronization.

Because of the high level of management required, the number of cows settling on first service may be lower than with natural breeding. This could tend to string the calving season out.

Artificial insemination has a place in the beef industry, but it is not a practice a cattleman should start without careful evaluation.

GESTATION CALENDAR

The average gestation period for a cow is approximately 283 days. However, variations from average gestation length occur for several reasons. Heifers tend to carry their calves for four to five days less than older cows. The sire as well as the dam influences gestation length of the calf. The following gestation calendar is based on 283 days.

Date of Breeding	Expected Date of Birth	Date of Breeding	Expected Date of Birth
Jan. 1	Oct. 11	July 10	Apr. 19
Jan. 11	Oct. 21	July 20	Apr. 29
Jan. 21	Oct. 31	July 30	May 9
Jan. 31	Nov. 10	Aug. 9	May 19
Feb. 10	Nov. 20	Aug. 19	May 29
Feb. 20	Nov. 30	Aug. 29	June 8
Mar. 2	Dec. 10	Sept. 8	June 18
Mar. 12	Dec. 20	Sept. 18	June 28
Mar. 22	Dec. 30	Sept. 28	July 8
Apr. 1	Jan. 9	Oct. 8	July 18
Apr. 11	Jan. 19	Oct. 18	July 28
Apr. 21	Jan. 29	Oct. 28	Aug. 7
May 1	Feb. 8	Nov. 7	Aug. 17
May 11	Feb. 18	Nov. 17	Aug. 27
May 21	Feb. 28	Nov. 27	Sept. 6
May 31	Mar. 10	Dec. 7	Sept. 16
June 10	Mar. 20	Dec. 17	Sept. 26
June 20	Mar. 30	Dec. 27	Oct. 6
June 30	Apr. 9		

Larger breeds, with exception of the Holstein, tend to have longer gestation periods. Gestation periods sometimes vary as much as 8 to 10 days from the expected, for unknown reasons. Birth weight generally increases with longer gestation periods.

The following are some average gestation lengths for breeds and crosses sired by certain new breeds, compiled from a variety of sources:

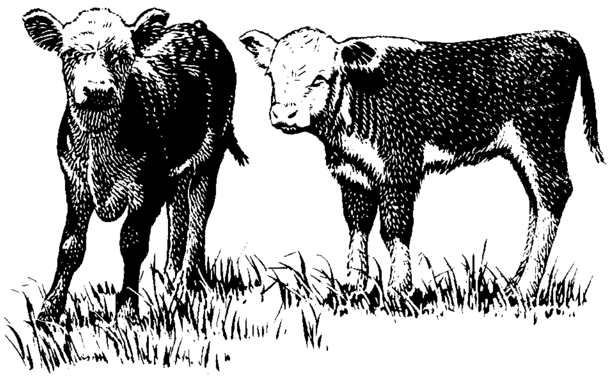
Breed	Average Length of Gestation Period
Angus	281
Shorthorn	282
Hereford	285
Charolais crosses	284
Limousine crosses	285
Simmental crosses	286
Jersey	279
Holstein	279
Guernsey	283
Brown Swiss	290

Early or Late Calving

Time of calving should fit the farm management plan. There are advantages and disadvantages for calving either early or late.

Advantages for calving early - February and March - include having heavier calves at weaning time, with lower feed costs per pound of calf produced. There is a better utilization of the grazing season for greater milk production and calf growth when calves are born early in the season. Early calving may fit the work schedule of combination grain and cattle operations, because the calving season is over before spring work starts. However, if calving is delayed until May or June the weather is better for calving.

Fall calving is not utilized to any great extent in North Dakota. Fall calving is better suited to the southern states, where pastures can be utilized much earlier in the spring. However, calving in the fall might fit some North Dakota operations, such as confined cow herds or cow herds kept in semi-confinement on irrigated acreage.



At Calving Time

For late winter and early spring, a calving shed or barn should be available. Provide 10 x 10-foot calving stalls, which can be either permanent stalls or stalls made from gates, portable corral sections or panels.

Place the cow in the calving stall just before calving. Have a calf puller available for use if the cow cannot deliver in about two hours of definite labor, but don't try to provide assistance too soon. If the calf is out of normal position, call a veterinarian.

When the calf is born, immediately clear its nose and mouth of mucus. If the calf does not breathe, hold it up by the back legs and apply artificial respiration. A resuscitator to provide oxygen for calves can be purchased. Some have suction equipment to draw mucus from the lungs as well.

Disinfect the navel cord with iodine to prevent infection. A heat lamp or an electric heater with a fan can be used effectively to dry the calf in inclement weather. Also, encourage the cow to lick the calf dry.

A calf should get colostrum milk the first half-hour of its life if possible. Colostrum contains the disease-fighting properties essential to the calf's health. If the calf does not get up and nurse within two hours, the cow should be restrained and the calf assisted to suck. If this is not possible, the cow should be milked and the colostrum fed with a tube, a nipple pail or a lamb nipple on a bottle. Having a supply of frozen colostrum on hand can help save calves that might otherwise die.

The calf's intestines loses its ability to absorb the antibodies colostrum contains in the first 12 hours, so it is important to get colostrum into the calf early.

To help prevent mix-ups, ear-tag the calf immediately after it is born. The cow and calf may be removed from the calving pen as soon as they accept each other readily. Graduate them to a larger pen or pasture as weather permits.

In suitable weather, a clean calving pasture or calving lot located so it can be checked every few hours is most satisfactory. To lessen the chance of contamination, the pasture or lot should not be used by other cattle. The area should be well-drained and protected by a shelter belt or board fence. It should have facilities for feeding and watering as well as a place to restrain a cow if necessary. Clean, dry bedding keeps the calves warm, dry and protected from drafts.

Natural shelter such as buck brush, trees and hillsides can be most valuable in sheltering cows and young calves in early spring. A "calf coop" or protected calf creep feeding area can protect calves during spring storms.

Keep ease-of-calving records for your management program. Sell cows that have difficulty in calving. A record of calving difficulty will help identify the sire causing the problem as well. Extreme difficulty in calving injures the young mother and can seriously delay or even prevent timely conception.

BEEF COW NUTRITION

The basic nutritional need for satisfactorily wintering mature, pregnant brood cows is enough energy to maintain the cow's body weight or permit only minimum weight loss (10 to 15 percent) from fall until the cow has calved, and ample protein, minerals, and vitamins for proper development of the unborn calf. Inadequate energy intake limits the productivity of many beef cows, especially younger cows, in many herds in the state.

A basic ration for wintering average-sized cows weighing approximately 1,100 pounds is about 22 pounds of hay (or its equivalent) per day. Larger cows will require about 7 percent more feed per 100 pounds additional weight. Cows of inherent higher milking ability seem to have higher feed requirements for winter body maintenance.

Requirements for lactating cows are substantially higher for all nutrients than those for pregnant cows. The daily feed requirement increases after calving to a level of 26 to 34 pounds per day, depending upon feed quality, cow size and milking ability. Energy or total digestible nutrient (TDN) needs of cows increase from about 9 to 10 pounds in mid-pregnancy to 12 to 19 pounds in early lactation, depending upon cow size and milk production. Since about 70 percent of fetal development occurs in the last third of gestation, daily nutrient allowance of pregnant cows should increase 15 to 20 percent at this time. This will help develop a strong, robust calf with high livability and some needed reserves in the cow's own body yet avoid needless fattening of the cow.

Simply changing the components of the cow's ration from straws and lower-quality roughages to higher quality forages will often provide adequate upgrading of the cow ration for the last trimester of pregnancy.

Protein and phosphorus needs increase 50 to 100 percent from mid-pregnancy to lactation, depending upon level of milk production. Daily calcium needs increase even more sharply, especially for high milk producing cows.

Cows with high milk production ability will require greater nutrient intake than cows having moderate to low milk production, even though they may be of the same size. Approximately 0.3 pound of TDN will be needed per pound of milk produced, after the cow's own body maintenance needs have been met. This is the equivalent of 6 extra pounds good quality hay for a 10 pound greater daily milk output. Cows with higher milk production will usually wean heavier calves, but unless their feed intake is increased appropriately during lactation they may not rebreed as

Table 1. Nutrient Requirements for 1,100 Lb. Beef Cows.

	Pregnant	Lactating	Heavier-Milking Cows, Lactating**
Air dry feed, Lbs.*	20	28	35
TDN (Energy) Lbs.	9	16	21
Protein, Lbs.	1.2	2.4	3.0
Calcium, grams per day	13	31	38
% of ration	0.16	0.24	0.24
Phosphorus, grams per day	12	23	28
% of ration	0.15	0.18	0.18
Vitamin A, units per day	18,000	40,000	50,000
or			
Carotene, mg per day	45	100	125

*Amounts of feed needed are approximations. Proportion of feed allowed that is wasted rather than eaten will affect amount needed per day. During mild winter weather, feed allowance can be reduced from amounts indicated. During severe weather, it may be necessary to provide nearly ⅓ more feed than indicated to prevent weight loss.

**Exact feed needs will depend upon level of milk production of cows, nutrient level of ration being fed (how much grain or concentrate is fed), and size of cow. Crossbred cows containing some dairy breeding will need 20 to 25% more nutrients during early lactation.

promptly as desired. Feeding some grain to the lactating cow is a practical means of increasing both energy and protein intake. Each pound of grain is roughly equivalent to 2 to 2½ pounds of good hay. Young heifers nursing calves should be grouped together and fed some grain supplement.

Undernourishment of cows during gestation often results in little change in calving success, but usually results in longer postpartum rebreeding intervals and greater percentages of open cows the next year.

GROUP COWS ACCORDING TO AGE AND CONDITION FOR WINTERING

Young bred heifers and young cows that have just weaned their first calf should be fed separately from the mature cows in the herd. These young females are smaller, still growing, and are replacing their temporary teeth at this stage of maturity. Heifers will be pushed away from feed by larger mature cows, or may be forced to survive on lower quality feed while the bigger, older cows get more than their fair share of higher quality feed if penned and fed together. Failure to separate heifers from cows during wintering typically results in underfed, thin heifers and possibly overfed cows.

Older cows that are declining in production because of losing their vigor and teeth are usually culled. When such cows are kept they are usually exceptional producers and merit some special attention. If kept, they should be fed with heifers and young cows, as they will be better able to compete in this group. Some older cows losing their teeth may require 2 to 3 pounds of grain daily to help them through winter in adequate condition.

It has been shown experimentally that grouping mature cows according to fall body condition and then adjusting relative feed intakes in an attempt to reach similar condition for all results in more efficient use of winter feed resources. This means increasing the daily feed allowance for thinner cows in the fall while slightly reducing feed for cows already in thrifty or adequate condition. For many cattle operations, the wintering facilities and area or number of lots available will limit the degree of grouping of cows for wintering.

With the increase in number of breeds and kinds of cows kept as beef cows, some groups may require different management than others. These individuals should be lotted as a group and fed to maintain adequate body condition for efficient rebreeding. Cows in this category are usually taller, leaner and more angular. They may wean some of the heaviest calves in the herd. They usually are high milk producers and lower in body fat content or insulation for protection against excessive body heat loss.

REPLACEMENT HEIFER CALVES

More heifers than needed should be kept as potential replacements. Keeping a larger-than-needed number of heifers will allow for some culling based on growth rates to 12 and 18 months of age. Not all heifers will become pregnant during the breeding season. Heifers that conceive early tend to be more fertile throughout their productive lives. For these and other reasons it is important to develop enough potential heifer replacements to allow additional culling later.

For most breeds and crosses it appears that a young heifer must attain at least 60 percent of her own eventual weight before she reaches puberty and can possibly be bred. Where the cowman plans to have first-calf heifers calve one month ahead of the main cow herd, the yearling heifers will have to be large enough to breed (at least 60 percent of her eventual weight) by 14 months of age. The use of scales and some arithmetic can quickly tell whether or not heifer calves are making adequate progress toward being large enough to breed by the desired breeding date.

Grouping heifer calves into two or more lots will help get all heifers adequately grown-out yet avoid needless overfeeding of larger heifers. There apears to be no permanent benefit from overfeeding replacement heifer calves beyond growing them large enough to ensure timely cycling. Excessive fattening can cause accumulation of undesirable fat deposits around the reproductive tract and in the udder, possibly resulting in calving difficulties and impaired milking ability. A strong, thrifty yet trim and lean condition should be the goal for developing female replacements for a long, productive future in the herd.

FEED LEVEL AFFECTS FERTILITY AND REBREEDING

Prompt initiation of cycling and high conception rates seldom occur unless the cow or heifer is gaining slightly in condition prior to and during the breeding season. Controlled studies have shown clearly that cows underfed during late pregnancy will have delayed onset of heat cycles, while cows underfed between calving and breeding time will often cycle but fail to conceive. When cows are underfed both before and after calving, the detrimental effects on rebreeding are cumulative, with the result that cows either do not conceive during the planned breeding season or conceive several weeks later than desired. This problem is much more acute in the two-year old dam suckling her first calf since she is still growing herself and also will not have a perfect set of permanent teeth because some of her deciduous teeth are being replaced. For this reason, many progressive producers now breed their yearling heifers to calve about one month prior to the main adult cow herd. This gives the young first-calf mother an extra month's time to recuperate from calving and still be able to rebreed and conceive on schedule with the main cow herd for her second calf.

CREEP FEEDING

Creep feeding refers to providing supplemental feed such as grain, commercial rations or high quality roughages to calves in a feeder or feeding area constructed so calves can enter but larger animals cannot. The purpose of the creep feeding is to provide supplementary nutrients under situations where milk and forage intake are restricted enough to prevent the calf from making optimum growth.

There is no simple yes or no answer as to whether or not creep feeding will pay. Creep feeding adds to the cost of producing a weaned calf; in some instances the cost becomes greater than the value of the increased weaning weight produced.

Creep feeding can best be justified under these conditions: (1) poor pasture conditions which reduce milk supply and available forage for calves; (2) creep feeding for the last two to four weeks before weaning, which will teach the calf to eat harvested feed, easing the transition from the cow to the feedbunk; (3) calves from groups of young mothers will probably respond more to creep feeding because their dams generally produce less milk; (4) calves born late in the spring and on into fall and winter generally show greater response to creep feed because of inadequate or poorer quality forage available to both them and their dams.

Creep-fed calves will generally be heavier at weaning time. Depending upon genetic makeup (potential growth rate and frame size of calf) creep feeding may result in excessive condition on weaned calves that are to be sold at weaning time or shortly thereafter. Earlier-maturing, easier-fleshing calves are more likely to accumulate excess condition as a result of creep feeding. Creep-fed calves typically suffer less set-back at weaning time since they already know how to eat dry feed, but calves that have not been creep-fed usually gain faster in the feed lot and tend to gradually compensate or "catch up" with calves that have been creep-fed.

Creep-fed heifer calves may deposit excess fat in the milk-secreting tissue of their developing udders, reducing future milk output. Records show that calves from dams that were themselves creep-fed as calves often wean lighter than those from non-creep-fed dams. Again, the genetics of the calf plays a major role in determining how creep feeding affects growth and development of the nursing calf. A large study by one of the major breed associations suggests that calves having high genetic capacity for rapid growth will not suffer impairment of future milking (mothering) ability by creep feeding, even though their own mothers produce abundant milk supplies. Clearly the genetic frame size, growth potential, and biological type of the calves involved affects the immediate and long-time influence of creep feeding on the suckling calf.

The question of which creep feed to use and how much to pay for it becomes relevant. Whole oats is most commonly used it is quite palatable to calves, fairly resistant to deterioration in the feeder from exposure to wetting and heat, and offers considerable safety from digestive upsets because of its bulky, higher fiber content. More complex preparations can be formulated or purchased already manufactured that may be consumed more readily by calves and may give superior gains. Avoid dusty, finely ground preparations for teaching calves to eat.

Creep feeding and calf adjustment to eating concentrate feeds also makes it easier to wean calves early if drought and lack of pasture become a problem. When this situation arises, it is often more economical to wean and feed the calves than to feed the cow to maintain or increase her milk production. This practice is especially useful with first or second calf heifers under short feed supply conditions.

FINISHING A VIABLE OPTION

Owning cattle right through to finished weight and condition is a management option that should be considered by the cow-calf producer. Calves can be

grown and fed to slaughter weight right on the home farm or ranch, or they can be put in a custom lot where someone else is paid for finishing calves. The profit (or loss) that accurs in such cases goes to the calf producer who retains ownership in the cattle all the way to the slaughter. Some producers may feel that an experienced feedlot has the knowledge, expertise and resources to finish cattle more efficiently than they could do themselves.

Some of the reasons for finishing cattle on the farm or ranch are as follows: (1) to realize more gross dollars and net return per cow unit kept in the herd; (2) to market additional grain and roughage through cattle, more total feed marketed through cattle per cow unit in the herd; (3) to take full advantage of breeding improvements that have been made in the herd's annual calf production, as compared to growing the calf only halfway from weaning to slaughter as is the case for "backgrounding" programs and especially as compared to selling calves at weaning time; (4) to retain flexibility of selling cattle prematurely if special cash flow requirements become demanding, prices rise to become especially attractive, or other conditions dictate premature sale of animals being fed for slaughter; there is always an active demand for heavy feeder cattle or feeder cattle of all weights; (5) to meet a special market for fed slaughter cattle, including custom sale of carcass halves or quarters to individual families, or (6) to take advantage of years when there may be more profit available from feeding calves from weaning to slaughter weight th[illegible] from maintaining the cow unit the whole year to produce one weaned calf, or slightly less.

Backgrounding

Backgrounding feeder calves means to feed a good growing ration to calves from weaning at around 400-500 pounds to the 600-750 pound range to produce a feeder animal ready for the finishing lot.

Backgrounding offers many advantages to the cow-calf operator. The cattleman on a backgrounding program feeds his own calves when they are making the most efficient gains. The operation provides an opportuntiy to utilize home-grown feeds and to make use of available labor during the winter months.

Backgrounding also helps build some flexibility into a cattle enterprise. Calves can be sold or fed to heavier weights depending on feed supplies and market conditions.

RAPID FINISHING OF LARGE-TYPE CALVES

Introduction of genetically larger, faster-growing breeds and lines within existing breeds has made rapid finishing of young cattle more feasible. Cattle of such breeding usually contain 50 percent or more large-type breeding in their make-up and are typically sired by bulls of large, fast-gaining breeding. Their dams in turn are generally sired by genetically larger bulls, possibly of higher-milking breeds. Such calves have tremendous ability to make rapid gains, but similarly must be fed to heavier slaughter weights than more "conventional" cattle to enable their carcasses to develop adequate marbling and maturity to be acceptable under current carcass quality standards.

To best utilize the rapid gaining potential of such cattle, they must be put onto high energy rations shortly after weaning and "pushed" to slaughter weight and condition. Such rations will need to contain upwards of 60 percent grains, on a dry-matter basis. Many of these cattle have a tendency to stay very lean and develop a rather coarse, bony appearance when not fed high-energy rations. Such cattle require high energy and higher protein rations to enable them to utilize their genetic potential for making high rates of gain and meat production per day.

Since this type of operation will involve use of more grain from weaning to market than many traditional growing-finishing programs, the economic feasibility of the operation is related to relative cost of nutrients from feed grains versus forage sources. There currently seems little likelihood of feed grains rising in price to limit the economic feasibility of this type of feeding program.

An important consideration is that the particular feeding program selected for the weaned calves should be based at least partly on the genetic makeup (biological type) of the calves being produced. A feeding program that is optimum for calves of straight British breeding may grossly underfeed large-type calves that may have tremendous impulse to grow but which finish or fatten much less readily. Rations for such high-gaining calves must necessarily contain a high proportion of grain to provide the needed energy level. Since grains are poor calcium sources, the reduced amount of roughage may not supply enough calcium for optimum nutrition for high gains. Such rations should provide twice as much calcium as phosphorus; it may be necessary to include some limestone in the ration to provide this higher calcium level when roughage intake is limited. The added limestone serves as a buffer and aids in digestion of starch from grains on such high-energy rations.

Fast gaining cattle can efficiently utilize about 2 pounds of ration protein daily from weaning to market. Because they are younger but also tend to gain faster at any given weight, large-type, fast-gaining calves should be fed rations formulated to provide higher levels of protein and major minerals, calcium and phosphorus, than "conventional" or middle-of-the road kinds of cattle at any given weight.

Because larger-type, faster gaining cattle are larger at the same age, they are consequently younger in a physiological or maturity sense at any particular weight than smaller cattle. For example, a large-type calf might reach 600 pounds at six months of age while a well-fed calf of medium size and growth rate may not reach 600 pounds until eight months or nine months of age.

GRAZING CATTLE AS YEARLINGS - THE "STOCKER" OR "YEARLING" PROGRAM

Many areas of North Dakota have large acreages of native pasture and range. These areas have survived sod destruction during years of high cash crops for various reasons, such as too many large rocks to be broken even by heavy equipment, soil too sandy or gravelly to attempt grain production, rolling or steep topography, or recognition by someone that such soils are fit only for permanent sod and grazing agriculture.

Such areas are well suited to grazing yearling cattle. Cattle can be removed from such ranges in late summer and either transferred to the owner's feedlot or sold to someone else for finishing. Yearling steers will typically gain from 150 to 225 pounds their second summer from grass alone.

Research and experience have clearly shown that summer gains of yearling cattle on pasture vary inversely with rate of gain the previous winter. It is very important to recognize this compensatory growth principle in planning for grazing yearlings and selecting cattle to be grazed. It has been shown to be uneconomical to winter calves at modest (1 to 1.3 pounds per day) daily gains to produce desirable "green" short yearling cattle for sale to others for pasturing. Such low rates of gain result in high costs per pound of gain and high costs per hundred weight of short yearling by the end of winter due to the large fraction of total feed intake being used only for maintenance purposes. However, if a producer overwinters the calves to make only modest gains and then pastures them, he will benefit from compensatory gains made on good pasture as yearlings.

Two yearlings will consume approximately the same amount of forage as one cow-calf pair. A considerable amount of flexility can be built into the total herd management program by planning to graze a certain share of each year's calf crop as yearlings, both steers and cull heifers. Such cattle can be sold early if prices climb attractively high. Perhaps more important, all yearlings can be sold rather than grazed in dry years when inadequate early rainfall promises sharply reduced grazing capacity, with no sharp upset to the total herd management plan. This is far preferable to being forced into unplanned liquidation of 20 to 50 percent or more of the breeding cows in order to come up with enough forage in dry years. Reducing the number of cows in the herd by one-third would provide enough grazing capacity for all steers and non-replacement heifers produced the previous year.

Grain supplements, growth implants, and feed additives can greatly increase the amount of summer gain by steers and feeder heifers.

IMPLANTING

Implanting calves in the ear with growth stimulants has been shown to improve rate and efficiency of gain in cattle at any age. Researchers have suggested that there is a $10 return for every dollar invested. Implanting once during the suckling phase results in a 15-20 pound advantage in weaning weight. A producer can expect an almost double advantage in weight if the cattle are reimplanted.

Directions should be followed when using these materials. Some implants are restricted to cattle heavier than 400 pounds. Withdrawal time prior to slaughter must also be considered.

FEED ADDITIVES

One of the best methods to reduce feed cost is with the use of feed additives. Numerous feed additives are available. This discussion will be limited to the group known as ionophores. Ionophores alter metabolic pathways of fermentation in the rumen. The result is improved feed efficiency and or rate of gain. Other benefits are reduced incidence of grain bloat, acidosis, and coccidiosis. Research studies have had 1 to 15 percent improvements in daily gain and 6 to 12 percent greater feed efficiency. The use of ionophores and implants together have been shown to be additive to the animals performance. It is important to follow directions in the proper use of these feed additives.

Common Feedstuffs for Wintering Cows

Alfalfa: Alfalfa is an excellent feed for part of the brood cow ration because of its high protein content

(13 to 18 percent) and because it supplies generous amounts of calcium, phosphorus, carotene or vitamin A and minor minerals. It is more valuable when fed as part of the ration, because when fed as the sole roughage it furnishes twice as much protein as brood cows need. Alfalfa is most efficiently fed in combination with lower quality roughages, where it makes up for protein and quality deficiencies.

Many cowmen prefer mixtures of grass hay and alfalfa over straight alfalfa for cows. However, grass-alfalfa hay will be somewhat lower in protein and less valuable for combining with lower grade roughage.

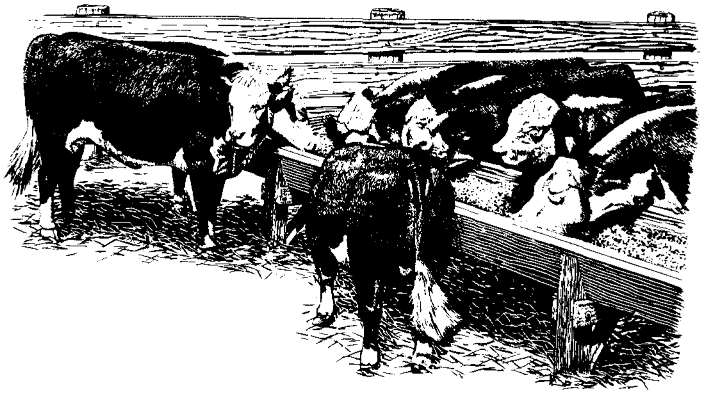
Stage of maturity has considerable effect on the nutritive value of alfalfa, with protein, digestible energy and mineral and vitamin levels declining steadily as maturity increases. Quality is highest when alfalfa is harvested at the late bud stage. However, the added tonnage obtained from harvesting at quarter to half bloom stage may provide more feed of adequate quality for beef cows.

Sweet Clover: High quality sweet clover hay or silage is comparable to alfalfa in nutritive value and protein content. Sweet clover should be cut before it becomes too mature, as the stems become woody and leaves are easily lost after blooming.

Sweet clover may contain dicoumarol, a compound that interferes with normal blood clotting activity, so it is important to feed sweet clover with caution. Clotting problems are caused by molded sweet clover, but in some cases the mold is not readily apparent.

Questionable sweet clover should be saved until after calving to avoid hemorrhage during calving. When known toxic sweet clover must be fed to pregnant cows, it should be fed for no longer than three weeks at a time, with intervals of at least three weeks with no sweet clover intake. This procedure will usually prevent any losses from blood clotting failure.

Corn Silage: Corn silage makes very palatable, high-energy feed for wintering brood cows. Although only moderate in protein content, corn silage contains more energy than needed for pregnant cows, so quantities should be limited if fed before calving.



Good quality corn silage Furnishes about 65 pounds of TDN per 100 pounds dry matter. Because of its high energy content, it is most useful when combined with lower quality roughages, such as straw.

When only a limited amount of corn silage is available, many producers prefer to save the silage and feed it after calving to meet the increased energy needs of cows nursing calves.

Crested Wheatgrass: Good quality crested wheatgrass or crested wheatgrass-alfalfa hay is an adequate ration for wintering mature cows. Protein content of crested wheatgrass can range up to 12 or 13 percent if the hay is cut early, at heading, and properly handled. Crested wheatgrass has a tendency to mature and become coarse quickly and should be harvested for hay when it begins to head.

Smooth Brome Grass: Brome grass makes a very good perennial hay crop, and is frequently seeded in combination with alfalfa. Brome grass should be cut for hay while still in bloom for highest quality, but does not lose quality as rapidly as crested wheatgrass.

Prairie Hay: The term prairie hay usually refers to native upland hay containing several species of grasses. Western wheatgrass, needle and thread or other grasses may represent the predominant species in any particular field.

Early-cut prairie hay sometimes contains up to 10 percent protein, but may contain as little as 3 percent protein if cut very late. Good quality prairie hay will also be adequate in vitamin A and barely adequate in phosphorus, but coarse, late-cut hay will be deficient in both. Good quality prairie hay is an adequate brood cow ration by itself, provided a high-phosphorus mineral supplement is fed free choice.

Grain Straw and Chaff: North Dakota produces a tremendous amount of straw and chaff, and successful cowmen are using a larger share of the abundant supply of these grain by-products each year for brood cow wintering rations.

Oats, barley and wheat straws are highest in feed values, in that order. Bright, high-quality straw will contain 40 to 45 percent TDN and can comprise up to half of the winter roughage ration for cows. If very good hay is available for supplement, straw can represent up to two-thirds of the wintering ration. Some straws, such as rye and flax, are unpalatable, very low in feed value and should not be considered as feeds.

Grain chaff consists primarily of light kernels and hulls or glumes of grain crops, together with the finer parts of stems and leaves. The energy value of chaff is variable, depending on the proportion of grain in the chaff. Chaff with considerable grain is higher in energy and protein value than straw. Chaff often contains weed seed, which may have high feed value.

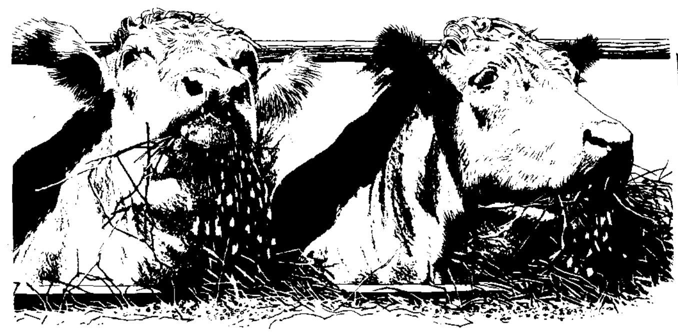
Grain straws are too bulky and low in nutrients to be used in rations for wintering replacement heifer calves. Even bred yearling heifers should be expected to consume only a minimum of straw.

Grain by-products are useful sources of energy for wintering cows, but are deficient in protein, phosphorus and vitamin A, and marginal in calcium. Because of the grain it contains, chaff will be higher in protein and phosphorus but still deficient in calcium and vitamin A. Straw and chaff can be used for up to two-thirds of the brood cow ration, but high quality hay or range cow supplement will be needed to assure adequate nutrient levels.

Corn and Sunflower Residues: Crop residues remaining in fields following harvest of corn or sunflowers offer considerable low cost roughage for brood cows. Combined corn fields can provide up to two month's grazing for cows after weaning their calves. Cattle tend to consume residues in this order; corn ears, leaves, husks. Mineral supplementation of phosphorus and calcium should be provided for cows gleaning stalks. After the first month of gleaning stalk fields, protein supplement should be considered. Three to four pounds alfalfa hay daily per cow is adequate. Cattle and calves relish the harvested head of sunflowers, as deer do, but will refuse to eat any of the stalks voluntarily. Sunflower heads have energy and protein levels similar to good average quality hay. Dry weight per acre of sunflower heads will be approximately 44% that of seeds harvested from the field. Both corn and sunflower heads can be collected behind the combine and moved to central areas for winter feeding, but many stockmen prefer to let cows graze these fields, doing their own low-cost harvesting. Electric fence can greatly help to control movement and grazing habits of cows.

Snow cover usually limits field grazing of these two residues in North Dakota, but in open winters some cowmen have carried cows nearly to calving time on little more than cornfield gleaning. Judicious use of these residues, particularly for mature animals, can go a long way towards stretching short supplies of hay and silage in dry years. In addition they can partially substitute for hay which may then be sold for cash to needy cowmen searching for winter feed.

Slough Grass: In some years, hay from low-lying areas is needed to help get the herd through the winter. Feed value of slough hays varies widely, and such hay may be of very little value. Hollow stem is considerably more palatable and more nutritious than other types of grasses commonly found growing in low, wet areas. Laboratory analysis of crude



protein and crude fiber would be useful in planning rations using such hay.

Low quality hays like slough grass should be used primarily for mature cows and should be combined with some better quality hay. Low quality roughages are best used early in the wintering period, changing to better quality hay as calving approaches and while the cow is nursing her calf.

Supplementing Protein

When protein in roughage feeds is inadequate adding a few pounds of grain is often the most economical way to meet the deficiency. Two pounds of North Dakota feed grain will contribute about ¼-pound of protein. High quality hay fed in modest amounts should also be considered a protein supplement.

High quality commercial range cubes or beef cow supplements contain generous amounts of phosphorus and vitamin A in addition to protein. Both nutrients are likely to be in short supply in any ration that is short of available protein.

Non-Protein Nitrogen

Chemical sources of nitrogen or crude protein equivalent are often included in protein supplements for ruminant animals because they furnish crude protein equivalent more economically than natural protein concentrates such as linseed or soybean oil meals.

Unfortunately, the ability of the ruminant stomach to use NPN materials in place of natural protein is limited and closely related to the proportion of high energy feeds such as grain in the ration. Urea, the most common NPN material, is a poor substitute for vegetable proteins when used with low quality roughages. A general rule is that the proportion of crude protein equivalent from urea should not exceed one-third of the total protein in the brood cow supplement.

Biuret, another form of NPN, is metabolized more slowly in rumen, so it is more useful than urea for furnishing supplementary protein to cattle on low quality rations. However, it is also substantially higher in price and harder to get.

To date, no nutritional advantage has been shown for supplements in liquid form as compared to dry supplements of similar formulation.

Vitamins and Minerals

High quality roughages that are harvested while immature and green in color will generally be adequate in calcium, vitamin A and phosphoruss. Feeds with green color will provide adequate vitamin E also. Feed grains are nearly devoid of calcium, but are fair sources of phosphorus.

Phosphorus: Phosphorus is frequently deficient in brood cow wintering rations. Good sources of supplementary phosphorus include steamed bonemeal, dicalcium phosphate, monosodium phosphate, mixtures of these, or commercial range cow minerals supplying 10 percent phosphorus or more. If allowed free access to a high-phosphorus mineral supplement, cattle do a satisfactory job of balancing their own diet for phosphorus.

Mineral: If cows have not had continuous access to supplementary mineral, they will frequently consume rather large amounts in the fall when first offered mineral. Intake will reduce to a more reasonable level once they have replenished their deficiency, which may take three weeks or more.

Mineral supplementation is critical in the fall when cattle are on low-quality roughages. After early August, most standing forage and range grasses are deficient in phosphorus. The phosphorus content of young, rapidly growing forage meets the needs of cattle in late spring and early summer, but the content declines steadily through the summer into fall.

Salt: Salt (sodium chloride) is needed in most areas of the state. Feeding trace-mineralized salt will take care of deficiencies of trace minerals such as iodine and cobalt. Salt and phosphorus can be self-fed separately or mixed together. Salt consumption varies from area to area due to water and soil variations, so this must be considered if salt and minerals are mixed together.

Vitamin A: Vitamin A is critical for normal health of all lining or surface tissues of the body. No vitamin A occurs as such in feeds. Carotene in feeds is converted to vitamin A as it is absorbed through the wall of the small intestine. For cattle, one milligram of beta-carotene is considered equal to 400 International Units of vitamin A. Alfalfa hay containing 10 milligrams of carotene per pound then furnishes 4,000 I.U. of vitamin A per pound of hay. The daily vitamin A requirement is about 1,000 I.U. per pound of air-dry feed consumed, with lactating cows requiring about twice this level.

Calves born to cows deficient in vitamin A may be weak, slow to nurse, much more susceptible to calf scours and show reduced livability. Cow herds deficient in vitamin A will have increased incidence of retained placenta at calving time. Vitamin A is also very important for normal rebreeding performance.

Green growing forages provide a surplus of vitamin A. Cows grazing high quality green pastures normally store enough vitamin A in their livers and bloodstream to provide for developing strong calves. Good quality green hays and high quality green silages normally provide enough carotene to meet the cow's needs for vitamin A if fed as a major share of the ration. However, a cow wintering on carotene-poor rations may deplete her body reserves to a point hazardous to her calf.

Synthetic vitamin A is economical and readily available. Good range cow supplements usually furnish enough vitamin A to meet needs if fed at recommended levels. Other ways of providing supplemental vitamin A include intramuscular injections, mixing with self-fed mineral, or mixing into supplemental grain and concentrates.

Since it is stored in several body organs, vitamin A is one of the few nutrients that can meet body needs if fed only at intervals, such as once weekly. Where rations are known or considered likely to be deficient in carotene, an intramuscular injection of vitamin A into the cow two months before calving will be effective insurance against vitamin A deficiency.

When the vitamin A level of the ration is in question, it is best to supplement. The cost is small - laboratory analysis to determine the carotene level in feeds would cost more than providing the total amount of vitamin A needed by the herd.

Carotene is readily destroyed in stacked hay, unprotected bales and silage piles, so the vitamin A value of feedstuffs declines steadily and fairly rapidly in storage, even under very good conditions. To be safe, assume that roughages carried over one year have lost all their vitamin A and must be supplemented. Badly weathered hays, hays very mature when harvested or silages in poor condition will also have lost most of their original vitamin A value. None of the grains or protein supplements furnish any carotene, except a limited amount in corn and millet.

Grinding Roughages

Grinding hay and straw through a coarse screen in a hammer mill or large capacity grinder and feeding in special hay feeders can greatly reduce the amount of wastage when feeding hay. Grinding also makes roughage easier to handle, making it possible to use self-unloading wagons.

Grinding some medium or poorer quality roughage together with good quality hay permits greater intake of the low-quality feed. Grinding roughage also permits uniform incorporation of grain into the roughage.

Grinding will increase the voluntary intake of roughage, especially poorer quality roughages. However, grinding does not increase the digestibility or nutrient value of roughages.

While grinding can be beneficial in many situations for growing cattle, it is usually of less value to the cow herd. There are situations where grinding roughages for cows will pay, such as for minimizing waste when hay is scarce or when the handling and storage system dictates grinding.

Cowmen must weigh the expected advantages of ground hay against the time and cost involved.

Short Feed Supplies

In years of low feed production, winter feed may be unavailable or very costly.

Studies in the Great Plains have shown that mature brood cows bred for spring calving can lose up to 10 to 15 percent of their body weight from fall to immediately after calving, provided they have enough feed and pasture to compensate and regain body condition lost over winter before breeding season. If these cows don't have excellent nutrition following calving, rebreeding performance will be impaired.

Comparisons at the Dickinson Experiment Station have demonstrated that mature, pregnant brood cows can be wintered at ration levels around three-fourths of those suggested. Reproduction performance was satisfactory when the cows wintered on reduced rations were put on excellent spring pasture, but calf weaning weights were 20 to 35 pounds lighter than calves from cows wintered at recommended feeding levels.

Limiting feed should be considered an emergency measure in case of a feed shortage, not a routine measure to cut costs.

In years of short roughage supplies, it is sometimes more economical to feed higher levels of grain than to purchase hay. Grain provides more energy than hay and also furnishes considerable protein, reducing the need for purchased supplements. A pound of grain may replace up to 2 to 2½ pounds of hay in the wintering ration.

Up to 5 or 6 pounds of grain per head can be used daily, in combination with enough roughage and appropriate supplementation to prevent more than minor weight loss over the winter. Don't attempt to feed cows on all-grain rations. The ruminant stomach is not designed for such a concentrated ration, so digestive problems could result.

Locate Winter Feed Supplies for Handy Access

It is important to have the feed supply handy to where cattle are quartered for winter feeding. Snow accumulation and blizzards can make feed handling very unpleasant to impossible unless the feed supply is handy to where it will be fed. Experienced cowmen move their winter feed supply adjacent to the feeding area before severe winter weather arrives. Large round bales can be stacked up to three layers deep once the winter freeze-up has arrived. During hay making time and prior to freeze-up, large round bales should be set individually so they will shed rain water to the greatest extent possible. Stacking large bales prior to the rain season results in far greater water penetration and resultant forage quality deterioration than if bales are set apart from each other, allowing maximum water shedding.

Square bales should be covered by some means to keep rains from soaking bales needlessly. A permanent shed-type roof is best since it keeps rain off and also allows for ample air circulation under the roof. Alternatively, covering piles of square bales with ridged loose hay in long form or plastic tarpaulins held down by twines and old tire casings or wooden posts is recommended. Bale piles covered tightly with a plastic tarpaulin will "sweat" or accumulate moisture due to alternating evaporation and condensation in warm weather. However, the resulting damage to hay will still be small compared to losses in uncovered piles of rectangular bales. Straw bales suffer more damage from rain than hay bales. Rectangular straw bales that become soaked and subsequently frozen become virtually useless as bedding.

Composition of Feeds

The following tables present typical rations and average nutrient composition of roughages and concentrates commonly fed to cattle in North Dakota. Protein content of home-grown feeds generally tends to be higher in the western part of the state and lower in the eastern part than the average figures indicate.

Table 1. Composition of Feedstuffs

FEEDSTUFF	Dry Matter (%)	Dry Basis (100% Dry Matter) NEg (Mcal/lb)	TDN (%)	Crude Protein (%)	Calcium (%)	Phosphorus (%)
HAY						
Alfalfa						
early bloom	90	.31	58	18.0	1.41	.22
mid bloom	90	.26	55	17.0	1.41	.24
Brome						
late vegetative	88	.30	57	12.0	.32	.37
late bloom	89	.24	53	8.0	.30	.35
Crested wheatgrass						
early cut	86	.26	55	11.0	.29	.22
mature	86	.18	49	4.6	.19	.11
Prairie Hay						
early cut	87	.29	57	9.0	.49	.23
mature	87	.20	51	4.6	.38	.12
Sweetclover	87	.25	54	16.0	1.39	.21
Oat hay	91	.26	55	9.3	.33	.17
STRAW						
Oats	92	.09	43	4.4	.36	.06
Barley	91	.03	40	4.3	.41	.07
Wheat	89	.05	41	3.9	.54	.08
Millet	88	.14	48	7.0	.38	.10
SILAGE						
Corn	25	.44	68	8.0	.4	.16
Alfalfa	35	.26	55	16.6	1.5	.31
Alfalfa-grass	35	.25	54	15.0	1.46	.22
Sweet clover	35	.25	54	16.0	1.26	.23
Oatlage	35	.25	56	10.7	.46	.31
Sunflower	31	.26	55	12.0	1.26	.40
Barlage	31	.29	57	10.3	.39	.28
CONCENTRATE						
Oats	89	.56	78	13.3	.07	.38
Barley	88	.63	84	14.0	.05	.38
Corn	88	.68	88	10.1	.02	.34
Corn & Cob Meal	87	.60	83	9.0	.08	.27
Millet (proso)	89	.62	83	12.9	.04	.33
Wheat	89	.68	88	16.9	.04	.43
Durum wheat	89	.65	85	16.8	.11	.44
Linseed oil meal	90	.56	78	38.3	.43	.93
Soybean oil meal	89	.63	84	49.4	.33	.71
Sunflower oil meal	90	.41	67	37.8	.39	1.05
Barley distillers grain	92	.41	67	30.9	.19	.69
Corn distillers grain	92	.49	75	30.7	.04	.79
Molasses	77	.57	79	8.5	.17	.03
Beet pulp with molasses	92	.54	76	9.7	.60	.09
RESIDUE						
Sunflower heads	30	.31	58	10.4	1.29	.38
Sunflower hull	90	—	34	7.4	.34	.18
Corn cobs	90	.20	51	2.8	.12	.04
Corn stalks	80	.20	50	4.5	.57	.10
Sugar beet tops	20	.26	58	13.0	1.40	.24
MINERAL SUPPLEMENT						
Steambone meal	97	—	—	8.4	31.5	14.2
Dicalcium phosphate	96	—	—	—	22.0	19.3
Monosodium phosphate	98	—	—	—	—	25.0
Ground limestone	99	—	—	—	38.0	.00

Table 2. Beef Cow Wintering Rations.

	I	II	III	IV	V	VI	VII	VIII	IX	X
Mixed alfalfa-grass hay	20	—	—	—	—	—	—	10	—	—
Prairie hay*	—	22	—	10	—	10	—	—	7	—
Alfalfa hay	—	—	9	—	—	—	3	—	—	—
Straw and chaff	—	—	13	—	10	8	8	12	14	—
Corn silage	—	—	—	30	25	—	30	—	—	—
Protein supplement (30% range cubes)**	—	—	—	—	2	2	—	—	1½	2
Winter grazing	—	—	—	—	—	—	—	—		free access***

*Prairie hay containing less than seven percent crude protein should be supplemented by legume hay replacing part of the prairie hay or by addition of a protein supplement such as range cubes to the ration.

**If range cubes contain considerable urea, consider using more pounds of a range cube containing less crude protein, as three pounds of 20% protein cubes. When feeding small amounts as one to two pounds of cubes daily, more uniform intake is obtained when cattle are fed cubes every second day rather than daily.

***Considerable standing forage must be available for winter grazing to provide an adequate ration, even when supplemented with range cubes.

Table 3. Bred Heifer Wintering Rations.

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Alfalfa-grass hay	—	—	18	—	11	18	—	—	—	—	—
Prairie hay*	24	18	—	—	—	—	—	12	16	17	8
Alfalfa hay	—	6	—	10	—	—	7	—	—	—	—
Corn silage (30% D.M.)	—	—	—	33	28	—	25	—	—	—	—
Straw and chaff	—	—	5	—	—	—	6	6	5	—	—
Grain	—	—	—	—	—	3	—	4	—	4	—
Range cubes (20%)	—	—	—	—	—	—	—	—	2	—	2
Winter grazing**	—	—	—	—	—	—	—	—	—	—	free access

Assume heifers weighing 800 pounds at start of wintering feeding season being wintered to gain slightly over one pound daily. Larger type heifers will require proportionately more feed per day.

*Prairie hay containing less than seven percent protein should be supplemented by legume hay replacing part of the prairie hay or by adding protein supplement or additional grain to the ration.

**Winter grazing might include a reserve pasture of native or seeded grass or harvested corn fields. It will usually be available only for the first part of the wintering period.

Table 4. Sample Backgrounding Rations - Pounds offered per day.

	Kind of Feed	Calf Weight, Pounds											
		400			500			600			700		
	Energy Level	Medium		High	Medium		High	Medium		High	Medium		High
Ration I	Grain	5	to	9 lbs.	6½	to	11 lbs.	7½	to	13 lbs.	8.75	to	14 lbs.
	Hay	7	to	2½ lbs.	7.75	to	2½ lbs.	8.75	to	3 lbs.	9	to	3½ lbs.
	Supplement	None		None	None		None	None		None	None		None
Ration II	Grain	4½	to	8	5.75	to	10.	7	to	12	8¼	to	14
	Hay	6½	to	2½	7	to	2½	8	to	3	9	to	3½
	Supplement	½		½	½		½	½		½	½		½
Ration III	Grain	4½	to	8	5.75	to	9	7	to	11	8¼	to	13
	Hay	3	to	2	3	to	2	3	to	2	3	to	2
	Silage	15	to	5	18	to	8	21	to	8	24	to	8
	Supplement	½		½	½		½	½		½	½		½
Ration IV	Grain	3¼	to	7	4¼	to	8	5¼	to	10	6¼	to	12
	Hay	3	to	2	3	to	2	3	to	2	3	to	2
	Silage	14	to	5	17	to	8	20	to	8	22	to	8
	Supplement	.75		.75	.75		.75	.75		.75	.75		.75

KEEPING THE HERD HEALTHY

Most Important Diseases

There are many diseases which can affect cattle; the list is nearly endless, but certain illnesses are more common than others. Severe economic losses usually result from a limited number of diseases. In North Dakota the most damaging beef cattle herd problems include, infertility and low conception rates, malnutrition in its many forms, calf scours, respiratory diseases like pneumonia and shipping fever, and parasites, both external and internal.

Treatment of these types of ailments is consistently expensive and often frustrating; emphasis must be placed on preventing them. A herd health program is the implementation of least-cost solutions to ongoing or potential threats to the cattle's health.

An Effective Herd Health Program

An effective herd health program is a year-round effort and **must include** the following ingredients:

- A well planned breeding program, a solid genetic base, and accurate and reliable records.
- Balanced and adequate nutrition. Good nutrition and health are one and the same; they cannot be separated from each other.
- Clean, dry, draft-free environment and reduction of stress, particularly in controlling scours and pneumonia.
- A productive relationship with the local veterinarian to tailor vaccination programs to each herd's specific needs, to diagnose diseases accurately and to treat them effectively.
- Finally, a successful herd health program requires CONSISTENCY to get things done in plenty of time and FLEXIBILITY should changes be needed.

Infertility, Malnutrition

Infertility, low conception rates, delayed onset of heat after calving, late calves, and light calves at weaning are consistently a reflection of malnutrition of the cow herd. Energy deficiencies of breeding females - particularly six to eight weeks before calving and immediately after calving - are primary reasons why they do not come in heat or breed late in the season. Refer to page 11 on "Nutrition."

Calf Scours

The known causes of scours are grouped into two categories: (1) noninfectious causes, and (2) infectious causes.

The noninfectious causes are often referred to as "predisposing" or "contributing" factors. Whatever they are called, there is a dramatic interaction between noninfectious causes and infection. Any effort to prevent infectious causes is usually fruitless unless serious control of contributing factors is part of the overall program.

The most commonly encountered noninfectious problems include:

Inadequate nutrition of the pregnant dam, particularly during the last third of gestation. Both the quality and quantity of colostrum are adversely affected by shortchanging the pregnant dam in energy and protein. Deficiencies in vitamins A and E have been associated with greater incidence of calf scours.

Inadequate environment for the newborn calf. Muddy lots, crowding, contaminated lots, calving heifers and cows together, wintering and calving in the same area, storms, heavy snow or rainfall, etc., are stressful to the newborn calf and may increase the chance for easy exposure to infectious agents. The wet and chilled newborn calf experiences a loss of body heat, is severely stressed, and all too often lacks the vigor to nurse sufficient colostrum early in life.

Insufficient attention to the newborn calf, particularly during difficult birth or adverse weather conditions. The calf is born without scours-fighting antibodies. The calf will acquire these antibodies only by nursing colostrum early in life. Any effort to prevent scours by vaccinating cows is wasted unless the calf nurses colostrum, preferably before it is two to four hours old. As the calf grows older, it loses its ability to absorb colostral antibodies by the hour. Colostrum given to calves 24-36 hours old is practically useless; antibodies are seldom absorbed this late in life.

Infectious causes of calf scours may be grouped as follows:

Bacterial Causes: *Escherichia coli, Salmonella spp., Clostridium perfringens* and other bacteria.

Viral Causes: Coronavirus, Rotavirus, BVD virus, and IBR virus.

Protozoan Parasites: Cryptosporidium and Coccidia

Yeasts and Molds

Prevention of calf scours requires special attention to the nutrition of the pregnant female and to the environment into which the calf is born. The newborn calf **must have a dry/clean place**.

Perhaps the single most important requirement for the newborn calf is **to nurse colostrum early in life**. The calf must nurse 1-2 quarts of colostrum during the first two to four hours immediately after birth. The calf is born without disease protection. Only by absorbing antibodies present in the colostrum will a calf acquire immunity against the various infectious causes of scours. At times it is not practical to milk a beef cow or heifer, but the calf still needs colostrum. Many cattlemen will have frozen colostrum on hand in small containers. Plastic bags, 1-2 pints in size, are ideal for storage. Colostrum may be saved from dairy cows. Make sure it is from cows vaccinated against infections predominant in your area and attempt to get it from the older cows in the dairy herd. Older, vaccinated cows are more likely to have greater antibody levels than young, unvaccinated heifers. Colostrum should be saved from only the first two milkings. When needed, frozen colostrum should be thawed out slowly; boiling will destroy most of the antibodies. Colostrum may be kept frozen almost indefinitely.

Many calves will also benefit from a vitamin A injection. Vitamin A deficiency is associated with scours. The calf should be given 500,000 I.U. (usually 1 cc) of vitamin A early in life.

Finally, a well planned vaccination program is important in preventing scours. Consult with your veterinarian to determine your herd's needs for vaccines.

Bovine Respiratory Disease

Respiratory diseases continue to be the major cause of disease loss in beef cattle. The costs to cattlemen for treatment, weight loss, death loss and culling in weaner calves are estimated to exceed a third of a billion dollars annually.

Approximately 80 percent of U.S. feeder cattle originate in herds of 50 cows or less. Because of the closed-herd status and scale of operation, it is sometimes difficult for these producers to appreciate the care and processing these calves should receive to be properly immunized. In addition, the concept of "preconditioning" has been poorly interpreted or badly abused. Furthermore, some feeders want to buy replacement cattle at the cheapest price and in as thin a condition as possible. They frequently overlook the immediate health status and prior immunization of animals they are purchasing, hoping to compensate for losses that might occur through compensatory gains. Success rates vary considerably.

Bovine respiratory disease (BRD) is seldom the result of a single factor. BRD usually is caused by a combination of stress, virus infection and invasion of the lungs by pathogenic bacteria such as Pasteurella and Hemophilus. Stress undermines the natural defenses in the lining of the trachea and bronchi, and respiratory viruses (such as IBR, $P1_3$, BVD, BRSV, etc.) further damage these natural defenses. Ultimately, pathogenic bacteria find a wide open road into the lungs where they localize, multiply and cause the severe damage we call BRD, or pneumonia, or shipping fever.

Preconditioning

Preconditioning is the preparation of the calf to better withstand the stress of movement from its production site into and through marketing channels. If a preconditioning program is followed, sickness and death rate will be reduced and weight gains improved. Preconditioning involves castration and dehorning, proper immunization against costly diseases, control of parasites, weaning and water trough and feed bunk adjustment at the calf's production site.

Preconditioning is a complete health management program for feeder calves. "Pre" means before some event. "Condition" means to process or to prepare. Preconditioning feeder calves means "to prepare them so they can withstand the stress and adjustment they undergo when they leave their point of origin enroute to the feedlot."

In simple terms, preconditioning is a management tool - it is an insurance program - which involves the use of best known practices to produce and market healthy feeder calves. Basically, preconditioning is common sense and sound husbandry.

The North Dakota Beef Cattle Improvement Association (BCIA) has sponsored an effective preconditioning program in our state. Consult your county agent or veterinarian for details.

INSECT PESTS OF CATTLE

An effective year-around insect control program is essential for profitable livestock production.

Each year insects take their toll of profits through reduced weight gains, decreased milk production, damage to hides and meat, disease transmission and even losses through death of infested animals.

Major Insect Pests

Horn Fly: The horn fly is the major insect pest on range and pasture cattle and is less often found around farmsteads. They deposit their eggs in fresh manure, usually within minutes after the manure is dropped. Horn fly eggs hatch and reach the adult stage in only 10 to 14 days. They pass the winter in the pupal stage with the first of the season's adults emerging and moving to the livestock about mid-May. Horn flies have blood sucking mouthparts and usually take several blood meals per day. These flies literally roost on cattle, with infestations of several thousand flies per animal not uncommon.

Face Fly: The face fly is a pasture and range pest, discovered in the U.S. in 1952 and first recorded in North Dakota in 1959. The face fly looks like the house fly and has sponging-type mouthparts. It is very annoying and persistent fly. It prefers to be in the sun and seldom enters barns or shady areas. The face fly breeds in fresh manure, requiring 15 to 25 days to complete development. They overwinter as adults and are usually the first flies seen in the spring. Face flies feed on the mucous membranes of the eyes, nose and mouth of livestock causing considerable annoyance, and in addition play a role in the transmission of pink eye.

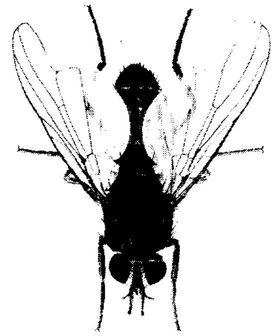
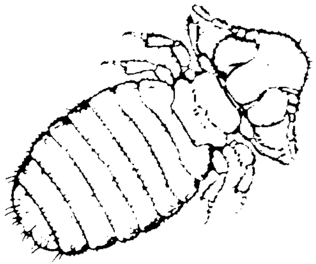
House Fly: In confinement operations and around barnyards, house fly populations can reach very high levels during the summer months. House flies breed in rotting plant or animal material and manure. The average house fly lays about 500 eggs and populations can become extremely high, especially if barnyard sanitation deteriorates during warm weather. The whole life cycle of the house fly will be completed from egg to adult in 10-20 days depending upon the temperature. The winter is passed in the pupal stage in barnyard litter. House flies, like the face fly, have sponging-type mouthparts and feed on livestock secretions and moisture in the manure.

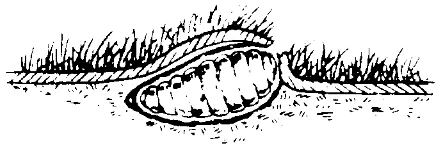
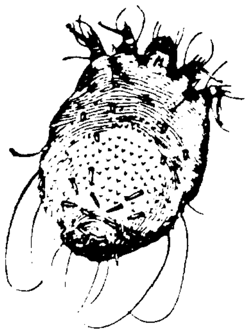
Stable Fly: The stable fly (sometimes called the biting house fly) is similar in appearance and habitat preference to the house fly but has piercing-sucking mouthparts. Like the house fly, the stable fly breeds in decaying organic matter of many types. Stable flies require 20 to 60 days to develop from eggs to adults. The adults live about three weeks, and the females produce about 500 eggs. The stable fly, like the housefly and horn fly passes the winter in the pupal stage. Stable flies greatly annoy cattle by their biting and bloodsucking of the animals.

Cattle Lice: Infested animals rub and scratch against fences, feed bunks and other objects, and often hair tags on fences are the first indication of a winter louse problem. Areas of the skin can become scurfy and hair may sluff off in patches. Infestations are usually most severe during the later winter and spring months.

Chewing lice, commonly know as "red lice," feed by chewing the skin. They are small, yellowish white with red heads and dark band across their bodies. **Sucking lice,** often called "blue lice," are larger than the chewing lice and are bluish-slate color. They feed by piercing the skin and sucking blood. Lice hatch from eggs or "nits" which are attached to the hair. They breed continuously upon the animals with a new generation developing about every 30 days.

Cattle Grubs: Cattle grubs or warbles, which infest the backs of cattle, are the mature larvae of a fly. The adults are bee-like flies that dart among cattle and lay their eggs on the hairs of cattle near the heels. Upon hatching, the small grubs burrow into the skin and work through the muscles and tissues. By late winter, the larvae have finally migrated to the


back of their host animal. Once in the back of the animal, the mature larvae cause considerable discomfort to their host and also contribute to carcass trim losses and a reduction in hide quality.

Mange Mites and Scabies: Beef animals may become severely infested with sarcoptic mange and scab mites. Infested animals will continuously scratch or rub. The animals' skin becomes inflamed, scurfy, scabby and raw about the eyes, ears and along the top of the neck.

Psoroptic scabies in cattle is a disease of national concern that has been infrequently diagnosed in North Dakota livestock. When diagnosed, this disease must be reported to state and federal livestock inspectors and requires quarantine and supervised treatment. This is a curable but highly contagious disease and rapid supervised treatment is required for the protection of the affected animals as well as the livestock industry. This disease is caused by small psoroptic mites which burrow into the animal's hide causing infested animals considerable discomfort. The hide roughens and infected animals rub and scratch the affected area to the point of hair loss and bleeding.

Toxaphene dips have been used to treat psoroptic scabies and two dips 14 days apart were required before animals would be allowed out of quarantine. Ivomec® is now registered for the treatment of psorptic scabies. This is an injectable pesticide applied by veterinarians that kills the mites and controls the disease.

Insect Control

Effective control of livestock insects can be obtained through timely treatment with approved insecticies used in conjunction with thorough barnyard sanitation. For additional information on insecticide recommendation rates and available products, Extension Circular E-433: **Insect Pests of Cattle** and Circular E-329: **Farm Fly Control** are available at your county agent's office.

Pour-On Formulations: Pour-on insecticides are available for both cattle grubs and lice. These pour-on formulations have become widely accepted by the livestock industry because they are quick and easy to apply.

Cattle grubs are most effectively controlled through application of systemic pour-on backline treatments in the fall. The grubs are small at this time and have not yet started their extensive migration through the animal's body. Systemic pour-on grub treatments also help suppress cattle lice, and there is a pour-on treatment specifically for louse control in winter when spraying is not possible.

These products are systemic insecticides which are readily absorbed and distributed in the animal's body; therfore, special care should be taken when using them. Applicators should wear appropriate protective clothing to avoid contact with these pour-on insecticides.

Backrubber and Oilers: Backrubbers and oilers will provide some reduction in face fly numbers but are generally not as good for controlling face flies as they are for horn flies. Nevertheless, equipment can be easily constructed and economically maintained that can be an important part of an overall fly control program. A large variety of commercially available backrubbers and oilers are marketed at a wide range of prices. Models that force the animal to get the toxicant around the head area are generally best for reducing face fly numbers. Backrubbers offer cattle the incentive to satisfy their instinct to scratch and are most effective if placed in pasture areas where livestock loaf. Loafing areas around water sources or shade areas are often choice locations for positioning these self-treaters. Insecticides approved for use in these devices include malathion, permethrin, fenvalerate, dioxathion, coumaphos, dimethoate and dichlorvos. Fuel oil or a low-base oil can be used as the carrier for the insecticide in oilers and backrubbers.

Dust Bags: Reductions in face fly and horn fly populations can be achieved by the effective use of dust bags. Many good, durable bags are available commercially and these may be charged with coumaphos, famphur, stirofos, malathion or methoxychlor dusts. Fly control with dust bags can be greatly enhanced by forcing animals to pass through dusting stations.

Insecticide Ear Tags: Since the early 1980's insecticide-impregnated ear tags have been used extensively on North Dakota Cattle for horn and face fly control. However, research at North Dakota State University first documented pyrethroid-resistant horn flies in the state in 1986 and producers reported that the pyrethroid tags no longer gave adequate season long horn fly control. In 1987 horn fly resistance was found to be widespread throughout the state.

Producers have two alternatives to control horn flies on pastured cattle in locations where resistance occurs. One alternative is to apply organophosphate or carbamate livestock insecticides using dust bags, oilers or backrubbers. The second alternative is to use insecticidal ear tags which contain organophosphate insecticides (e.g., Terminator™ or MaxCon™ tags).

If organophosphate insecticide tags are used the manufacturers recommendations should be adhered to. Apply two tags per animal. Delay tagging until horn fly populations are present on the animals. Tags applied in June will provide a greater degree of control toward the end of the grazing season. Tags should be removed from the animals at the end of the season.

HOUSING AND EQUIPMENT

Equipment and facilities for a cow-calf operation include protection from the weather, adequate water supply and watering equipment, feed storage, feed processing and conveying equipment and manure handling equipment. Investment in buildings and equipment is a trade off for daily labor and permits handling more animals.

When starting or expanding a beef operation, use existing facilities wherever practical to keep investment down and allow gradual expansion. Expansion must be accompanied by planning to permit investing in suitable facilities and to insure an orderly arrangement in the completed unit. Provide space for treating animals, bull pens, cows, calves and replacement heifers.

Feeding Facilities

There are basically four alternatives for cattle feeding-housing facilities. The first alternative, feeding outdoors with only protection from the wind, such as trees or a slatted windbreak fence, requires a minimum investment for fencing, feedbunks, and water but a maximum of labor and management.

Feeding outdoors with a separate barn or shelter is another alternative. This is the conventional pole-barn and feedyard arrangement and requires an additional investment for the barn.

Feeding inside an open-covered shelter and letting cattle loaf outside is about the same as the conventional setup except the cattle can be inside to eat. With this alternative, additional investment is required for a concrete floor in the barn to facilitate regular cleaning.

The final alternative is feeding inside a total confinement facility with no access to outside lots. This can be done with solid-scraped or slotted floors and a liquid manure storage. This system requires maximum investment but should reduce labor to a minimum. Usual feed processing equipment includes a hammermill or roller mill for grinding grain. Grinding dry roughages (PTO operated tub type grinder for hay and straw) can usually be done by a custom operator.

Minimum facilities are usually used with a beef cow herd where calves are sold in the fall. Necessary items would be a water system, windbreak fence or trees, shed or barn for emergency use, and pens for treating cattle, holding cows, bulls and replacement heifers.

Where calves are kept over winter, more facilities, along with equipment to reduce labor, are needed. Provide separate feeding yards for sick animals, cows, bulls, heifers and steers. Cows are usually fed on sod in a wind-protected area. A fenced feedyard with separate pens for heifers and steers is often used, along with a 10-foot high slatted board fence and well-ventilated shed for windbreak protection. A pressure water system with heated waterers in each pen area is recommended. Grain storage bins and storage for salt, supplement and minerals also are needed. Steers and heifers are hand fed outside, but self-feeders can be used for feeding a mixture of ground hay and grain.

What facilities are best depends on the individual situation, including such factors as cattle numbers, age and size of cattle, available labor and capital and kind of feed available.

One man with a 50 hp. tractor loader, limited water supply and a barn is busy handling 50 cows on a well-drained site. When four or more workers are available with a 100 hp. tractor-loader and a plentiful water supply, several hundred cows can be wintered and calved satisfactorily using windbreaks and a small barn.

Location and Layout

Drainage, water supply, feed storage and handling, cattle handling, location of existing buildings, wind protection and space are major factors to consider when deciding where to locate a feedyard area.

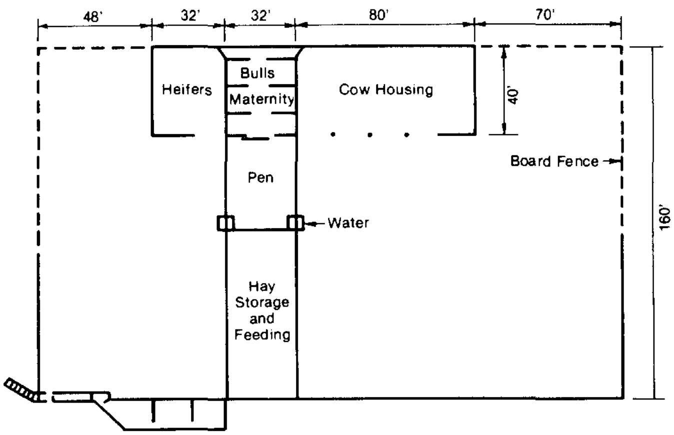
Select a well-drained site that is accessible from the farmstead. If possible, a 4 to 6 percent slope to the south or southeast is recommended. A northeasterly location from the farmstead is preferred to permit future expansion and minimize odor problems around the farmstead.

Allow a minimum of 200 square feet per animals or about 200 head per acre for outside dirt feedyards. An area 100 by 200 feet is about right for 75 head. Where drainage is poor and cattle will be kept in dirt yards during wet weather, provide 300 to 400 square feet per animal and concrete pavement around barns, waterers along bunks, etc. Larger yard areas with 600 square feet per animal or more are desirable for calving.

When cattle receive limited amounts of feed, provide 18 to 24 inches of feeding space per head for calves and 24 to 30 inches for cows. When self-feeding grain, provide 3 to 4 inches of bunk space per head. Provide 4 to 6 inches per head when self-feeding roughages. Height and width of bunks depend on type of bunk, feeding equipment and size of cattle. Usually an 18 to 22-inch throat height is provided. A flat bottom precast concrete feedbunk is preferred for high roughage rations where all animals eat at once.

Buildings

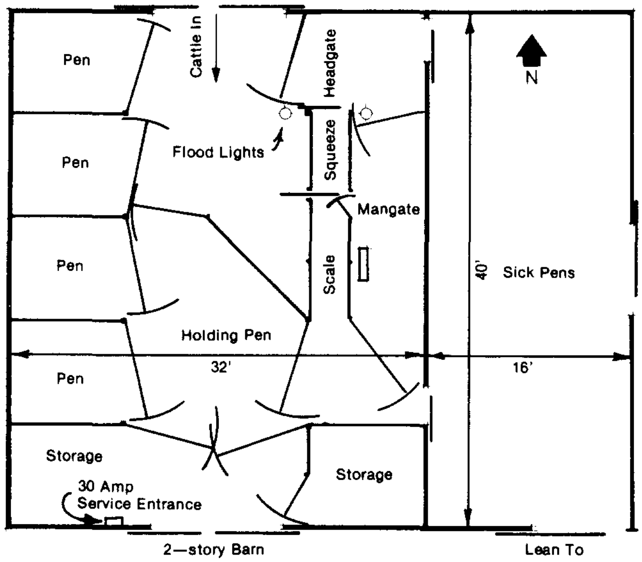
A barn is needed primarily for shade and protection from rain, wind and snow.



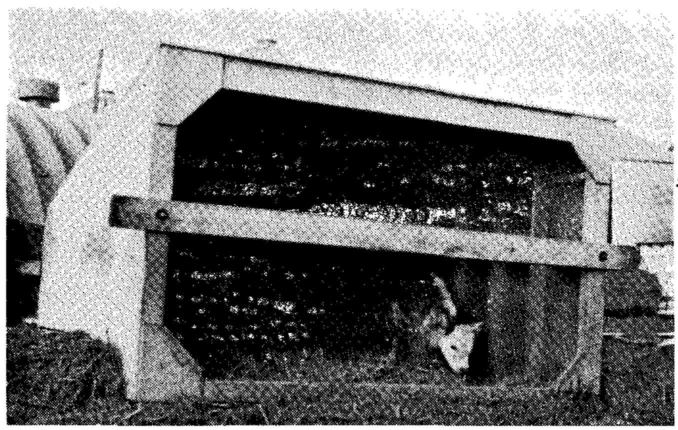
Typical layout, beef cow and calf winter quarters.

Shelter is especially important for cows during calving and for cattle and feedbunks with year-around feeding operations. Other factors favoring shelter include snow in feedbunks, dry feed blown by the wind, wet feed, shade, waste handling and operator convenience.

In buildings, allow 15 to 20 square feet per calf, 20 to 25 square feet per yearling and 25 to 30 square



CALVING/TREATMENT BARN layout can be done in an existing two-story barn. The posts supporting the overhead mow can be used for the 10 and 12 ft. long gates.

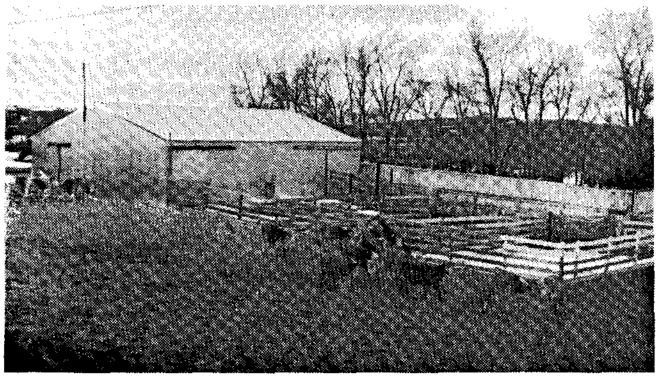


SHELTER for newborn calves can be provided by small, portable sheds that permit the cow to see and be close to her calf yet not be in the shelter.

feet per cow. Calving pens 10 by 10 feet are minimum size.

Consider locating a large building so it can be divided to provide shelter for cows and calves, heifers and steers, or for an extra yard area. Two buildings are often more usable than one large building. Open-front pole buildings cost about the same as a lean-to on an existing barn and can be located to fit the lot arrangement. Locate barns about 185 feet in from the windward row of trees in a shelterbelt. Also consider location of silos and barns to reduce wind and snow problems.

A barn should provide protection from wind, hot sun, snow and rain. Adequate ventilation is essential, especially during the summer. With uninsulated



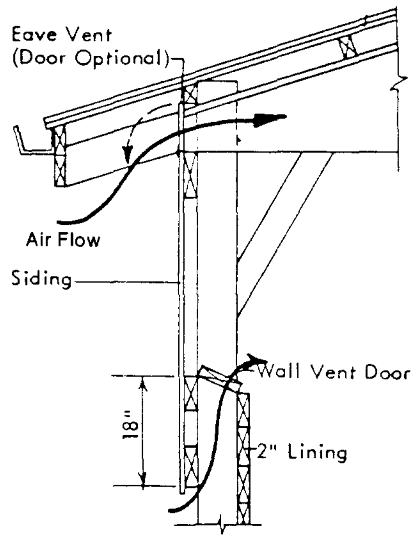
CATTLE TREATMENT INDOORS permits working on cattle during bad weather or anytime of day. A 30' x 40' poleframe building is about the minimum. To permit groups of cattle to move readily into the barn provide an inside holding pen from the outdoor alley.

buildings, try to keep the same temperature indoors as outdoors during cold weather to prevent condensation and unhealthful conditions. Avoid direct drafts on cattle during cold weather.

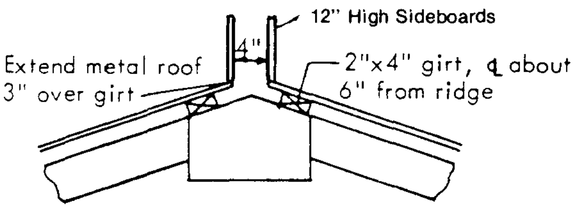
Open sheds 30 feet or more wide with large doors provide the best protection. Sheds can be ventilated by leaving the ridgeroll off large buildings, providing roof ventilators, or with endwall louvers for small sheds. A fresh air inlet can be provided by hinging the top manure-skirt plank (the one that slopes inward between the poles). This can be easily closed during severe weather.

Forced air ventilation with fans and supplemental heat may be needed with insulated hospital rooms, calving facilities, etc.

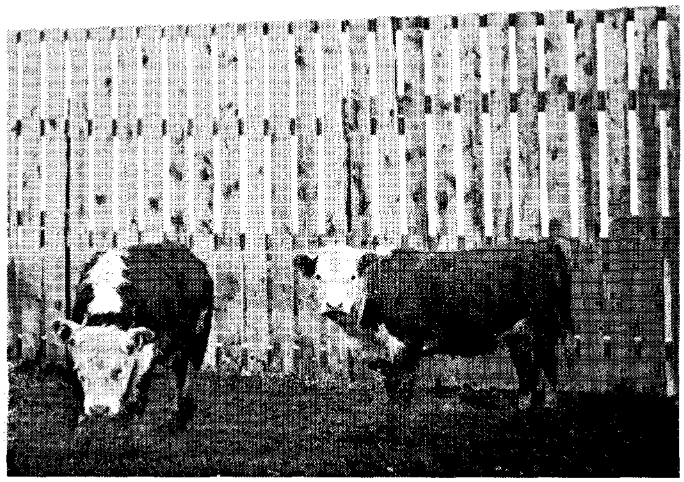
A good tree shelterbelt, seven rows or more wide and 20 feet high, along the north and west sides of the feedyard is essential for adequate wind protection and to control snow and wind swirling in yard areas. A 10 to 20-foot high slotted board fence (6-inch boards with 1½-inch spacing) will provide localized protection. Offset board fences 16 feet or more to the side and toward the rear of open-front buildings to reduce wind and snow problems in front of the buildlings.



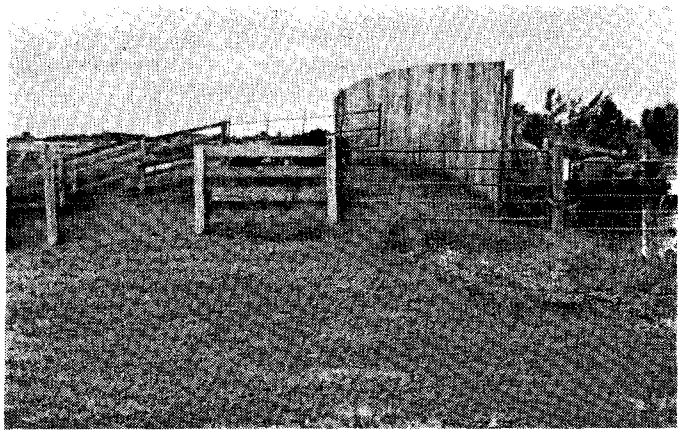
Provide small opening in back wall: 4 to 6-inch continuous slot under the eave. If possible, place the slot at the edge of the overhang rather than next to the wall to prevent snow from sifting into the barn. In addition, provide a 4-inch slot at the ridge of the roof (below).



VENTILATION SYSTEM installation is critical in enclosed, uninsulated cattle barns. Practical air inlets can be provided with adjustable wall openings along each wall of the barn. Stale, wet air exhausts upward out the open ridge.



Slatted-board type windbreak fences allow snow to spread out and accumulate more away from the fence than do solid windbreak fences. It is recommended to fill snow or straw along the bottom of fences to restrict severe drafts from coming through under the fence. Clearance under the fence allows for drainage and summer air movement.



MOUND AND WINDBREAK fence combination can be an effective housing system if tree shelterbelts and barns are available for sever storm protection. Note the waterer is located away from the mound to prevent manure buildup and soggy conditions.

Two lines of snow fence 50 yards apart and 50 yards out from the slotted fence or pole barn aid snow protection. Hay stacks, rows of trees and board fences can be located to provide wind protection along the south and east sides of the feedyard.

Storing and Handling Feed

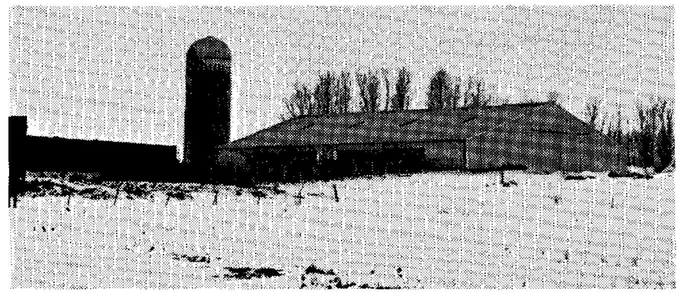
With any of the basic facilities, feeding can be done by hand, with a conveyor feeder, or with an unloading wagon. Portable bunks and loose hay feeders are usually used with herds of 100 head or less. Fenceline bunks are sometimes used with larger cow herds when unloading wagons are used for other operations and available for feeding the cows, especially if silage and chopped hay are used in the ration. Permanent bunks with mechanical feeders are best suited to use with upright silos, inside feeding, and for feedlot operations up to about 600 head.

Self-feeders are best suited to feeding grain or complete mixed rations. They have the advantage of only needing filling once every week or 10 days, with a daily check to see if they are functioning properly. Feeding roughage in self-feeders is difficult because of bridging problems. Waste is also a problem when long hay is self-fed.

Provide space for hay storage that will permit self-feeding using slanted-rail type feeders. Allow for the use of grapple forks and stack movers. Box-type feeders along fences can be filled with hay or silage with a tractor loader. Manure will build up near feeders and needs to be scraped away every week. Ice and snow buildup by bunks will need to be loosened by chiseling after several weeks use.

Covered hay storage is recommended for bales, first cutting and carryover hay. Good care of hay from harvest to feeding is essential for good quality feed.

Some type of permanent silo (upright, trench or bunker) often becomes part of a cattle operation, so a silo location should be included in plans even if the structure is not added right away. Room for silo filling, shade in the yard from an upright silo, snow and wind protection, and feedbunk locations are all part of this planning.

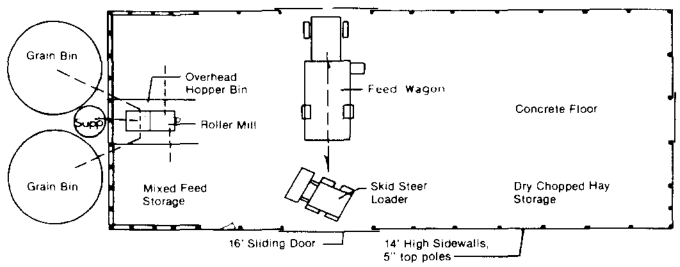


SILO location near the feeding area minimizes hauling and conveying time. Provide for filling access from the service yard.

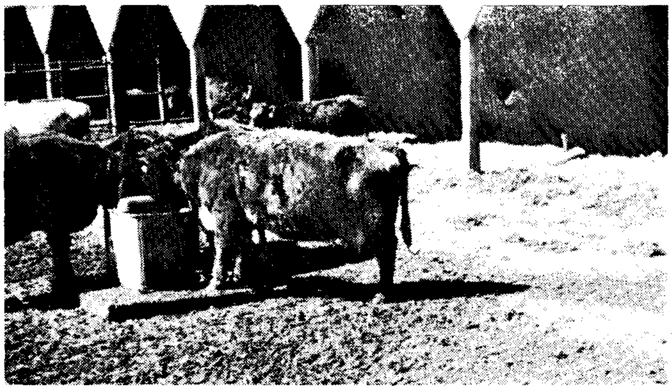
Plan for the use of grain and supplement storage and mixing and grinding equipment. A five to 7½-horsepower electric grinder, a 4-inch auger and hopper bottom feed storage can supply ground feed needs for several hundred head of cattle. A tractor powered grinder-mixer will handle grain, roughage and complete ration mixing. When roughage is included in the mixed ration, a large auger is required to prevent plugging problems.

At least two round steel bins, 18 feet or more in diameter, are needed for grain storage. Space for bulk supplement, sacked mineral, salt, ground feed, a scale and a feed wagon can be provided in a building 24 by 30 feet or larger.

Plenty of water is essential for herd health and feed use. Plan for water needs of up to 12 gallons a head daily. Allow about a foot of watering space for



GRAIN/FEED STORAGE & HANDLING can begin with one or two bins and grow into a complete indoor layout as shown. This arrangement shows a 40 ft. wide poleframe building used for chopped hay and rolled grain from two steel bins.



WATERER location to permit cattle access to all sides reduces crowding and boss cow problems. An outdoor, wind-protected location stays drier. The "step" shown prevents cattle from backing up to the waterer.

each 40 head of cattle. Locate herd watering facilities in a protected area, but outside the barn with cattle access from all sides to prevent boss cows from blocking others from drinking.

Waste Handling

A system for handling manure must be a part of building and layout plans. Basic items are how manure will be stored and disposed of and the control of feedyard drainage. Dead animal disposal is usually done by local rendering services.

When cows are moved around and fed on sod during the winter, wastes are usually distributed well enough. Build-up in feedyards, around feeders and in sheds will need to be hauled out.

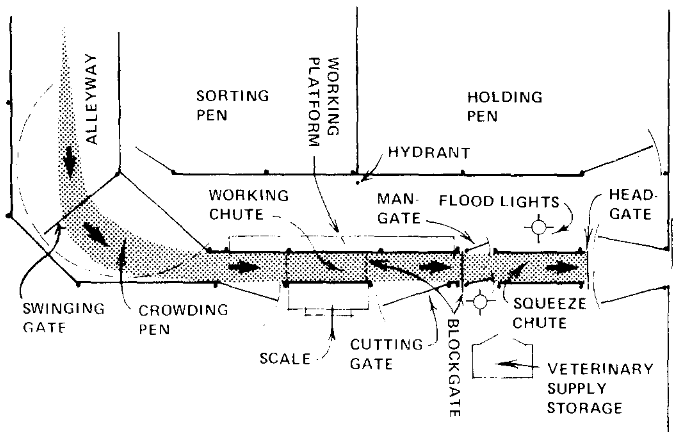
State law forbids feeding livestock on the ice cover over lakes and streams in the winter and also feeding livestock within 60 feet of the bank of a lake or stream.

If possible, divert surface water and roof water away before it comes in contact with feeding areas or where manure is stored. If drainage from yard areas and manure piles is directed to a state waterway or onto a neighbor's land, runoff control facilities will be required. Consider construction at a new location where runoff water can be drained onto surrounding cropland.

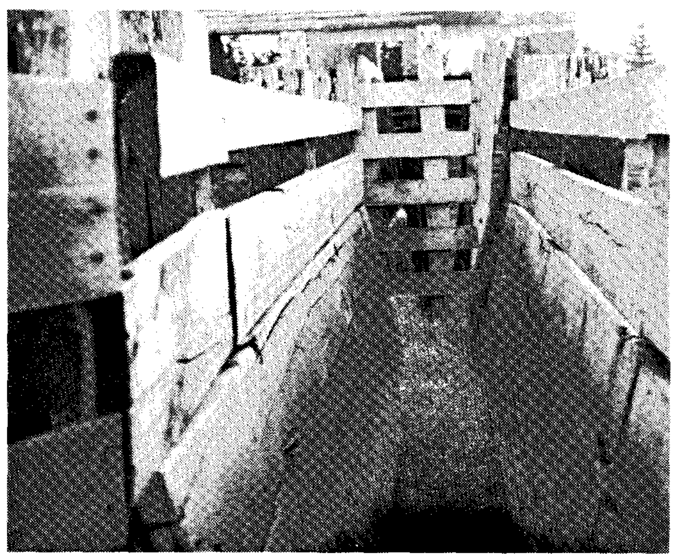
Corrals and Handling Equipment

Provide for two or more 12' × 40' or equivalent size sorting pens, a working chute 18 ft. or longer with cutting gates, a headgate, a scale, squeeze chute and stock trailer loading gate. Cattle loading facilities should be accessible for large semi-trucks.

Working pens 24 to 30 feet long and wide are suitable to work up to 50 head at a time. Arrange the pens to permit easy movement of cattle in a continuous flow from the yard areas, through the storing pens, to the working chute, to the headgate, and back to the yard areas. There is no one corral arrangement that fits every operation.



CATTLE HANDLING systems that are "L"or "U" shaped permit cattle to return to holding areas after being worked. Adaption of circular crowd pens, separate AI breeding chutes and other facilities can be made at individual sites.



VEE-SHAPED working chutes can be used for large and small cattle. The 13-inch wide narrow bottom and 31-inch width (3 ft. and higher above the ground) restricts cattle from turning around when being forced through the chute.

MANAGING THE DRYLOT BEEF COW/CALF ENTERPRISE

Drylot is defined as an alternative management option to range or pasture grazing cows and calves during the summer. In the strict drylot enterprise cow/calf pairs are kept in a pen and cared for much as feedlot cattle.

There are some distinct advantages and corresponding disadvantages associated with a drylot cow/calf enterprise. There is lower capital investment in land per cow unit and higher carrying capacity per acre with drylot. Better use of crop residues and forage produced on the farm is possible, and there is more control of the herd for breeding, nutrition and management. Weaning stress for calves is lower and daily observation of animals is easier. Drylots lends itself to integrated beef production, including backgrounding and finishing cattle. Drylot systems produce calves at lower breakeven prices than either irrigated pasture or range enterprises. There is greater cropping flexibility and higher energy production per acre on cropland used for pastures.

Disadvantages need to be considered before embarking on a drylot enterprise. None of these are prohibitive but require some attention and planning to prevent them from becoming serious problems. Drylot production is labor intensive, requiring daily feeding. More facilities and equipment and increased maintenance of facilities and equipment are required. Higher level of management is needed for ration balancing and herd health. There is increased crowding among animals, and the environment is not as conducive to animal health, with more mud and flies. It is necessary to harvest more feed for lactation and creep rations.

Drylot is not intended to replace range and pasture cow-calf enterprises. Drylot offers an opportunity for spreading the labor and capital investment for farmers engaged in grain production. It may allow young cattlemen the opportunity to start without requiring a large investment in land. Dairy farmers wanting to reduce milk production and still utilize feed storage and cattle facilities may find drylot beef cows an alternative.

Research is limited on drylot beef cows, but data available suggest a possible trend similar to what happened in poultry, swine and dairy enterprises. More efficiency with greater control of inputs and maximizing outputs through intensive management is possible.

Nutrition of the Drylot Cow and Calf

The nutritional management of the drylot cow requires balancing of rations and attention to detail not usually done with pasture cows. Balancing a ration becomes a process of evaluating available feedstuffs and incorporating them into a least cost formula. Analysis of feedstuffs can be done by commercial labs. Pricing home grown feeds should be done according to current market price to fairly compare with the option of selling the feed.

Producers considering a drylot cow enterprise should evaluate forage and feed crops based on maximizing energy production per acre. Corn grown for silage has repeatedly dominated other crops as an energy producer. It makes a base for lactation rations. Mixed hays which include some alfalfa add protein and minerals as well as needed dry matter to the ration. Small grain straw or corn stover provided free choice allows cows to fill any further drymatter demand. Increasing straw in the ration by mixing with silage or reducing the hay may require additional protein. Low cost protein in the form of urea (not more than one-third of the protein requirement), screenings, sunflower meal or cheap grain fill this need. Some of the rations used successfully at the Carrington Irrigation Station include:

Ration 1

corn silage	35 lb per hd/day
alf/grass hay	15 lb per hd/day

Ration 2

corn silage	40 lb per hd/day
straw	8 lb per hd/day
sunflower meal	8 lb per hd/day

Using green chop has proven to beneficial to production but the cost of equipment and labor to do the daily chopping increased costs above returns.

Water is a critical ingredient in any lactating cow ration. Fresh water should be available to both cows and calves.

Calves in the drylot need to be offered something other than their mother's milk. When calves are six to eight weeks old creep feeders should be filled with moderate energy rations. Chopped mixed hay and whole oats or barley have been used successfully. Creep feed consumption increases to approximately 8 pounds per head per day. Adding aureomycin to the creep ration at 75 mg per head per day improves daily gains, feed consumption and net returns over increased feed costs.

Creep pastures adjacent to the drylot allow calves to graze at will and provide a less stressful environment. Creep pastures reduce creep feed consumption and increase weaning weights by about 20 pounds per calf in research trials. Creep feeders for calves should be checked often to insure continued access. Drylot allows sorting cow/calf pairs by sex of calf to permit higher energy creep rations offered to steer or bull calves. Heifer calves should be given a moderate energy creep to prevent detrimental fat deposits in the udder. These fat deposits have been shown to reduce potential milk production of replacement females.

Cows can be fed once or twice daily depending on the volume of the bunk and the bulk of the ration. Little information exists on how often to feed lactating cows, but high labor and equipment costs suggest a maximum of twice a day.

Herd Health in the Drylot

One of the popular misconceptions of the drylot is the rampant diseases cows in the supposedly crowded, muddy, fly-infested environment experience. The environment is a precursor to many of the normal health challenges that face cattle, such as foot rot and dust pneumonia, but prior planning and reasonable care can prevent many health problems from occurring. The key to overcoming serious problems is aggressive treatment and vaccination. Drylot lends itself to early detection, and treatment started early is effective.

Hairballs, feet and leg problems and compaction can occur infrequently in a drylot environment. Hairballs occur from the social closeness and usually are not treatable. First awareness is generally a dead calf. Feet and leg problems may develop from extended periods on paved surfaces, especially concrete. Asphalt paving is softer and places less stress on the cattle. Minimizing time spent on paved surfaces should increase the longevity of drylot cows. Compaction is a nutritional problem. It is more likely to occur in cows fed large amounts of chopped straw without long hay or significant amounts of silage to act as a laxative. Normal corrective measures include administering a laxative.

Drylot sanitation is the key to reducing the fly population. Aggressive spraying with residual sprays, providing cows and calves with dust bags and rubs and placing insecticide ear tags in both cows and calves have proven effective. Removing manure accumulation frequently remains the most effective fly control measure.

Facilities and Equipment for the Drylot Cow Herd

Some would consider it easier to start from a bare base in designing and constructing a drylot facility for beef cattle. Improving on an existing facility is often more desirable, especially if cows on the farm or ranch are used to the environment. The site chosen for the drylot should be well drained with appropriate pollution controls to reduce or stop runoff from contaminating watersheds. Wind direction and odor should be considered if the drylot is close to any population centers.

Pen size and lot space per cow/calf pair are quite variable depending on the drainage and soil type. General recommendations call for 500 square feet per pair for a minimum with 800 to 1000 square feet desirable, especially with less rapid drainage. Wintering cows require as little as 300 square feet per cow. Number of cows per pen is most critical during the post calving period when calves imprint their mothers. Use of temporary pens to accumulate 10 to 20 newborn pairs is suggested if more than 100 pairs will be penned together. Grouping young or thin cows together and older well finished cows together will allow feeding closer to requirements and improve returns from the feed available. Pens should be colocated with feed supply to reduce travel.

Fencing for the drylot should be sturdy and able to withstand the stress of mature cows crowding and reaching. Steel cables on heavy springs are ideal. Mesh panels and lumber fences are satisfactory but require more maintenance. Panels tend to get pushed out of shape in high stress areas with welds breaking and openings developing. Dimensional lumber fences need occasional replacement, especially of weak or chewed boards. Some cows will tend to chew on board fences more than others. This is thought to be either a mineral craving or result from social boredom. Rough lumber is probably a better value than smooth planed lumber if reasonably available. High tensile fence or barbed wire fences can also be used successfully but may require more frequent attention. If cows start to put unreasonable pressure on any of the fences it may be necessary to run an electric wire along the inside of the fence.

Cows in the summer drylot do not require much protection. Winter windbreaks and bedded mounds during calving help to offset effects of the elements. The value of shade is not well established. If shades are constructed, 40 square feet per cow/calf pair is recommended. Young calves need some type of shelter, especially during the spring when snow and cold rains are possible and frequent. Several types of calf shelters are useful, from school bus bodies to wooden calf sheds. These shelters should be large enough to allow all calves access with 6 to 10 square feet per calf depending on age and size of calves. It may be more desirable to place several shelters around the drylot rather than one large area. This would reduce the spreading potential of any infections. Clean dry bedding is also useful in reducing disease. Shelters should be placed on well drained areas. Good ventilation will reduce humidity problems. Pole sheds work well for calf shelters if bumper boards are used to keep cows out. An electric wire may be needed to discourage cows from crawling under bumper boards. Creep gates with openings of no more than 18 inches wide can be constructed out of steel for use in creep areas or calf shelters.

A self fed ration for drylot cows would be ideal. Some producers have devised movable gates set across bunker silos that allow cows to consume a mixed ration free choice. The challenge then goes back to placing the proper feed ingredients in the bunker silo to make a balanced ration for the lactating beef cow.

Most producers will use a bunk fed ration of some kind with fenceline bunks being the most labor efficient. Several plans are available for constructing fenceline bunks in the Midwest Plan Service Beef Housing and Equipment Handbook. Each moderate size cow should have 24 inches of bunk space. The ration is usually very bulky so a high capacity bunk is in order. A concrete slab behind the bunk allows firm footing and easy cleaning. This slab should be 10 to 12 feet wide and slope ½ inch per foot. Automatic feeding systems represent high capital investment that may not be justified in a beef cow/calf enterprise.

Water facilities for summer drylot cows need special attention. Cows tend to gather at the water tank after consuming the daily ration. Adequate flow means providing up to 20 gallons of water per lactating cow within a reasonable amount of time. Waterers should be accessible to young calves as well. Waterers need to be sturdy because of crowding. Summer drylot cows require a reliable source of water. A second backup well is desirable in case of malfunction or problems with the primary water source.

The drylot lends itself to manipulating the breeding of beef cows in the form of synchronization and artificial insemination. Having all cows close and visible allows easy heat detection that would be much more time consuming on the open range. Gomer cows have proven very successful for assisting in heat detection in the drylot because of maximum exposure of cows. Moving cows through the chute for breeding or synchronizing is much easier and takes less time and labor. Bulls used in the drylot can service 20 to 25 percent more cows due to less distance traveled and social proximity. Producers need to be especially careful in using proven bulls with good libido to make use of the increased exposure.

Replacement females should be generated from the drylot enterprise if at all possible. Experience at the Carrington Station suggests some females raised under more traditional environments do not easily adapt to the drylot.

Performance records are easier to keep in the drylot with daily observation of individual cows. Selection of culls and replacement females is easier and more accurate with records.

HAY AND PASTURE PLANTINGS

Many different grass and legume varieties are available for hay and pasture seedings. The grasses and legumes selected will depend on the intended use, area of adaptation, productive potential, season of use if seeded for pasture and soil conditions, such as periodically flooded or saline-alkali soils.

Alfalfa and alfalfa-grass mixtures are the most widely grown forages for hay. They produce an abundance of high quality forage on a wide range of soils when harvested at the proper growth stage. The use of alfalfa and alfalfa-grass mixtures for hay and alfalfa-grass mixtures for pasture will increase forage production per acre when compared to unfertilized grass. The final stand of alfalfa-grass mixtures should contain more than 50 percent alfalfa when used for hay and about 25 percent when used for pasture. The addition of alfalfa to grass mixtures has been shown to increase the yield of forage 20 to 40 percent or more throughout North Dakota. Suggested seed mixtures and seeding rates for alfalfa and alfalfa-grass mixtures for hay are provided in Table 1. Alfalfa-grass seed mixture for pasture are provided in Table 2.

Table 1. Dryland seed mixtures for hay production.

	Area of State				
	West		Central		
Species	Mix 1	Mix 2	Mix 1	Mix 2	East
	lbs. pure live seed/acre				
Alfalfa:					
Direct seeded + herbicide	6	—	6	8	8
Companion Crop	5	—	5	6	6
Alfalfa-grass:					
Alfalfa	3	3	3	3	4
Crested wheatgrass	2		2		
Meadow bromegrass		5			
Smooth bromegrass				3	4
Slender wheatgrass[1]	2	2	2	2	
Totals	7	10	7	8	8

[1]If seed not available, use intermediate or pubescent wheatgrass at 3.5 lbs/acre PLS.

Table 2. Dryland seed mixtures for pasture.

	Area of State						
	West		Central			Statewide	
Species	Mix 1	Mix 2	Mix 1	Mix 2	East	Mix 1	Mix 2
Alfalfa (Pasture type)	1	1	1	1	2		
Crested wheatgrass	5		5				
Meadow bromegrass		10					
Smooth bromegrass				6	7		
Slender wheatgrass[1]	2	2	2	2			
Russian wildrye[2]						7.5	
Altai wildrye[2]							10-12
Totals	8	13	8	9	9	7.5	10-12

[1]If seed not available use intermediate or pubescent wheatgrass at 3.5 lbs/acre PLS.
[2]Use for fall grazing. If required, they may be grazed earlier.

Direct seeded alfalfa (no companion crop) plus a preplant soil incorporated herbicide will provide 1 to 2 tons of forage per acre in the year of seeding if adequate moisture is available, especially in central and eastern North Dakota and on good moisture sites in western areas. Under good moisture conditions, the first crop is ready for harvest about 10 weeks following planting. Early planting, late April or early May, will permit two harvests during the establishment year under favorable moisture conditions. Harvest the first crop when the stand is at 25 to 50 percent bloom and the second crop at the 10 to 20 percent bloom growth stage. The last harvest should be removed by late August.

Seed mixtures suggested for pasture all include alfalfa except for Altai and Russian wildrye which are fall grazed. If a pure stand of grass is desired for spring grazing, use 7 pounds pure live seed (PLS) of crested wheatgrass per acre, 10 pounds PLS of smooth bromegrass and about 15 pounds PLS of meadow bromegrass.

Pure stands of grass will require fertilization following the second or third production year if forage yields are to be maintained. Grass stands will often require only nitrogen fertilization, but on very low phosphorus testing soils, or those containing 5 to 6 pounds of 'P' per acre, the addition of 20 pounds per acre P_2O_5 will be required to obtain the full response to nitrogen fertilization. Nitrogen fertilizer recommendations for introduced or tame grasses by areas of the state are provided in Table 3.

Table 3. Annual nitrogen fertilizer recommendations for introduced grass plantings.

Areas of State	lbs. Nitrogen Per Acre
West	40-50
West Central	50-70
East Central	70-90
Red River Valley	90-115

The response of grass stands to fertilization is highly dependent upon available soil moisture for growth. Generally, if fall stored soil moisture is adequate and timely, well distributed spring rains are received, growth response should be excellent. The greatest forage yield response per increment of nitrogen applied is obtained at low 'N' application rates, 60-70 lbs 'N' in the Red River Valley and 25 to 30 lbs 'N' in western North Dakota. Fertilizer application rates should be adjusted based on the inherent production potential of the soil. Producers should experiment using two or three different application rates to determine the best rate for their area and soils. Apply fertilizer in late fall or very early spring on medium to heavy textured soils when temperatures are cool. On coarse textured sandy soils, an early spring application is suggested to minimize potential losses from leaching.

Occasionally problem soil areas such as periodically flooded areas and saline-alkaline soils require special seed mixtures. Grasses and legumes vary in their degree of tolerance to flooding and to saline-alkali soils conditions.

Creeping foxtail and reed canarygrass are best adapted to wet, poorly drained soils. They can withstand flooding for a period of 35 to 50 days in the early spring before growth begins without injury to the stand. Creeping foxtail, variety Garrison, is moderately tolerant to saline-alkali soils, but reed canarygrass is only slightly tolerant. The following seeding rates are suggested for straight grass seedings on wet, periodically flooded acres.

Seeding Rates:

- Creeping Foxtail
  Var. Garrison — 4.0 lbs PLS/acre
- Reed Canarygrass — 4.5 lbs PLS/acre

Reed canarygrass, especially older varieties, contains alkaloids which reduce acceptance by livestock when grazed. The varieties Palaton and Venture contain very low levels of alkaloids and are recommended for grazing. If not available, use the varieties Rise and Vantage as they contain lower alkaloid levels than other older varieties. Alkaloid content is not a problem when the forage is harvested for hay.

Grasses and legumes vary in their tolerance to saline-alkali soils (Table 4). Tolerance to salts determines the potential of a particular forage crop to produce a satisfactory yield at levels of salinity and/or alkalinity not tolerated by other crops. A particular forage species may vary in its tolerance to salts due to differences among varieties or strains.

A commonly used seed mixture on strongly saline-alkali soil and seeding rates of individual species in the mixture is as follows:

	lbs PLS/acre
Tall wheatgrass	5
Slender wheatgrass	4
Western wheatgrass	5
Sweetclover	1-2
	15-16 lbs

Seeding rates are higher on saline-alkali soils due to the harsh environment for seedling establishment. Seed germination, seedling emergence and stand establishment are the most successful under moist soil conditions. A dormant-season seeding, just prior to freeze-up, will place the seed in the soil, ready to germinate early the following spring when

Table 4. Estimated salt tolerance of forage crops.

Slightly tolerant	Moderately tolerant[1]		Strongly tolerant	Very strongly tolerant
Alfalfa (seedling)	Crested wheatgrass	DECREASING TOLERANCE	Altai wildrye	Beardless wildrye
White Dutch clover	Creeping foxtail		Slender wheatgrass	Tall wheatgrass
Alsike clover	Inter. wheatgrass		Western wheatgrass	
Red clover	Pubes. wheatgrass		Russian wildrye	
	Smooth bromegrass			
	Birdsfoot trefoil			
	Sweetclover			
	Alfalfa (established)			
	Reed canary grass			

[1]Annual forages including barley, oats, foxtail millet, sudangrass and sorghum possess moderate tolerance.

soil moisture is usually high. High soil moisture decreases the salinity of the soil-water solution, increasing the chances for successful seedling emergence and stand establishment. Additional seed mixtures are provided in Extension Service circulars R-584, "Forages for salt-affected soils," or R-876, "Forages for periodically flooded areas."

EMERGENCY FORAGES

Annual crops can be a valuable part of the regular farm or ranch forage program. They can be used to provide temporary or supplemental forage for hay, pasture and silage while perennial crops are being established. They are the only choices available for emergency use during years of short moisture or when stands of perennial forages are lost due to winter-kill and/or injury. The annual forage crop selected will depend on its growth season, intended use and the date at which planting can be completed (Table 5).

The use of annual forages may also create management problems. Annual forages may accumulate high levels of nitrate, and sudangrass and sorghum varieties, hybrids and crosses may possess a high prussic acid poisoning potential.

High Nitrate Forages

The nitrate content of annual forages will usually increase when plant growth is under stress. Drouth is the primary cause of nitrate accumulation in annual grasses planted for hay or grazing.

Under normal conditions for plant growth, nitrates will usually not accumulate to dangerous levels. The plant converts nitrate to protein about as fast as it is absorbed by the roots. The conversion process, referred to as the nitrate-to-protein cycle, requires an adequate supply of water, energy from the sun and a temperature warm enough for chemical reactions to occur within the plant. If any one of these factors is out of balance and the nitrate-to-protein cycle slows down, nitrates will accumulate unchanged in plant stems and leaves.

Normally, nitrate consumed by cattle is converted to ammonia in the rumen by rumen bacteria. The steps in the conversion process are as follows:

NITRATE
→NITRITE
→AMMONIA
→AMINO ACID
→PROTEIN

In this process, the rate of nitrate conversion to nitrite must be in balance with the conversion of nitrite to ammonia or nitrite will accumulate. If higher than normal amounts of nitrate are consumed, an accumulation may occur in the rumen. Nitrite will then be absorbed into the bloodstream, reducing the ability of the blood to transport oxygen. Thus, nitrate poisoning symtoms in livestock are a result of a lack of oxygen.

Table 5. Temporary or Emergency Crops for Forage.

Crop	Use	Planting Date	Seeding Rate/Acre	Harvest Stage	Comments
Corn	Silage	Mid-May to early June	18 to 20,000 plants	Kernels well dented or glazed	Use hybrids that provide high grain and silage yield.
Foxtail millet - Common, German Siberian, Hungarian (var. Empire, Manta, White Wonder)	Hay Pasture	Late May and June	15 to 25 lbs.	Graze: 6-inches Hay: early heading	Better hay crop than pasture. Shallow rooted and slow re-growth. Use high seeding rate in high moisture areas or where weeds are a likely problem. See Circular R-635.
Oats - med. to late maturity varieties	Hay Pasture Silage	Early spring to mid June	2½ bus.	Graze: 6-inches Hay or silage: early milk to soft dough	Early maturing varieties lower yielding. Fertilize for high yields. Provides a 50-60 day grazing season.
Oats and field peas	Hay Silage	Early Spring	1½ bus. oats 35 lbs. peas	Oats in early milk to soft dough	Feeding value about equal to corn silage, especially for dairy cows. Plant early as peas do best during cool weather.
Rape, Dwarf Essex	Pasture	May and June	5-7 lbs.	Late summer or when 8 to 10-inches tall	Rape may sensitize light-skin animals. Excellent sheep and swine pasture. Will cause off flavor in milk. If grazed by dairy cows remove 2 hours before milking.
Rape and oats - use early oat variety	Pasture	May and June	1¼ bus. oats 5 lbs. rape	Oats 6-inches tall	
Rye, Winter (any common variety)	Pasture	Fall	2 bus.	6-inches	Graze intensively for 30 days in spring and/or early summer. May cause off flavor in milk. Remove dairy cows 2 hours before milking. Oats is a superior forage for spring seeding.
Rye, Spring (Var. Gazelle)	Pasture	Early Spring	2 bus.	6-inches	
Soybeans	Hay Silage	Late May to mid-June	2 bus.	Early podding and/or before lower leaves brown.	A good protein hay. Sometimes difficult to cure. Plant only in areas where soybeans are adapted. If mixed with sudan, plant in separate operation for best results.
Soybeans and sudangrass	Silage	Late May and June	1 bus. soybeans. 8 lbs. sudan	When grass is about 24-inches	
Sudangrass - Piper or sudan hybrids	Hay Pasture Silage	Late May and June	25 to 30 lbs.	Graze: Sheep, 12-14 in. Cattle, 18-24 in. Hay: early heading Silage: dough stage	Sudangrass (Piper) and sudan hybrids lowest in prussic acid content for grazing. Do not graze sorghum or sorghum-sudangrass hybrids until completely killed by frost and forage has dried. Sorghum and sorghum-sudangrass hybrids higher yielding for silage. If sudangrass is used for hay, two crops are sometimes possible from early seeding and/or early first cutting. Often difficult to cure for hay. Use crimper if available. See Circular R-207.
Sorghum or sorghum-sudan grass hybrids	Silage	Late May and June	5 to 8 lbs. in wide rows	Dough stage or after frost	
Wheat, winter	Pasture	Fall	¾ to 1 bus.	6-inches	If grain crop is to be harvested, remove grazing animals as soon as crop begins to joint.
Forage type pearl millet	Hay Pasture Silage	Late May and June	15-20 lbs.	Graze: 18-24 in. Hay: before heading Silage: heading	Plant shallow - 0.5 in. **Does not** contain prussic acid glucocide. May lower butterfat in dairy. Good animal performance with growing animals and beef cattle.

Forages suspected of having high nitrate levels should be tested. Problem forages can then be diluted to a safe feeding level by blending with forages low in nitrates. Also, problem forages can be made into silage. Forages high in nitrates will often lose 40 to 60 percent of their nitrate content during fermentation.

Frequent intake of small amounts of high nitrate feed increases the total amount of nitrate that livestock can consume daily without toxic effects. More high nitrate forage can be fed without harmful effects by feeding it in limited amounts several times daily rather than feeding large amounts once or twice daily. With frequent intake of limited amounts of high nitrate feed, the concentration of nitrate in the rumen does not become extremely high at any one time, reducing the potential for nitrate poisoning to occur.

Prussic Acid Poisoning

Prussic acid (HCN) poisoning potential is greatest in forage sorghums and their hybrids, followed by sorghum-sudangrass hybrids and sudangrass varieties and their hybrids. The poisoning potential of forage sorghums varies greatly among varieties and hybrids. Sorghum plants contain a glucoside called dhurrin (dur'in) required for the formation of hydrogen cyanide.

When animals consume fresh forage sorghum containing dhurrin, HCN may be released in the stomach, absorbed by the blood and carried to body tissue where it interferes with oxygen utilization. If sufficient forage containing dhurrin is consumed by the animal, the poison acts quickly, resulting in respiratory paralysis. Observations indicate that the greatest number of livestock losses from consuming fresh sorghum forage usually occur after a period of drought or frost and from grazing young regrowth forage. HCN poisoning of livestock is also referred to as prussic acid, hydrocyanic acid, hydrogen cyanide and cyanide poisoning.

HCN poisoning by sorghum and sudangrass varieties and/or hybrids decreases as plant height increases and with advancing maturity. The poisoning potential increases when grown under drought conditions regardless of plant height or maturity. Use the following guidelines for reducing the risk of HCN poisoning.

Grazing

- Sudangrass and sudangrass hybrids possess the lowest HCN poisoning potential.
- Do not graze sudangrass or sudangrass hybrids until 12 to 15 inches tall for sheep and 18 to 24 inches tall for cattle. Sorghum-sudangrass hybrids will be safer to graze at a height of 24 inches or more.
- Forage sorghum may not be safe to graze until fully headed.
- Do not graze sorghum, sorghum-sudangrass hybrids or sudangrass during or after a drought or if showing visible signs of moisture stress.
- Do not graze short regrowth forage following hay or silage harvest or following a period of close grazing use, drought or frost.
- Do not graze sorghum or sorghum-sudangrass hybrids following a series of light frosts as potential for poisoning increases for a time. Sorghum-sudangrass hybrids will usually increase in poisoning potential more than sudangrass, and short growing plants will have a higher HCN poisoning potential.
- Do not graze sorghum or sorghum-sudangrass hybrids following a killing frost until the plant has dried. The plant contains less HCN after drying than before the frost.
- Do not graze hungry livestock on sorghum or sorghum-sudangrass hybrids; the poisoning potential increases with the amount of high risk forage consumed.

FORAGES CAN BE TESTED FOR HCN POISONING POTENTIAL BEFORE GRAZING. IF FORAGE IS DROUTH STRESSED OBTAIN TWO TESTS - one test for stressed or stunted plants and one test for actively growing plants. The stressed plants are generally younger and are likely to be grazed first by livestock. Test results can be used as a guide to grazing safety. High risk forages should be made into silage or harvested for hay.

Silage or Greenchop

Sorghum and sorghum-sudangrass hybrids produce similar yields for silage. The sorghum-sudangrass hybrid will be safer to use as greenchop and tiller more actively, producing more regrowth forage. Precautions:

- DO NOT GREENCHOP MORE FORAGE THAN LIVESTOCK CAN CONSUME IN ONE FEEDING.
- DO NOT STORE GREENCHOP FORAGE ON THE FEED WAGON OVERNIGHT; HEATING WILL OCCUR, CAUSING AN INCREASE IN HCN POISONING POTENTIAL.
- SILAGE MADE FROM SORGHUM AND SORGHUM-SUDANGRASS HYBRIDS USUALLY CAN BE SAFELY FED TO LIVESTOCK FOLLOWING A ONE TO TWO MONTH STORAGE AS THE HCN GAS ESCAPES DURING STORAGE AND FEEDING.

Hay

All sorghums, regardless of growth stage, can be fed safely when harvested as hay, especially when properly cured in the field. Sorghums are difficult to cure as hay. Sudangrass has finer stems and is easier to cure in the field than sorghum and sorghum-sudangrass hybrids, especially if conditioned. Even good quality sudangrass hay may be difficult to obtain because wet stems cause molding in the bale. Decreasing windrow size to allow better air circulation in the swath or mowing and raking will usually aid in drying hay for storage.

GRASSLAND MANAGEMENT

Proper grazing management is the key to maintaining productive stands of grass for livestock use. Forage production can be highly variable from year to year because of the amount and distribution of precipitation and the intensity of past grazing use. The number of livestock grazing a pasture should be based on the potential forage production during an average year and the regrowth needs of the grass plant.

Proper use is important to maintaining grass in a healthy, vigorous growing condition. The date of grazing readiness for native grass in North Dakota ranges from about May 15 in the south to May 25 in the north. Native pastures grazed from this date through fall should have 45 percent of the current season's production left standing at the close of the grazing season. Various studies indicate that if grazing is delayed on native grassland until June 1 to 20, total forage production will increase compared to grazing during the month of May.

Late fall and winter grazed pastures don't require as much carryover of standing forage. Up to 60 to 80 percent of the current season's production can be grazed without apparent injury to the grass stand. This is because the grass plant has stored up food reserves in its roots and crown during the growing season. A carryover of standing grass is desirable to provide winter protection and trap snow to provide moisture reserves for the following year's growth.

Seeded tame grass pastures will produce higher forage yields than native pastures on comparable soils. Since production is higher and because old grass carryover does not have to be as great, more forage is available to the grazing animal. A utilization of 70 percent of the current season's production should be the goal to maintain healthy stands of tame grass. A 2 to 3-inch stubble height on crested wheatgrass and Russian wildrye pastures will provide about 30 percent forage carryover. Smooth bromegrass requires a 3 to 4-inch stubble to obtain adequate regrowth during the grazing season. Seeded pastures should have about 4 to 6 inches of leaf growth before grazing begins in the spring.

Following several years of grazing, livestock numbers or acres available for grazing should be adjusted to provide proper grass carryover at the close of the grazing season.

GRAZING SYSTEMS

A grazing system is a grazing management plan. It is just one of a number of management tools available to livestock producers to obtain uniform and proper use of the forage resource. The use of a specialized grazing system will not provide the desired results if livestock numbers are not in balance with the forage available for grazing.

The grazing system used must be adapted to the individual farm or ranch. Consideration must be given to the type of livestock operation, the kind and type of forage available for grazing, the number, size and/or carrying capacity of different pasture units available and the relative location of pastures for easy movement of livestock between pastures.

The type of grazing system used will depend to a large extent on the kind and type of forage available for grazing. If the acreage of native grassland is limited for seasonlong grazing, other forage types will have to be selected for use in combination with the native grassland resource. If only seeded pastures are available for grazing, then a combination of grasses and/or alfalfa-grass mixtures should be used to provide an abundance of nutritious forage during the spring, summer and fall grazing seasons.

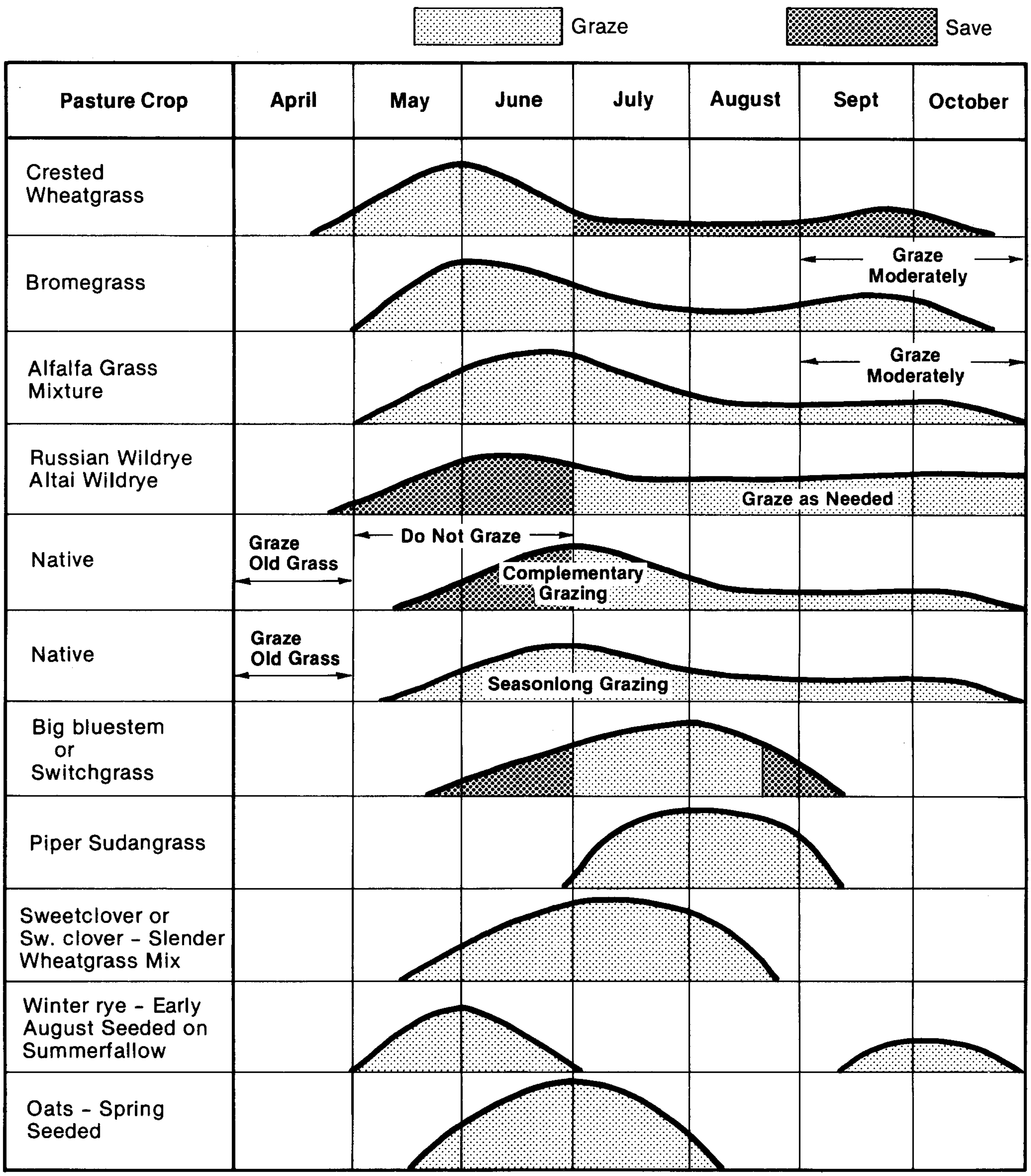
Native grasslands begin growth early in the spring but growth is slow compared to introduced cool-season grasses such as crested wheatgrass and smooth bromegrass. In western North Dakota 25 percent of the yield of native grasslands is produced prior to June 1, 75 percent to July 1 and more than 90 percent is -produced prior to July 15. In comparison, crested wheatgrass produces approximately 25 percent of its total yield by May 10, 50 percent by May 25, more than 70 percent by June 10 and 90 percent by June 25. In eastern North Dakota fertilized smooth bromegrass or a mixture of smooth bromegrass and alfalfa produce 55 to 60 percent of their total prouction by about June 20.

Cool and warm-season grasses and legumes begin growth at differen times in the spring. The cool-season forages begin growth when the soil temperatures reach 40° to 45°F. In comparison, warm season forages begin growth when the soil temperature rises to about 50 to 55°F. In comparison, warm-season forages begin growth when the soil temperature rises to about 50 to 55°F. Growth of cool-season grasses and legumes slows down surface soil and air temperature rise to nearly 100°F. Since environment conditions for growth differ, cool and warm-season forage crops reach peak production at different times during the growing season (Figure 1). The most successful grazing management programs with a limited acreage of native grassland use a combination of seeded pastures with summer grazed native grasslands to provide full season grazing. Studies have shown that the later in May and June that native grasslands are grazed, the greater the forage production. Therefore, the use of a cool-season seeded pasture for spring grazing could increase stocking rate potential on native grasslands and extend the period of grazing later into the fall season.

Native Pasture Systems

Seasonlong Grazing, often referred to as continuous grazing, is the most common grazing method used on native grasslands in North Dakota. Livestock are turned onto the pasture on the date of grazing readiness and left to graze throughout the

Figure 1. Relative Pasture Productivity and Grazing Guide.



grazing season (Figure 2). Although seasonlong grazing is the easiest to manage of all grazing systems and/or methods, it is the least desirable from the standpoint of maintaining a healthy, vigorous growing stand of grass. A major disadvantage of seasonlong grazing is that livestock return and regraze the regrowth of the first grasses grazed in the spring several times during the grazing season. Repeated regrazing of the first grasses grazed results in poor distribution of grazing throughout the grassland. Livestock tend to concentrate on the same areas every year, causing severe overgrazing in some areas while other areas are underutilized.

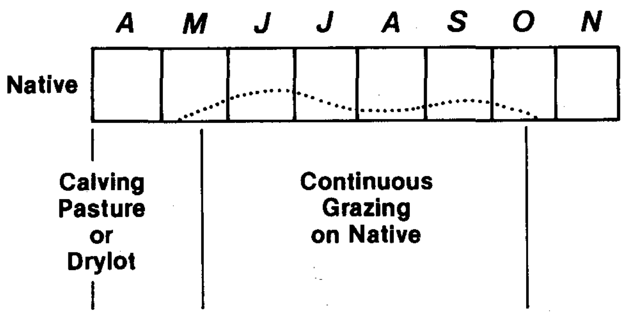


Figure 2. Relative production of native pasture by months and a seasonlong grazing system.

The main advantages of seasonlong grazing are that it requires the least investment in range improvement practices such as fencing and water developments and a minimum of livestock handling is required. In addition, with proper stocking, animal performance is excellent because livestock select the most nutritious forage for grazing throughout the grazing season. Seasonlong grazing of native pastures produces less animal gain per acre compared to rotation grazing due primarily to the lower stocking rate potential.

Rotation Grazing of native pasture may be done in different ways. One approach is to have three or more pasture grazing units (Figure 3). Grazing begins on the date of grazing readiness and livestock are rotated through the system in the same sequence each year. The disadvantage of grazing in the same sequence is that early growing, cool-season grasses are always closely grazed in the spring. These grasses are using stored food to initiate new spring growth. Continued, close grazing in the spring and early summer may cause a loss in plant vigor or "health" resulting in a reduced growth rate due to low stored food reserves and an eventual thinning of the stand. Forage production will eventually decline, reducing the pasture carrying capacity.

Deferment of grazing on native pastures is often practiced on grasslands where key management grasses need to regain their "health" and vigor. When a particular native pasture is deferred, grazing

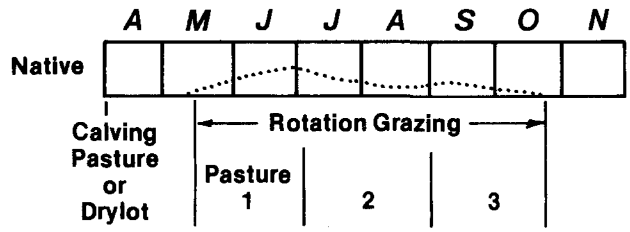


Figure 3. Relative production of native pasture by months and a repeated seasonal rotation grazing system.

should be delayed until the important forage grasses have become fully developed or have set seed. Deferment of grazing periodically (Figure 4) on native pastures used first in the spring will improve forage production and plant vigor.

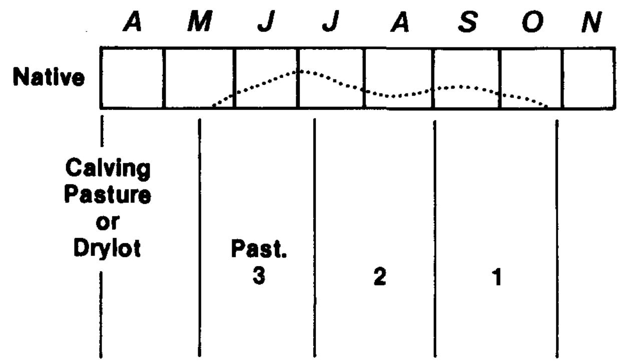


Figure 4. Relative production of native pasture by months and a deferment of grazing on pasture 1 until Fall.

Deferred-Rotation Grazing on native grassland is a specialized system combining the concepts of deferred and rotation grazing into one system. The more specialized a grazing system becomes the more difficult it is to incorporate into a farm or ranch grazing program. A major obstacle on many farms and ranches is the location of the various pastures in relation to each other. Livestock must be rotated at different growth seasons, and ease of rotating animals becomes an important consideration.

Under this system, grazing is deferred (delayed on a portion of the grazing unit) during a different growth period for one or more years. Then, by rotating the areas deferred, all pastures in the system will have the benefit of grazing deferment during the spring and summer before being grazed first in the spring (Figure 5).

When using the deferred-rotation systems, pastures should be of nearly equal size and/o livestock carrying capacity. The advantage of the rotation system is that more livestock are concentrated on a smaller area for a portion of the grazing season, improving grazing distribution. Grazing

Figure 5. 3-Pasture deferred-rotation grazing sequence by years for native grassland.

	Grazing Sequence by Years		
Grazing Period	1st Year	2nd Year	3rd Year
	Pasture Number		
Spring	1	2	3
Summer	2	3	1
Fall	3	1	2

units containing a considerable acreage of the wet meadow range site may not experience improved grazing distribution unless burning and/or mowing is made a part of the management plan. The burning and/or mowing of wet meadow sites removes the unpalatable old growth forage, providing a lush growth of green grass for grazing. Burning and/or mowing of old growth forage on wet meadow range sites will be required about every three years to maintain acceptable forage utilization.

The purpose of pasture rotation and deferment from grazing is to allow plants to regain vigor, mature seed and establish new plants. The full benefits of specialized grazing systems will not be realized until all pastures in the system have been grazed and deferred during the different growth seasons and until each pasture has received the influence of the treatment the year following grazing and deferment. Studies in North Dakota indicate that restoration of plant vigor was the major benefit from deferred-rotation grazing as seedling establishment did not occur.

Variations of the deferred-rotation grazing system are sometimes made to improve forage utilization of cool-season grasses and sedges before they become too mature and/or unpalatable to livestock. One variation is the 'twice over' 3-pasture rotation system. An example of such a system (Figure 6) is a variation of the deferred-rotation system shown in Figure 5. In the 'twice over' method livestock are rotated through the system faster, resulting in more acceptable forage for livestock throughout the grazing season. During the second grazing cycle more high quality vegetative regrowth forage is available for livestock use. Another alternative would be to rotate through the system quite rapidly during the first cycle or in about 21 days, then graze 'twice-over' the remainder of the grazing season.

Rest-Rotation Grazing is similar to deferred-rotation grazing except that one pasture in the system is rested (no use) for one full year. The purpose of the year's rest is to encourage seedling establishment, improve plant vigor and provide litter accumulation. This system is used only to a limited extent in North Dakota. It was developed on bunchgrass ranges in the western United States. Bunchgrasses, unlike sod-forming grasses, require seed production and new plant establishment to become more abundant on run-down or depleted native grasslands. A four-pasture rest-rotation grazing design is shown in Figure 7.

Short Duration Grazing is a highly intensive method of rotation grazing. This grazing method should not be implemented unless grass and herd management practices are at a high skill level. The theory of the system is that the concentrated physical impact of grazing animals or the "herd effect" is beneficial to soil and vegetation and that short periods of grazing on small pastures coupled with periods of grazing rest, similar to deferred-rotation grazing, reduces the stress on vegetation. The system is designed with eight or more individual pastures. The theoretical stock density or cows per acre during any grazing period is 2.0 to 3.0 to produce the desired herd effect. Each pasture in the grazing unit is grazed for seven days or less and receives 30 days or more rest from grazing during each rotation grazing cycle before being grazed again. Livestock should be rotated through each pasture in each grazing cycle before regrowth on grazed plants is regrazed. Livestock can be rotated through the system faster during the early part of the grazing season when grass has a faster growth rate compared to the drier, warmer part of the growing season. The number of grazing cycles obtained during the grazing season depends on the stocking rate

Figure 6. Twice over grazing of a 3-pasture rotation grazing system.

	Grazing Sequence by Years		
Grazing Period	1st Year	2nd Year	3rd Year
	Pasture Number		
Early Spring	1	2	3
Late Spring	2	3	1
Early Summer	3	1	2
Late Summer	1	2	3
Early Fall	2	3	1
Late Fall	3	1	2

Figure 7. 4-Pasture rest-rotation grazing sequence by years for native grassland.

	Grazing Sequence by Years			
Grazing Period	1st Year	2nd Year	3rd Year	4th Year
	Pasture Number			
Spring	1	2	4	3
Summer	2	4	3	1
Fall	3	1	2	4
Rest	4	3	1	2

and forage regrowth. If properly stocked, four to five grazing cycles are possible during a grazing season.

The system may be initiated by using existing native pastures, by dividing existing native pastures into smaller grazing units or by installing a series of pastures referred to as a 'grazing cell' (Figure 8) into an existing native grassland grazing unit. Regardless of how the system is designed, access to water must be provided at the cell center.

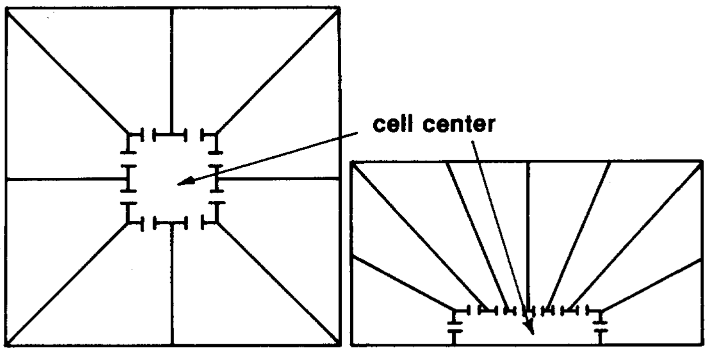


Figure 8. Short-duration grazing design layouts.

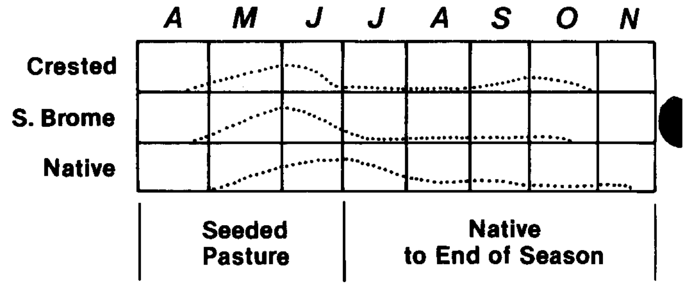


Figure 9. Relative production of native and introduced grasses by months and a complementary grazing system.

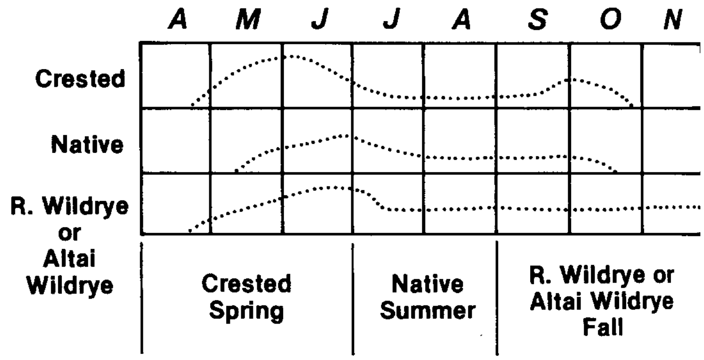


Figure 10. Relative production of native and tame grasses by months and a complementary grazing system.

In summary, specialized native pasture grazing systems will be the most successful if similar vegetation types can be fenced in the same grazing unit. This will provide forage with similar palatability and/or acceptance by livestock and permit regrazing individual units which possess faster regrowth potentials.

Grazing on native grassland is often delayed in North Dakota because the acreage is limited for use throughout the grazing season.

Complementary Grazing Systems utilize introduced, cool-season perennial grasses to complement or enhance the native grassland resource. Crested wheatgrass and smooth bromegrass or both are often used for spring and early summer grazing. These introduced grasses begin growth earlier in the spring, produce more early season forage, can be grazed earlier, and require fewer acres per cow compared to native grassland. Seeded grasses used in the spring can provide excellent grazing for 45 days or longer (Figure 9).

The acreage of native grassland on many farms and ranches is limited for use during both the summer and fall grazing periods. Russian wildrye and altai wildrye may be used for fall grazing if necessary. These grasses retain their nutritional value quite well when early season growth is saved for use during the fall (Figure 10).

Complementary grazing systems are currently being evaluated at the Dickinson Experiment Station and the Central Grasslands Research Station. Crested wheatgrass, native grassland, Russian wildrye and Altai wildrye are being grazed during the spring, summer, early fall and late fall, respectively.

Specialized grazing management plans, once in operation, often permit increased stocking rates, increasing livestock production per acre. If stocking rates are excessive before implementing an improved grazing management plan, a reduction in animal numbers should be made until plant vigor and forage production have improved.

Depending on the degree of intensification of grazing management, observations indicate stocking rate increases of 30 to 50 percent are possible when compared to normal stocking rates recommended for properly managed, seasonlong grazed native grassland.

Use caution when increasing stocking rates as severe overgrazing could result.

Tame Grass Systems

Livestock producers who do not have native grassland for grazing must depend on seeded pastures for grazing. They must use introduced grasses and alfalfa-grass mixtures and selected native grasses for seasonlong grazing. The majority of the introduced forages are cool-season crops.

Their forage production potential declines as the growing season progresses (Figure 1). Warm-season annuals and selected warm-season perennials will provide excellent grazing during mid-summer when the growth rate of cool-season forage declines.

There are no perfect grasses or legumes for grazing. None of the introduced, cool-season forage crops will provide high yields of palatable forage for a fixed number of livestock from the date of grazing readiness into the late fall.

The grasses and legumes planted in each pasture must be utilized during their primary growth season or grasses that retain their nutrient qualities must be used if early growth is saved for fall grazing. The use of fertilized smooth bromegrass, a smooth bromegrass-alfafa mixture and Piper sudangrass (Figure 11) is one possibility. Grazing can begin on the fertilized smooth bromegrass, then rotate to the brome-alfalfa mixture when 10 to 12 inches tall. Livestock can be rotated on about 21-day intervals or less if forage growth is rapid. The sudangrass should be grazed from about mid-July to early September. Crop aftermath can be utilized in the fall. The regrowth on the bromegrass and/or alfalfa pastures is best utilized after a killing frost following fall regrowth and food storage.

A study conducted at Norbeck, S.D., located in the north central portion of the state, compared a "short-season" and a "full-season" introduced grass and/or alfalfa-grass grazing system with continuously grazed native grassland. The short-season pasture contained a mixture of smooth bromegrass, intermediate wheatgrass and alfalfa. The full-season grazing system consisted of four different pastures - (1) crested wheatgrass; (2) smooth bromegrass, intermediate wheatgrass and alfalfa; (3) switchgrass and (4) Russian wildrye. Switchgrass is a warm-season perennial which requires special establishment techniques. It is best adapted to eastern North

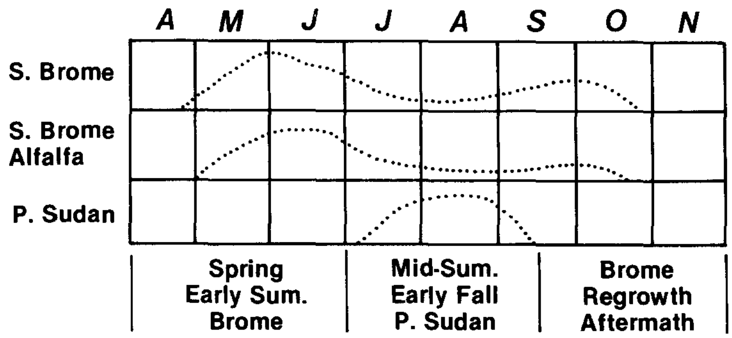


Figure 11. Relative production of tame grasses and legumes by months for grazing seasonlong.

Dakota. Plant only on good moisture sites. Grazing should begin on switchgrass at the late jointing to early boot stage of growth. Graze to maintain a minimum stubble height of about 10 inches. Sudangrass, a warm-season annual, can be substituted for switchgrass in the grazing system. The "full-season" grazing system (Figure 12) produced 200 cow/calf days of grazing compared to 128 days for the "short-season" system and 181 days for the native grassland system.

Flexibility is the rule when using a more specialized grazing system. The more intensive the grazing management, the greater the potential problems in case of drouth, hail, fire, etc. During periods of vegetation stress due to weather conditions, it may be necessary to abandon the planned schedule of grazing management. However, as soon as plant growth improves, move back into the system as soon as possible. Maintain a reserve supply of harvested forage to extend the winter dry feed period during a late spring and to supplement grazing needs during low moisture years.

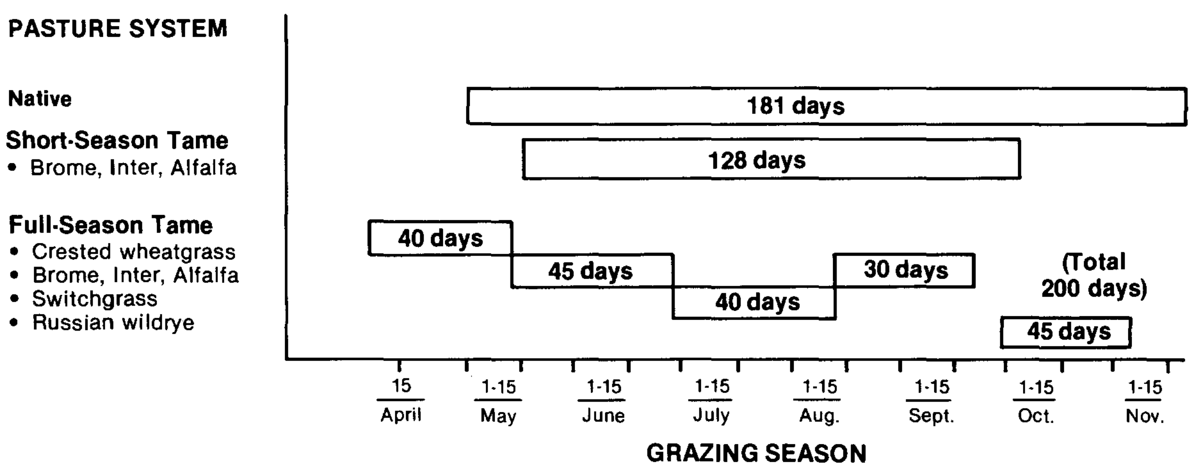


Figure 12. Average dates of grazing three pasture grazing systems. Norbeck, S.D. (1967-1972).

ECONOMIC EVALUATION OF TWO KEY MANAGEMENT FACTORS

This section will present a series of tables illustrating the economic importance of weaning weight and percent calf crop. These tables are based on estimated 1985 production costs and actual October 1985 West Fargo average selling prices. The two different economic evaluations that will be presented are: (1) economic returns to labor, management and capital per cow and (2) net cash flow per cow. The first (economic returns) should be used in making long run profitability decisions about the beef cow enterprise and the second (net cash costs) should be used to determine the short run feasibility of the beef cow enterprise.

Profitability and feasibility are two different economic measures and need to be considered separately. For example, it may be profitable for a specific farmer to expand his beef cow herd, but if he has to borrow all of the investment money to buy the cows, it may not be feasible when both principal and interest payments are also considered. On the other hand, if another farmer has the cash in the bank, it may be feasible for him to invest in beef cows but the production ability of the cows that he is considering may not be profitable. Feasibility and profitability are two different economic concepts.

Emphasis in this section will be placed on the economic importance (both profitability and feasibility) of obtaining a high average weaning weight and a high percent calf crop.

Profitability

Gross income from the beef cow herd consists of selling three jointly produced products - steer calves, heifer calves, and cull cows. Table 1 presents the estimated gross income from a typical beef cow herd selling steer calves ranging from 400 to 550 pounds per calf. Heifer weights were assumed to be 30 pounds under their associated steer weights. Cull cows were assumed sold at 900 pounds. The selling prices in Table 1 are based on October 1985 average prices at West Fargo. Gross income ranged from a low of $174 per cow to a high of $258 per cow for a projected economic reward to high management of an additional $84 gross per cow.

Cost Allocation with Joint Products

One of the more difficult aspects to deal with in estimating production costs from the beef cow enterprise is how to take into account the three jointly produced products - steer calves, heifer calves, and cull cows. What production costs should be allocated to each product?

Researchers have developed several methods of handling joint products. The one that is used here converts all income to "cwts of steer equivalents."

The cwts of steer equivalents is calculated by dividing gross income from the three products by the price of steer calves sold. All income is expressed in an equivalent value of steer calves. For example, the cwts of steer equivalent for 450 pound steer weaning weights is:

Cwts of Steer eq. = $266.78 divided by $65.00
= 3.49

Table 1. Gross Income Projections for Alternative Production Systems (October 1985 prices).

	Alternative Steer Weaning Weights (lbs)			
	400	450	500	550
Selling Price[1]:	Price per Cwt Sold			
Steers	$66.00	$65.00	$63.00	$62.00
Heifers	$60.00	$57.00	$55.00	$54.00
Cull Cow	$35.00	$35.00	$35.00	$35.00
Percent Calf Crop:	Income Per Cow			
70%	$174	$188	$200	$213
75%	$185	$201	$214	$228
80%	$197	$214	$228	$243
85%	$208	$227	$241	$258
90%	$220	$240	$255	$273
95%	$231	$252	$269	$288

[1]Selling prices are based on West Fargo October 1985 average prices.

Cwt of steer equivalents will vary with weaning weights, percent calf crop, the cull cow rate, and the price of steer calves. Table 2 presents the cwts of steer equivalents calculated for alternative management levels assumed in this section.

Costs of Production

Table 3 presents a set of typical production costs for a beef cow herd. The top part of the table presents the costs per cow and the bottom part presents the costs per cwt of steer equivalent. It is projected that a typical beef cow will cost $250 per year to own and maintain. Note that this does not include the opportunity cost of operator labor, management and capital.

The cost per cwt of steer equivalent produced will vary with weaning weight and percent calf crop. As illustrated in the bottom half of Table 3, cost of production varies from a high of $95.60 down to $54.26 depending on the weaning weight and percent calf crop sold.

Returns to Labor, Management, and Capital

Table 4 presents the projected returns to labor, management, and capital per cow for the two different management factors. This table suggest that in 1985, weaning weights needed to be above 450 pounds and percent calf crop sold needed to be above 85 percent in order to make a positive return.

The herds with lower management levels did not make money in 1985. On the other hand, herds with high management levels are projected to have made up to $36 return per cow. Clearly, management level does make a difference.

Table 2. Cwts of Steer Equivalents Assumed In Budgets.

	Alternative Steer Weaning Weights (lbs)			
	400	450	500	550
Percent Calf Crop Sold	Cwt Steer Eq. Sold			
70%	264	290	317	344
75%	281	310	339	368
80%	298	329	361	392
85%	316	349	383	416
90%	333	369	405	440
95%	351	388	427	465

Table 3. Production Expenses for Typical Beef Cow Herd (1985).

Summer Pasture Rent	$ 57.64	
Crop Aftermath	$ 3.00	
Winter Feed	$106.37	
Total Feed		$167.37
Livestock Costs		$ 28.60
Fixed Costs		$ 22.20
Total Costs/Cow (Excluding Labor, Management, & Capital)		$252.04

	Alternative Steer Weaning Weights (lbs)			
	400	450	500	550
Percent Calf Crop:	Cost/Cwt Steer Eq. Sold			
70%	$95.60	$86.94	$79.43	$66.88
75%	$89.68	$81.42	$74.30	$68.52
80%	$84.45	$76.56	$69.79	$64.30
85%	$79.80	$72.24	$65.80	$60.56
90%	$75.63	$68.39	$62.24	$57.24
95%	$71.88	$64.93	$59.04	$54.26

Table 4. Returns to Labor, Management, and Capital Per Cow.

	Alternative Steer Weaning Weights (lbs)			
	400	450	500	550
Percent Calf Crop:	Returns Per Cow			
70%	$-78	$-64	$-52	$-28
75%	$-67	$-51	$-38	$-24
80%	$-55	$-38	$-25	$- 9
85%	$-44	$-38	$-25	$+ 6
90%	$-32	$-12	$+ 3	$+21
95%	$-21	$+ 0	$+17	$+36

FEASIBILITY

While economic profitability is used to measure the long run profitability of an enterprise, feasibility is used to measure the short run net cash flow of an enterprise. Net cash flow is the difference between: (1) cash income, the money flowing into the enterprise and (2) cash expense, the money flowing out of the enterprise.

Cash income is the actual dollars received from the sale of beef products produced by the beef cow enterprise. Cash expenses are those production costs that a producers actually pays cash or writes a check for. Net cash flow is determined by subtracting cash expenses from cash income.

Profitability vs Feasibility

Many economic costs of production such as depreciation, operator labor, management, and interest on equity capital are normally treated as opportunity costs. Appreciation, depreciation, and opportunity costs are not included in the feasibility analysis; therefore, cash expenses are frequently less than total economic costs of production. Principle payments, while not considered economic costs of production, are considered cash costs of production. This means that the principal and interest payments that result from financing the beef cow herd will have a direct impact on the feasibility measures; financial arrangements, on the other hand, will have no direct effect on the profitability measures of the beef cow herd. Many producers miss this relationship.

Cash Flow Is What's Critical Today

In today's economic times, feasibility (cash flow) of the beef cow enterprise is generally the critical economic factor. If the beef cow herd is to be feasible, this enterprise will need to have a positive cash flow covering cash costs, interest and principal payments. Producers will also need to have considerable equity in the herd at all times. The support for this statement is best summarized by this quote:

> *Farm Credit System sticks with most customers current on their interest payments. But, if the cattleman's collateral dips in value below the amount of the loan, the loan could be called in, even if the rancher was current on his interest.*

To demonstrate the impact that cash flow has on the feasibility of beef cow herd, let's first look at the cash flow associated with a "debt free" herd and, second, look at the maximum debt that a typical beef cow can support.

Cash Costs of Production

A debt free beef cow producer will have cash costs of production considerably lower than total economic costs of production. Let's illustrate this point with winter hay costs. Assuming that this typical producer puts up his own hay with his own haying equipment, cash cost of harvesting hay was estimated to be $15 per ton. This is to account for the twine, fuel and lubricant cost directly associated with hay harvest. Depreciation, interest on equity capital, labor, land, etc., on this debt free farm are all non-cash costs.

Table 5 summarizes the cash cost projections for a typical North Dakota beef cow herd. The total cash cost of production is projected at $85 per cow. Spreading these cash costs over the total cwts of steer equivalents produced, gives the results presented at the bottom half of Table 5. Cash costs of production vary from $32 for low management to $18 per cwt of steer equivalent produced for high management.

Table 5. Cash Costs of Production Under a Debt Free Herd.

Summer Pasture Rent	$ 3.95	(Mineral & Salt)
Crop Aftermath	$ 0.00	
Winter Feed	$42.94	
Total Feed		$46.89
Livestock Costs		$28.60
Fixed Costs		$ 9.70
Principle Payment		$ 0.00
Family Living		$ 0.00
Total Costs/Cow (Excluding Labor, Management, & Facilities)		$85.19

	Alternative Steer Weaning Weights (lbs)			
	400	**450**	**500**	**550**
Percent Calf Crop:	Cash Cost/Cwt Steer Eq. Sold			
70%	$32.31	$29.38	$26.85	$24.79
75%	$30.31	$27.72	$25.11	$23.16
80%	$28.54	$25.87	$23.59	$21.73
85%	$26.97	$24.42	$22.24	$20.47
90%	$25.56	$23.11	$21.04	$19.35
95%	$24.29	$21.94	$19.96	$18.34

Net Cash Income

Net cash income is the difference between cash income and cash expenses. The projected net cash income for two management factors are presented in Table 6. Net cash income is projected at $89 per cow under low management and increases up to $203 per cow for high management.

Table 6. Net Cash Income from a Debt Free Herd.

	Alternative Steer Weaning Weight (lbs)			
	400	**450**	**500**	**550**
Selling Price:	Net Cash Income Per Cow			
Percent Calf Crop:				
70%	$ 89	$103	$115	$128
75%	$100	$116	$129	$143
80%	$112	$129	$142	$156
85%	$123	$142	$156	$172
90%	$135	$154	$170	$188
95%	$146	$167	$184	$203

HOW MUCH DEBT PER COW?

A logical question to ask now is: How much debt will a beef cow support if the producer could borrow the money investment for seven years at 12.25 percent interest? The economic principle that must be used to answer this question is the TIME VALUE OF MONEY, specifically, discounting. All future net cash flows must be discounted back to the present. In other words, each year's annual net cash income for the next seven years must be discounted back to the present. The sum of these seven discounted present values is the maximum debt that can be financed per cow.

Table 7 presents the maximum debt that a beef cow could support for the alternative management factor levels. This represents "all" debt that can be supported; i.e., cow investment, equipment, land, etc., based on the assumption that all seven years of net cash income equals 1985 projections. A cow weaning 550 pound steer calves in a herd with a 95 percent calf crop can support 2.3 times as much debt as a cow weaning 400 pound calves in herd with a 70 percent calf crop.

Table 7. Maximum Debt That a Beef Cow Support 7 Year Loan@12.25% Interest (No Family Living Drawn).

	Alternative Steer Weaning Weights (lbs)			
	400	450	500	550
Percent Calf Crop:				
70%	$403	$466	$521	$580
75%	$453	$525	$584	$647
80%	$507	$584	$643	$706
85%	$557	$643	$706	$779
90%	$611	$697	$770	$851
95%	$661	$756	$833	$919

Impact of Family Living Draw on Maximum Debt

Family living is also an important part of the cash flow on any farm or ranch. The actual family living that must be paid from a beef cow herd will depend on the circumstances of the individual farm or ranch. Family living draw from the beef cow herd will vary substantially from farm to farm. A rancher that receives all of his business income from selling cattle and has no off-farm income must get all of this family living from the beef cow enterprise. On the other hand, a farmer who has 50 beef cows as a supplementary enterprise may not expect any family living draw from the beef cow enterprise.

Family living draw has a very strong bearing on the maximum debt that a beef cow can support. Table 8 assumes the same production and economic conditions as in Table 7 except that a $50 per cow family living draw is taken. Maximum debt that can be supported is reduced to $177 per cow for the low management to $693 per cow for high management. This $50 family living per cow reduces the debt that can be supported by $226 per cow.

Table 8. Maximum Debt That a Beef Cow Support 7 Year Loan@12.25% Interest ($50/Cow Family Living Draw).

	Alternative Steer Weaning Weights (lbs)			
	400	450	500	550
Percent Calf Crop:				
70%	$177	$240	$294	$353
75%	$226	$299	$358	$421
80%	$281	$358	$417	$480
85%	$331	$417	$480	$552
90%	$385	$471	$543	$625
95%	$435	$530	$607	$693

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