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1983 Minnesota Beef Cow—Calf Report

AGRICULTURAL EXTENSION SERVICE
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WEANING MORE POUNDS OF BEEF EFFICIENTLY: A TO Z

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The economic returns from a cow-calf herd are determined to a considerable extent by the total pounds of calf sold, which, in turn, depends on a high percent calf crop and heavy weaning weights. Feed costs and other costs need to be kept as low as possible, consistent with high production. Finally, the calves need to be marketed as effectively as possible.

Some tips or suggestions:

A. Crossbreed: have crossbred cows as soon as possible, as well as crossbred calves.

1. Utilize heterosis: can increase pounds of calf weaned per cow exposed to breeding by 20 to 25 percent.
2. Utilize breed strengths: breeds that increase milk production and/or gaining ability will increase weaning weights.

B. Select for performance

1. Improve weaning weights and other traits by within herd selection.
2. Select sires based on performance.

C. Avoid calving difficulty

1. Breed yearling heifers and two-year-old cows to bulls from moderate size breeds and bulls with "calving ease."
2. Avoid crossing breeds with extreme size differences.

D. Calve early and in a short period: Calves born in March, for example, will be much heavier in late October than those born in June. The average weight of calves born early and "bunched" will be heavier than calves born over a period of 3 or 4 months.

E. Identify calves and cows with ear tags or other devices for management records as well as performance records.

F. Provide enough bull power

G. Purchase the bulls early when selection is best. Allow about 45 to 60 days of isolation and give them a chance to adjust to your farm.

H. Pre-breeding check-up for bulls: physical and semen checks.

I. Check breeding herds at least daily.

J. Pregnancy check cows, cull open cows.

K. Separate cows according to age, condition, etc.

1. Winter growing heifers, yearlings and mature cows in separate groups.
2. Consider keeping two-year-old cows in a separate group during the grazing season and give them the best pasture(s).

L. Winter replacement heifers properly. After weaning they should be kept separate from other cattle. Feed them to gain about 1 to 1.25 pounds per day and to weigh 650 to 700 pounds at breeding time.

M. Provide adequate nutrition prior to calving. Feed cows about 8 to 9 pounds of T.D.N. and 1 pound of protein per head per day. Provide vitamin A if needed. Provide salt and other minerals.

N. Separate cows that have calved and feed them adequately, i.e., about 12 to 14 pounds of T.D.N. per day. Cows need to conceive within about an 82-day period to maintain a 12-month calving interval; feeding enough energy post-calving will help insure early estrus.

O. Use good calving management: Observe cows often. Have equipment and supplies available. See that calves nurse early. Use warming boxes in cold weather. Treat navel cords with iodine.

P. Have adequate handling facilities so that cattle may be treated when needed and so that other procedures may be done easily.

Q. Dehorn (where needed) and castrate before calves are 3 months old.

R. Control insects and parasites

S. Establish a good herd health program and follow it.

T. Provide (and manage) a good forage program

U. Cheapen winter feed costs when possible

   1. Consider grain as a replacement for forages when grain is cheap and forages are high priced.

   2. Use crop residues and by-products where there are cost advantages.

   3. Feed enough energy and protein, but don't overfeed.

V. Implant suckling calves. Ralgro or Compudose may be used. Weaning weights may be increased from about 15 to 35, or more, pounds.

W. Market effectively. Consider alternative methods. Sort calves into uniform groups. Consider having calves eating grain before weaning and/or marketing.

X. Consider owning calves beyond weaning. Look at alternatives of selling at weaning vs yearling vs finished cattle.

Y. Analyze feeds, especially forages. Use the results to provide least cost, balanced rations.

Z. Attend Extension sponsored events. 1983 Area Beef Cow-Calf Days, other educational meetings, and go on the 1983 Minnesota Beef Study Tour (probably to Canada).

MANAGING COWS TO GET THEM PREGNANT

R. L. Arthaud, J. C. Meiske, S. D. Plegge

THE SITUATION AND SOME PROBLEMS

Ideally all of our beef cows would produce a live calf every 12 months and every one of those calves would be alive 6 months later at which time none would weigh less than 500 pounds.

We are obviously far from that utopia. In Minnesota only 75 to 80 percent of the beef cows that are exposed to breeding end up with a live calf at weaning time. The average weight of seven month old beef calves is about 430 pounds. Thus the average weaning weight of calf produced per cow exposed to breeding is about 330 pounds!

When do the losses occur that lead to such a poor percent calf crop? Several surveys have shown that losses occur in about the frequency shown in Table 1.

Table 1. Time of Reproductive and Death Losses

Cows fail to become pregnant	17 to 23 percent
Calves lost during pregnancy	2 to 3 percent
Calves lost at or after birth	3 to 7 percent

By far the greatest loss is from failure of cows to get pregnant. This great loss is often overlooked because records are not kept or not used to show it, nor is it as dramatic as seeing a dead calf; yet failure to conceive is a far greater problem than postpartum deaths.

Losses occurring because cows fail to become pregnant can be divided into: 1) losses from failure of cows to show heat and 2) failure of cows that do show estrus to conceive.

We will not discuss failures to conceive that occur because of bull failures or problems. Some of these problems and solutions are outlined elsewhere in the 1983 Cow-Calf Day Report C-48.

The problem of cows failing to show heat was evident in one study of cows that were nursing calves. Twenty-one percent of the cows failed to show heat during a 90 day breeding season. An additional 17 percent of the cows came into heat only once during the breeding season, hence had only one chance to conceive during that season.

Cows should not only show estrus during the breeding season, but should come into heat soon after calving. This will give them more than one opportunity to conceive if needed. The basic need, however, is to get the majority of cows pregnant within 75 to 90 days after calving. Cows must get pregnant within 75 to 90 days if they are to produce a calf 12 months later.

Early postpartum estrus and a high conception rate at first service will build the foundation for success, not only in the next calving season, but in successive ones as well. Cows that calve early during the 1983 calving season, for example, will have a good probability of breeding early in the 1983 breeding season. These same cows will calve early in the 1984 season with more likely early breeding in 1984, etc. Early calving cows provide an additional bonus in that their calves will be heavier at weaning time than those from late calving dams.

SOME POSSIBLE SOLUTIONS TO THE PROBLEMS

There are at least five tools which can be utilized to achieve the final goal of getting cows pregnant: 1) calving time, 2) nutrition, 3) selection for fertility, 4) use of hormones, and 5) manipulation of suckling or combinations of these tools.

1. Calving time:

   Cows calving late in the calving season have a lower percent calf crop than cows calving early. Cows calving late tend to be late calvers throughout their productive life.

   Late calving cows are not only slow to come into heat, but have a poorer conception rate than early calvers. The effect of late calving on heat is shown in Table 2, taken from a publication by Dr. J. Wiltbank.

Table 2. Effect of Calving Time on Heat.

Calving Time	Ave. No. Days Calving to Start of Breeding	In Heat 1st 20 Days of Breeding Season (May 1st to May 21st): Cows 5 yr. or older	In Heat 1st 20 Days of Breeding Season (May 1st to May 21st): 2 and 3 yr. old cows
2-10 to 3-1	70 days	95%	79%
3-2 to 3-21	50 days	58%	64%
3-22 to 4-10	30 days	70%	32%
4-11 to 5-1	10 days	29%	10%

Ninety five percent of the cows five years old or older which calved early (2-10 to 3-1) showed head the first 21 days of the breeding season, only 29 percent of the late calvers (4-1 to 5-1) achieved this. The effect in young cows was more drastic: 79 percent of early calvers in heat the first 21 days and only ten percent of the late calvers.

Late calving presents other problems. Cows that calve late have low conception rates. They don't have time for the uterus to "clean-up," for example, resulting in low conception rates at first service. This is shown in Table 3, also from a report by Dr. J. Wiltbank.

Table 3. Time of Calving and Conception on First Service

Calving Time	Ave. No. Days Calving to Start of Breeding	Cows Conceiving on First Service
2-10 to 3-1	70 days	62%
3-1 to 3-21	50 days	58%
3-22 to 4-10	30 days	33%
4-11 to 5-1	10 days	33%

Some aids to early calving will be covered in the next section "nutrition." In the meantime we can consider some management tools leading to earlier calving.

Two year old cows nursing their first calf are slower to come into heat than mature cows, hence this group is likely to continue to be late calvers. One solution to part of this problem is to breed these heifers the first time - when they are yearlings - before most of the mature cows. If one starts breeding the yearling heifers about three weeks before the start of the breeding season for mature cows, these heifers will calve earlier the next year. Earlier calving will enable them to come into heat (while nursing their first calves) at about the same time as the mature cows.

2. Nutrition:

Adequate amounts of all essential nutrients throughout the development and productive life of cattle will help insure good reproduction.

Some brief comments on growing replacement heifers are included elsewhere in the 1983 Cow-Calf Day Report (C-48) and will not be discussed here. Likewise we will not discuss nutrition at some other stages of the life/reproductive cycle such as late lactation and early pregnancy.

Nutrition of the pregnant cow can, and often does, affect fertility. The effect is particularly evident in time of returning to estrus after calving. All of the essential nutrients in adequate amounts are needed. Adequate energy is extremely important and we will emphasize it more than other factors.

Some of the nutrient requirements of beef cows at some stages of production are given in Table 4.

Table 4. Daily Nutrient Requirements of Beef Heifers and Cows.*

Body Weight	Daily Gain	Daily Dry Matter Intake	Total Protein	Digestible Protein	Total Digestible Nutrients
			pounds		
Pregnant yearling heifers, last 3 to 4 months of pregnancy.					
700	1.3	18.7	1.65	0.93	9.9
800	1.3	19.6	1.75	1.00	10.6
Dry pregnant, mature cows, lost third of pregnancy.					
1000	0.9	14.8	1.06	0.51	9.4
1200	0.9	17.0	1.19	0.55	10.7
Cows nursing calves, first 3 to 4 months after calving, average milking ability					
1000	---	20.5	1.90	1.10	11.0
1200	---	22.7	2.14	1.26	12.3

*Adapted from the Nutrient Requirements of Beef Cattle, 1976, National Research Council, Pub. No. 0-309-02419-6.

The pregnant yearling heifer is usually the most susceptible of any group of cows to nutritional deficiencies. She is still trying to grow and to provide for the fetus; after calving she must try to grow, to produce milk to the best of her ability and still try to get ready to breed and reproduce again. If nutrients are lacking, reproduction will be the lowest priority among these demands and will suffer accordingly.

Yearling pregnant heifers should be kept separate from the mature cows throughout the wintering period if possible; if not for the entire period then at least during late pregnancy. They often cannot compete with mature cows for enough feed or the best feed. They may need supplemental energy as with grain whereas the mature cows would not.

During the last 3 or 4 months of pregnancy yearling heifers should gain at least 1.3 pounds per day - more if they are thin or stunted. Most of this gain will be in the developing fetus, the associated fetal membranes and fluids rather than body gain.

The nutrient requirements of these pregnant heifers, as shown in Table 4, may be met by various rations. A full feed of extremely good quality hay or haylage may be adequate; if not, or with slightly poorer quality forage, 1 or 2 pounds of grain per head per day may be needed. Poor to medium quality hay should be supplemented with about 2 to 3 pounds of grain. About 30 to 35 pounds of corn silage plus 4 or 5 pounds of good quality legume hay will also make a satisfactory daily ration.

Nutritional level before calving and cow condition at calving will affect how soon a cow comes in heat after calving. Research done at the Fort Robinson Nebraska Experiment Station, Table 5, shows the drastic effect of poor condition on reproduction.

Table 5. Cows Showing Heat as Related to Body Condition at Calving.

Condition at Calving	Percent in heat at x days after calving		
	40 days	60 days	80 days
Thin: range from on the verge of starving with no fat on the backbone to those in slightly better condition, but still with little fat over the ribs and backbone.	19	46	62
Moderate: generally good overall appearance with some fat over the ribs and the backbone and tailhead not protruding. Good hair coat.	21	61	88
Good: from those obviously fleshy with visible fat cover over the ribs and around the tailhead to some extremely fat with fat patches around the tailhead.	31	91	98

There would be no possibility of getting most of the thin cows rebred, even in a 90 day breeding season. Only 62 percent were in heat 80 days after calving and only 66 percent at 90 days (not in the table). Most of the cows in moderate condition and all of the cows in good condition would have a chance for at least one service within 90 days of calving.

The nutrient needs of mature pregnant cows during late pregnancy (Table 4) are somewhat lower than for young cows. With mature cows most nutrient needs are about 10 percent higher during the last one third of pregnancy compared to the first two thirds.

Some rations used early in pregnancy - and adequate at that stage - will be deficient in energy, possibly in protein and also possibly in vitamin A. If the rations have considerable amounts of such feeds as straw, cornstalks and very poor hay, then some changes are needed; probably additional energy, protein and vitamin A will be needed.

Actually during the last few weeks of pregnancy large amounts of poor quality roughages should not be fed. Poor quality feeds should be replaced by good quality hay, haylage, corn silage or small grain silage.

Some rations for cows in late pregnancy include:

a. Good quality legume-grass hay, 18 to 19 pounds
b. Good quality legume-grass hay, 4 lb.; corn silage, 30 lb.
c. Good quality legume hay, 17 to 19 pounds
d. Good legume-grass haylage. Fed as with legume-grass hay with the weight of the haylage being 1.75 times the weight of the hay.
e. Low quality, mature grass hay, full-fed plus 1 pound of a 40 percent protein supplement.

We have not said much about protein even though it is one of the key nutrients. Many typical wintering rations for beef cows will have enough protein to meet the needs of the pregnant cow. Good quality hay, even grass hay, in the amounts usually fed will provide plenty of protein. When poor quality roughages, such as barley straw or cornstalks, make-up most of the daily diet then supplemental protein is often needed. Analyses of these roughages may show they contain enough total protein but the protein is usually low in digestibility. Without supplemental protein the rumen microorganisms cannot function adequately to "break-down" the fibrous material in the poor roughages. In this case cows may "go down" for lack of available energy.

Most mineral needs may be met with a mineral mixture using salt with added trace minerals plus a source(s) of calcium and phosphorus. The proportions of each will vary with other components of the diet. With a diet of grass hay, or mixed hay, a mixture of 70 percent salt and 30 percent dicalcium phosphate (both by weight) will meet the mineral needs. This mixture would be fed "free-choice" and no additional source of salt should be needed.

Cows may become deficient in vitamin A if their diet consists mostly of poor quality roughages or of even good hay that is several months old. Supplemental vitamin A should be considered when a shortage is likely.

The energy level after calving is perhaps even more critical than the level just before parturition in its effect on onset of estrus after calving. Cows that calve in March and April need a higher plane of nutrition than they were fed during the winter. Some example rations for this period are:

a. Good quality alfalfa-grass hay, full-fed.
b. Good quality alfalfa-grass hay, 10 lb.; good quality grass hay, full-fed.
c. Good quality alfalfa-grass hay, 7 lb.; corn silage, 45 pounds.
d. Good quality alfalfa-grass hay, full-fed; oats, 5 to 6 pounds.

Cows in programs <u>a</u> and <u>b</u> will lose weight and may not produce adequate milk for their calves. However, cows in both programs will have adequate protein intakes--energy (TDN) will be limiting. Cows in program <u>c</u> would be adequate in both protein and energy, while those in program <u>d</u> would have adequate protein and nearly adequate energy intakes. Care should be taken not to increase energy intakes before the calves are large enough to take the increased milk production that will result when programs <u>c</u> and <u>d</u> are followed. The calves will likely be 2 to 4 weeks old before they can utilize the increased milk production and not scour.

A mineral mixture with 70 to 80 percent trace mineralized salt and 20 to 30 percent dicalcium phosphate would be satisfactory with these rations if fed free-choice.

3. Selection for fertility:

Selection is not within the scope of this paper. Fertility is about 10 percent heritable so, conversely, about 90 percent of the differences in fertility are due to "environment." Hence we need to look closely at nutrition, management and other environmental factors. However, even though the heritability is low, we do need to select for fertility because even small gains are important in profit and loss.

Culling of open-cows, late calvers and other cows with problems may not greatly affect the genetics of fertility, but doing so will help improve calving rate and shorten the calving season.

4. Hormones:

Prostaglandins and other hormones are available that may control estrus and affect reproduction in other ways. These are not included in this report. They were included in the 1980 and 1982 Minnesota Beef Cow-Calf Reports, C-39 and C-42, respectively.

5. Manipulation of suckling:

The onset of heat following calving is delayed in beef cows which are suckling calves - hopefully all of our beef cows will be nursing calves before and during the breeding season. Exceptions would include cows whose calves died at or soon after birth.

In one study of the suckling effect, Hereford cows took an average of 73 days from calving to come into first estrus; comparable non-suckled (dry) cows took only 29 days.

We are not likely to wean calves at a few days of age in order to have their mothers come into heat more quickly. There are some systems for removing calves from their mothers for a short period of time that do help achieve early post-partum estrus.

Calf removal for 48 hours in non-cycling cows has been shown to increase cycling rate. This was shown in a study conducted by Dr. J. Wiltbank at Colorado State University and presented in Table 6.

Table 6. Effect of calf removal on cycling and conception rates.

	21 day A.I. breeding results	
	Suckled	Calves removed for 48 hours prebreeding*
No. of cows	50	50
Percent cycling	31%	62%
Percent conceived	55%	71%
Precent pregnant	17%	44%

*Calves were taken from the cows for 48 hours, before the breeding season, then the cows were bred A.I. for 21 days.

Removing the calves for 48 hours doubled the cycling rate (31% vs 62%). More importantly, it greatly improved conception and pregnancy rates.

A similar study reported recently by the University of Nebraska showed similar results. Calf removal for 48 hours in non-cycling two year old cows significantly increased cycling rate (71% vs 31%) within five days.

This system of calf removal for 48 hours and other systems of calf removal show promise but may not be practical for some producers and also probably needs more study.

Other management ideas:

Another management scheme - while not applying to the topic of this report, i.e. the cow - may be of interest and provide some opportunities for improvement.

In the 1983 Nebraska Beef Cattle Report data was presented on the influence of exposure of cows to bulls from time of calving on time the cows returned to postpartum estrus.. Mature cows exposed to bulls from time of calving returned to estrus 21 days earlier than cows not exposed to bulls until 53 days after calving. The average number of days post-calving before the start of estrus cycles was 41 for cows exposed to bulls from time of calving compared to 62 for cows not exposed to bulls until 53 days post-calving.

Comparisons on conception rates were not reported. A statement was made that "twenty four of the 45 cows (53.3%0 exposed to bulls at calving conceived at the first estrus post-calving."

PREVENTION AND TREATMENT OF CALF DELIVERY PROBLEMS

Dale L. Haggard, DVM

The act of calving is continuous, but for the purpose of definition it is divided into the following stages:

Stage 1 - Uterine muscular contractions force the fetal membranes (placenta) and their fluids against the cervix, which is relaxed and begins to dilate. During this stage, cows may be off feed and strain occasionally. Heifers are usually more restless and may show symptoms of colic or abdominal pain. The first stage usually lasts 2 to 6 hours, but may be up to 24 hours in first calf heifers. During this stage colostrum may leak or run from the udder and toward the end of the stage the water bag will rupture. Stage 1 usually lasts for 2 to 6 hours in cows, but may last up to 24 hours in first calf heifers.

Stage 2 - During this stage the fetus (calf) has entered the dilated birth canal and abdominal contractions (labor) push the calf through the cervix and it is delivered. This stage usually lasts about an hour in cows, but up to 2 hours in first calf heifers.

Stage 3 - This stage is expulsion of the fetal membranes which normally occurs in 1 to 8 hours following birth.

Stage 4 - Involution of the uterus to normal nonpregnant size takes about 20 to 30 days. Complete repair of the uterus epithelium occurs in about 5 to 6 weeks.

Causes of Dystocia

The most important cause of dystocia (difficult labor) is calf birth weight or size, followed by abnormal presentation of the calf at time of birth. Torsion of the uterus, fetus monsters, postmortem changes, stenosis of the cervix, and uterus inertia are less frequent causes of the condition. If the duration of stage 2 of calving lasts longer than 1 hour for cows or 2 hours for heifers, they should be examined to determine the reason the calf has not been delivered.

Calf Birth Weight

Birth weight results from the genetic growth potential of the calf responding to the uterine environment of its dam. Selection of herd sires is commonly done on the basis of yearling weight. Usually with increased yearling weights there will also be an increase in birth weights in the herd, which will result in more calving problems. There are bulls that had relatively low birth weights yet good yearling weights. Studies have shown that the heritability of birth weight is about 48%. Careful attention to performance records should be used for selection of sires, particularly for mating of replacement heifers.

The cow contributes half of the genetics and all of the uterine environment which affects the birth weight of her calves. Larger cows tend to give birth to heavier calves. Mature cows produce heavier calves than first calf heifers when bred to the same bull. Reciprocal crossbreeding experiments with cattle have demonstrated that smaller breed cows bred by a larger breed bull will drop calves of lower birth weights than larger breed cows bred by a smaller breed bull.

Nutritional management can affect calf birth weight and calf delivery problems. Research has shown that heifers fed a good ration will deliver heavier calves than heifers fed an inadequate ration. The calving difficulty may not differ between the groups because poorly fed heifers are smaller at calving time. Added losses from inadequate rations would occur because poorly fed heifers, losing weight after calving, will not cycle to be rebred. Calving difficulties are increased when heifers are excessively fat even though birth weights are not increased. These difficult births are probably caused by excessive fat in the pelvic birth canal.

Abnormal Presentations

For a calf to be delivered it must be right side up (dorsosacral) in either front or backward presentation. With the frontwards presentation the head and both front legs must be extended, while in the backwards presentation both rear legs must be extended for the calf to be delivered. Only about 5% of all calves are born backwards and it is not known why.

Abnormal presentations include 1) one or more legs flexed or turned back, 2) head deviations including turned back, down under, or to either side, 3) breech, which is backwards presentation with both rear legs forward, 4) crossways, or 5) upside down.

Torsion of the Uterus

A twist in the vagina and cervix generally means a torsion of the uterus, like twisting a paper bag shut. Professional help should be summoned immediately.

Other Causes of Dystocia

Fetus monsters are deformed or have anklylosed (bent and stiff) joints, occur infrequently and generally require caesarian section to be delivered. The same may be said for cases of postmortem changes, stenosis of the cervix and uterine inertia.

Handling Calf Delivery Problems

Cattlemen and their veterinarian should have a planned program for handling calf delivery problems. Some problems can best be handled by herdsmen while others require calling for professional help. Proper animal restraint and strict sanitation are absolutely essential. Then you must diagnose and recognize the problem with which you are presented. Know when you are making progress and should continue, as well as when you are not and should call for help. A good guideline to follow is to call for professional help when little or no progress has been made after working one-half hour or more.

Oversize Fetus

The size of the fetus related to the diameter of the cows pelvis should be made to determine if the calf should be pulled or delivered by caesarian section. If natural delivery is attempted, time should be spent dilating the vulva and vagina. A lubricant such as obstetrical lubricant, crisco, lard, or vaseline should be used and it is best to have obstetrical chains and handles for applying traction.

Getting the head and both legs of an oversized fetus into the cows pelvis can be a problem. Traction may have to be applied to the head, using a head snare or chain as a halter, as well as to both legs. Bringing one leg at a time into the pelvis may make it possible. The next obstacle is starting the calf's shoulders into the cows pelvis. You can rotate the calf about 45 degrees, then pull in one shoulder first followed by the other to make it easier. Traction should only be applied when the cow is straining and be patient, don't try to work too fast.

The last obstacle in delivery of an oversize calf is the calf's hips. Hip lock can be prevented by rotating the calf so the calf's pelvis enters the cow's pelvis at a 45 to 90 degree angle. The calf's hips are widest straight across and the cows pelvis is wider from top to bottom or on a diagonal, therefore rotating the calf may help. Also, pulling in a downward direction after the head and shoulders are out will raise the calf's hips higher in the cows pelvis, where it is wider. This will allow the calf's hips to pass through the birth canal.

Abnormal Presentation

Calves with one or both legs turned back and/or with the head turned back are the second most common problems causing difficult birth. A correct diagnosis is important in correcting the problem. Legs can be straightened by repelling (pushing the calf back into the uterus) and gently guiding the legs into the pelvis. The same procedure, repelling and straightening, is used in correcting head deviations, which are sometimes easy to correct, but may be extremely difficult.

The calf may be presented backwards with both rear legs forward. With this presentation the calf should be repelled and one hock brought up into the pelvis. Then the hock is repelled and the hoof brought up into the pelvis. This should be repeated for the other leg. Care should be taken not to injure the uterus during all forms of assistance. In cases when the cow is straining excessively, spinal anesthesia may be necessary to allow you to repel the calf and correct the presentation.

With crossways or upside down presentations a caesarian section is usually necessary to deliver the calf.

Following Delivery

It is recommended that all calves requiring assistance during delivery be hung up by their rear legs for a few minutes. This will allow mucous drainage and clearing of the lungs. Artificial respiration may be given by placing a short section of ½ inch hose in one nostril. The other nostril and mouth are held closed while air is blown into the lungs. Air is expelled from the lungs on its own and the process is repeated every 5 to 7 seconds until the calf begins to breathe or until its heart stops beating.

In all cases where it was necessary to enter the uterus to correct a presentation, it is recommended that antibiotics or sulfas be placed in the uterus. This will decrease the occurrence of metritis (uterus infection).

MANAGEMENT AND VACCINATIONS OF CALVES

Dale L. Haggard, DVM

Cow Vaccination Program

Protecting calves from certain diseases starts with a good immunization program in the cow herd. Antibodies that a calf receives in its first fill of colostrum can protect it from neonatal calf diseases and up to 4 to 8 months of age against virus diarrhea and rednose. The cow vaccination program also includes vaccination for diseases that can cause abortions or abnormalities in newborn calves.

Immunization for Prepartum Disease

Disease	Time of Vaccination
1. Brucellosis	2-6 months age
2. IBR and BVD	before weaning and breeding (± annual boosters)
3. Vibriosis	before breeding each year
4. Leptospirosis	before breeding each year

Immunization for Neonatal Calf Disease

Disease	Time of Vaccination
1. Rota and Corona virus	dams - about 6 and 3 weeks before calving - following years about 3 weeks before calving calves - oral vaccination at birth if dam not vaccinated
2. K99 E. coli bacterin	dams - about 6 and 3 weeks before calving - following years about 3 weeks before calving
3. Clostridium bacterins	dams - about 3 weeks before calving

Processing Newborn Calves

As soon as possible after a calf is born: 1) the navel is clipped and/or dipped in iodine, 2) the calf is identified by ear tag and and tattoo, this is necessary for record keeping which is essential in herd management, 3) calf weight should be determined if possible, 4) injections of vitamin A, D and vitamin E and selenium are administered if deemed necessary, 5) 3 to 4 pints of colostrum are given if there is a question about the calf having nursed, this is done before 4 to 6 hours old.

Calves are observed for scours twice each day. Fluid therapy begins at the first sign of scours, along with antibacterial treatment. It pays to submit fecal swabs to a veterinarian for bacterial identification and antibiotic sensitivity testing. This will show what antibiotics will be effective in treatment of bacterial scours.

Calf Vaccination and Management Programs

Program A - for calves 1 to 3 months of age

1. Respiratory disease
   a. IBR-PI3 - intransal mlv (modified live virus) or killed virus intramuscular
   b. Pasteurella spp.
   c. Hemophilus somnus

2. Other diseases
   a. Leptospirosis - multiple strain
   b. Clostridium - multiple strain

3. Other processing
   a. implant (except animals to be kept for breeding)
   b. castrate and dehorn
   c. external and internal parasite treatment

Program B - for calves 3-4 weeks prior to weaning

1. Respiratory disease
   a. IBR-PI3 - if killed vaccine was used at 1-3 months age can use it again or mlv intranasal or intramuscular
   b. BVD - can use mlv vaccine if calves are not stressed, some cattlemen and veterinarians prefer not to use BVD mlv at same time as IBR-PI3 mlv
      - can use killed virus BVD vaccine and repeat at weaning time
   c. Pasteurella - 2 injections 2-4 weeks apart are needed with bacterins. If the first injection is given at this time, follow with the booster injection at weaning time.
   d. Hemophilus somnus - same as Pasteurella

2. Other diseases
   a. Clostridium - booster
   b. Leptospirosis - booster
   c. Vibriosis - heifer and bull calves kept for breeding
   d. Brucellosis - heifer calves kept for breeding

3. Other processing
   a. Vitamin A injection
   b. Implant (except animals to be kept for breeding)
   c. external and internal parasite treatment

Calf Processing at Weaning Time

1. If Program A and program B have both been followed no additional vaccination is needed.
2. If Program A was done, but not followed by Program B, give boosters listed under Program B and treat for internal and external parasites at weaning time.
3. For calves not previously processed, Programs C or D are offered as alternatives. They are not always adequate substitutes, there may be a degree of risk when calves receive various vaccinations for the first time at weaning, or worse, after weaning.

Program C

At Weaning

1. Respiratory disease
   a. IBR-PI3 - intranasal mlv or killed virus intramuscular
   b. Pasteurella bacterin
   c. Hemophilus bacterin
2. Other diseases
   a. Clostridia bacterin
3. Other procedures
   a. internal parasite treatment
   b. growth stimulant implant
   c. vitamin A injection

14-21 Days Later

(Calves must be consuming 2-3 percent body weight of feed or are on pasture and eating well)

1. Respiratory disease
   a. IBR-PI3 - booster if killed vaccine was used at weaning
   b. BVD vaccine - mlv or killed virus (which must be repeated in 2-3 weeks)
   c. Pasteurella booster
   d. Hemophilus booster
2. Other diseases
   a. Clostridia booster
   b. Leptospirosis bacterin
   c. Vibriosis bacterin (heifers and bulls)
   d. Brucellosis vaccine (heifers)
3. Other procedures
   a. external parasite treatment

Program D

At Weaning

1. Respiratory disease
   a. Pasteurella bacterin
   b. Hemophilus bacterin
   c. BVD vaccine - mlv or killed virus (which must be repeated in 2 to 3 weeks)
2. Other diseases
   a. Clostridium bacterin
3. Other procedures
   a. internal parasite treatment
   b. growth stimulant implant
   c. vitamin A injection

14-21 Days Later

(Calves must be consuming 2-3 percent body weight of feed or are on pasture and eating well)

1. Respiratory disease
   a. IBR-PI3 - intranasal or intramuscular mlv
   b. Pasteurella booster
   c. Hemophilus booster

2. Other diseases
   a. Clostridia booster
   b. Leptospirosis bacterin
   c. Vibriosis bacterin (heifers and bulls)
   d. Brucellosis vaccine (heifers)

3. Other procedures
   a. external parasite treatment

Management Tips

1. High levels of antibiotics may be fed during the weaning period on the advice of a veterinarian.
2. Antibiotics should not be fed unless calves are consuming 2-3 percent of body weight in feed.
3. Prior to processing cattle consult with your veterinarian on the clinical signs of shock or sensitivity reactions in cattle and the treatment. Always take time to observe cattle that have been treated or vaccinated
4. An adequate supply of fresh water is a necessity, preferably from a source which cattle can see and hear running.
5. Check calves 2 or more times a day for signs of disease.
6. Seek professional help from your veterinarian when needed and before a major, serious problem arises.

IMPLANTS FOR BEEF CATTLE

S. D. Plegge, R. L. Arthaud, J. C. Meiske

Introduction

Implants are a management tool cattlemen cannot afford to ignore. Implants are effective at all stages of growth. Suckling calves, growing and finishing cattle all respond to implants. Implants improve both rate and efficiency of gain which result in lower production costs. Few, if any, management practices can equal the economic return on investment that implants offer the cattle industry. Implants are not a panacea for an economically depressed cattle industry, but if the decision is made to produce cattle destined for slaughter, implants are an essential management tool. Cattle intended for slaughter should be implanted as suckling calves and an effective implant maintained in the animal until slaughter. Cattle intended for reproductive purposes should not be implanted.

Approved implants

Four commercial implants are approved for use in steers and two commercial implants are approved for use in heifers in the United States. The implants differ in their chemical composition, period of effectiveness, withdrawal period and implanting site. All approved implants are effective when properly implanted. Few, if any, management practices will equal the economic return implants offer once the basic needs of the animal have been satisfied.

Implants approved for use in steers are Compudose, Ralgro, Steer-oid and Synovex-S. Implants approved for heifers are Ralgro and Synovex-H. Steer-oid was released in November, 1982 and research data are lacking. However, Steer-oid has the same chemical composition as Synovex-S and would be expected to have a response similar to Synovex-S in steers.

Restrictions

Steer-oid, Synovex-H and Synovex-S are not cleared for use in cattle weighing less than 400 pounds. Ralgro cannot be implanted within 65 days of slaughter. Compudose implants must be removed from the ear before a second Compudose implant is administered. These restrictions do not favor the use of one implant over another; they simply indicate that the various implants are managed differently. These restrictions should not be used as excuses not to implant. All implants are effective when properly implanted and managed. Whenever implants are administered, it is essential that they be used legally.

Implants for suckling calves

Implants are effective in improving rate of gain at any stage of growth. Cattle implanted as suckling calves continue to respond to implants administered during the growing and finishing period. Calves implanted during the suckling phase would be expected to be 20 to 50 pounds heavier at weaning than non-implanted calves.

Compudose and Ralgro are the only implants approved for use in steers weighing less than 400 pounds, and Ralgro is the only implant approved for use in heifers weighing less than 400 pounds. Compudose is effective for at least 200 days while the other implants (Steer-oid, Synovex-H, Synovex-S and Ralgro) are generally thought to be effective for 80 to 100 days. Research data with Ralgro have shown two implants during the suckling phase to be more effective than a single Ralgro implant. Data with Compudose have shown it to be effective in suckling steer calves. Sufficient comparative data between the two implants are not available.

Implants should not be used in cattle intended for reproductive purposes. Implants drastically reduce testicular development in bulls such that they are unsuitable for reproductive functions. Implants have less effect on restricting the sexual development of heifers, but if heifers are intended for use in the cow herd, they should not be implanted. The risk relative to the benefit from the implant is too great to routinely use implants on suckling heifers intended for reproductive purposes. Limited research has suggested that heifers mistakenly implanted shortly after birth will probably have acceptable reproductive performance if kept as a replacement heifer. However, as implanting occurs closer to the onset of puberty, reproductive performance will likely be decreased. Thus, it is advisable to avoid implanting heifers that may be kept as replacements.

Implants for growing and finishing cattle

All commercial implants are effective in improving rate and efficiency of gain in growing and finishing cattle. Cattle implanted as suckling calves continue to respond to implants administered during the growing and finishing periods. Implants will generally improve rate of gain 7 to 10 percent and reduce the pounds of feed required per 100 pounds of gain 6 to 12 percent in growing and finishing cattle.

MARKETING ALTERNATIVES FOR COW-CALF PRODUCERS

S. D. Plegge, J. C. Meiske, R. L. Arthaud

Introduction

The cattle industry is a mature, traditional industry. Changes in the structure of our present cattle market will not occur rapidly. Yet, there is an alternative for cow-calf producers to consider for marketing their calves. This alternative is to maintain ownership of the calf and to market it as a pre-conditioned feeder, yearling or slaughter animal instead of the more conventional system of marketing at weaning. This marketing decision is a business decision that must be addressed each year and will differ among cow-calf producers depending on their equity, management and genetic potential of their cattle. Business decisions are made to maximize profit or, more realistically, with the expectation of maximizing profit. The decision to maintain ownership should be made on the same basis. This paper will discuss some of the economic considerations that are essential components of that decision.

Alternatives

Cattle can be marketed at virtually any weight. This allows a cow-calf producer considerable flexibility when marketing calves on which ownership has been maintained. A discussion of the principles involved in maintaining ownership and marketing the calves as either feeder yearlings or slaughter cattle will serve to outline the decision-making process whenever maintaining ownership is considered.

Maintaining ownership does not imply that calves must be fed to yearling or slaughter weight at the ranch or farm on which they were produced. Custom feedlots offer this service and use of their services should be considered if a resource such as feed, labor or equipment is lacking. The option to use a custom feedlot is critical when making a marketing decision. For the producer of genetically superior calves, maintaining ownership may be the only way to realize a fair return for their calves. The current calf market does not offer sufficient economic incentive for producing genetically superior calves. But this type of calf will gain more rapidly and efficiently in the feedlot with cheaper cost of gain which will increase returns to the feeder. Thus, the option to use the services of a custom feedlot is important to all cow-calf producers, but especially to those who produce genetically superior calves.

Table 1 summarizes the effect that genetics may have on feedlot performance. These data were collected at the Rosemount Experiment Station and illustrate the differences in feedlot performance among calves sired by different bulls. These bulls, selected by breeders as having superior performance potential in the Angus breed, were randomly mated within dam sire and age groups to purebred Angus cows at the Rosemount Station. As these data show, considerable variation existed for rate of gain among steer progeny of these top bulls. Progeny from sire 2 gained .49 lb more per day than progeny from sire 3 from birth to 365 days of age. If progeny from sire 3 continued to gain at the same rate after 365 days, they would have required an additional 90 days in the feedlot to reach the same 365-day weight as progeny from sire 2. Clearly, genetic potential of cattle is important and these data illustrate the need for performance testing and especially the use of selected performance tested bulls.

Table 1. Performance of steer progeny of four angus sires.

Item	Sire Group			
	Reference Sire 1	Reference Sire 2	Test Sire 3	Test Sire 4
No. steers	10	7	9	16
Avg birth weight, lb	81	86	76	81
Avg 205-day weight, lb	507	550	432	543
Avg 365-day weight, lb	858	979	783	964
Daily gain, birth to 365 days, lb	2.33	2.68	2.19	2.63
Carcass characteristics				
Avg weight, lb	671	678	609	690
Fat thickness, in	.51	.46	.50	.47
Rib eye area, in^2	12.2	12.1	11.3	12.6
Yield grade	3.0	3.0	2.9	2.8
Marbling score	7.1	6.1	5.4	5.8
Quality grade	13.8	13.1	12.4	12.6
Lean day of age, lb	.76	.82	.69	.83

Meiske and Goodrich, 1981. Minnesota Beef Report B-281.

Economic considerations

Before a decision to maintain ownership and use an alternate marketing system can be made, the economic return over production costs must be estimated. A breakeven price should be calculated and an expected market price used to estimate economic returns. In 18 of the 30 years from 1949 to 1978, prices for yearlings in the spring were equal to or higher than the price of calves the previous fall. If forward contracts offer sufficient returns from the cattle, they can be used to minimize risk.

Production costs are divided into feed and non-feed costs. Feed costs are those associated with the price of the ration ingredients and processing costs associated with preparing the ingredients for feeding. Grains are easier to price than forages because grain markets and standards are well established and accessible. To calculate returns from a cattle feeding program, grains should be priced according to their market value. The quoted market price for grain must be adjusted for transportation, storage, shrink, and drying costs, if applicable. This adjusted price is the market value of the grain. For example, if 15% moisture U.S. No. 2 corn is purchased for $2.40/bushel on the cash market, a bushel of 28% corn is worth $2.12 after adjustment for moisture, assuming equal feeding value. But, the 28% moisture corn price must also be adjusted for transporation costs for delivery to the market and for drying costs that were avoided by harvesting high moisture corn. If transportation costs to the cash market were 15¢/bushel and drying costs 20¢/bushel, the market value of the corn would be $1.77/wet bushel. The major advantages of harvesting high moisture grains are elimination of drying costs and an extended harvest. These advantages must be accounted for when high moisture grains are priced for cattle feeding.

Forages are more difficult to price because markets and quality standards are not as well established as those for grains. Forages must be priced using the same criteria as grain pricing but the market value is calculated somewhat differently. For example, a market for corn silage is virtually non-existant but a wet ton (35% dry matter) of average corn silage contains approximately 7 bushels of corn grain which, if harvested as grain, could be sold on the cash market. Thus, corn silage is priced by multiplying the number of bushels of corn contained in a ton of corn silage by the bushel price of corn and adding the cost associated with harvest. If corn grain is worth $2.40/bushel delivered, and transporation costs to the market are $.15/bushel, a ton of wet corn silage would be worth ($2.25 x 7) + $7 = $22.75 per wet ton (35% dry matter) or $65.00 per ton of dry matter. This $22.75/wet ton would be the maximum price that could be assigned to the corn silage since adjustments for elimination of drying costs, extended harvest, and cost of alternative forages, for example, have not been used in the pricing equation. These costs are difficult to measure for corn silage and are not normally used when pricing silage. However, these costs are real and emphasize the fact that the pricing equation calculates a maximum price. Table 2 illustrates the amount of feed a 500-pound, medium-frame steer calf would require when fed to a yearling (750 pounds) or slaughter weight (1,050 pounds). Feed requirements were calculated from an intake equation developed by Goodrich and Meiske (1981 Minnesota Beef Report, B-267) using data collected from steer calves fed in Minnesota. It is assumed that the calves will be full fed corn silage with 3 pounds of corn grain/day until they reach 750 pounds, at which time they will be switched to a full feed of corn and 10 pounds of corn silage/day. Rations of alfalfa hay and corn grain that should result in similar performance of the cattle are also shown. Cattle fed the alfalfa:corn grain ration would receive 7 pounds of hay/day and 9 pounds of corn grain/day until they weighed 750 pounds at which time they would receive 3 pounds of hay/day and a full feed of corn grain. High levels of corn silage or alfalfa hay are fed until the cattle weigh approximately 750 pounds to avoid slaughter cattle with excess condition at too light a weight. Large frame calves probably could be placed directly on a high grain diet at this weight with little fear of finishing at too light a slaughter weight. The rations contain sufficient metabolizable energy to allow the calves to gain 2 pounds a day until they reach 750 pounds and 3.3 pounds a day from 750 pounds to slaughter (1050 pounds). The cattle would be on feed approximately 215 days. The calculations also assume the cattle are implanted for the entire feeding period and are fed an ionophore (Bovatec or Rumensin) continuously.

Table 2. Feed requirements of steer calves fed from 500 pounds to yearling (750 pounds) or slaughter (1,050 pounds) weights.

	Ration[a]	
Item	Corn: corn silage	Alfalfa: corn
Feed required from 500 to 750 lb.		
Corn silage, ton	2.12	
Alfalfa hay, ton		.44
Corn grain, bushel	6.7	20.1
Feed required from 750 to 1,050 lb		
Corn silage, ton	.47	.14
Alfalfa hay, ton		
Corn grain, bushel	26.2	32.1
Total feed required from 500 to 1,050 lb		
Corn silage, tons	2.59	.58
Alfalfa hay, ton		
Corn grain, bushel	32.9	52.2

[a]Assuming corn silage, corn grain, and alfalfa hay with 70, 90 and 55% TDN (dry basis), respectively.

Non-feed costs comprise the other portion of production costs. Non-feed costs are all charges, other than those for feed, and accrue as a result of owning cattle. These charges include bedding, housing, labor, interest, veterinary, equipment and miscellaneous expenses, such as telephone charges, which are a direct result of cattle feeding. Non-feed costs are apportioned differently for the one-lot-a-year cattle feeder and the cattle feeder who feeds cattle continuously. These basic differences will not be discussed; however, if both types of cattle feeders feed cattle for 365 days the non-feed costs per head are equal. Table 3 illustrates non-feed costs for 500-pound calves fed in a conventional feedlot. These non-feed costs are average costs and may vary considerably among feedlots. Anyone feeding cattle should always calculate non-feed costs based on their conditions. Available labor, equity, capital in facilities and equipment have considerable influence on these costs.

Table 3. Non-feed costs per calf in a conventional feedlot.

Item	Amount per head	Rate or price	Annual cost per head
Capital in feedlot	$200.00	15%	$30.00
Capital in equipment	90.00	20%	18.00
Bedding	600 lbs	3¢/lb	18.00
Interest on animal (500 lb. X $.70)	$350.00	14%	49.00
Power and fuel			8.00
Veterinary			7.00
Death loss	$350.00	2.5%	8.75
Insurance, telephone, miscellaneous			5.00
Labor	4/hr	$6/hr	24.00
Total			$167.75

For a one-lot-per-year cattle feeder; bedding, interest, labor and power and fuel costs are daily charges and amount to 27.1¢/day for each day the calf is in the feedlot. The other charges are per head charges which are assigned to each animal regardless of how many days he is in the feedlot. Per head charges total $68.75.

Non-feed costs calculated for the example illustrated in Table 2 total $127.00 ($68.75 + (215 X 27.1¢/day) = $127.00). Non-feed cost per pound of gain would be 23¢. Table 4 shows the relationship between rate of gain and non-feed cost per pound of gain for the one-lot-a-year feeder feeding 500-pound medium frame steer calves to slaughter (1,050 pounds).

Table 4. Effect of rate of gain on non-feed costs for 500-pound medium frame steer calves fed to slaughter.

Rate of gain, lb	Non-feed cost per pound gain, ¢	Total non-feed cost, $
2.6	23	127.00
2.3	24.3	133.55
2.0	26	143.27
1.7	28.4	156.43

As shown in Table 4, rate of gain has considerable influence on non-feed costs. Feed costs also increase dramatically as rate of gain decreases. When rate of gain is decreased, the calf must spend more days in the feedlot to reach the same final body weight. When more days are required, more feed is used for animal maintenance and more pounds of feed are required per pound of gain. It must be remembered that cattle must have acceptable finish at desirable market weights. This implies that there are different feeding programs for cattle of different frame sizes and genetic potentials.

Break-even prices for producing a yearling or slaughter animal from the example illustrated in Table 2 are shown in Table 5.

Table 5. Production costs and break-even prices for yearling or slaughter cattle produced from 500 pound steer calves.

Item	Feed cost[a], $	Non-feed[b] cost, $	Break-even price, $/100 lb
Yearling (750 pounds)[c]			
corn:corn silage ration	64.38	102.63	68.93
corn:alfalfa ration	77.03	102.63	70.62
Slaughter (1,050 pounds)[c]			
corn:corn silage ration	135.50	127.00	58.33
corn:alfalfa ration	160.66	127.00	60.73

[a] Corn $2.30/bushel, corn silage $23.10/ton, alfalfa hay $70/ton.
[b] Non-feed costs are shown in Table 3.
[c]Calf is valued at $350 (70¢ a pound).

The assumptions used in calculating the break-even prices are shown at the bottom of Table 5. The break-even prices reflect the selling price needed to recover the value of the 500-pound feeder calf and all production costs. Feed and non-feed costs may vary considerably and should be calculated by each cattle feeder based on their conditions. The non-feed cost for producing yearlings appears to be disproportionate to the non-feed cost for producing slaughter cattle. However, if only one set of yearlings are produced under the conditions illustrated in Table 3, those cattle must assume the cost of depreciation and repair of equipment and facilities for the entire year. Therefore, the difference in non-feed costs between producing yearlings and slaughter cattle under these conditions is the daily charge of 27.1¢ multiplied by days on a high grain diet (90) or $24.39 per head. Certainly, yearlings can be produced with considerably lower non-feed costs, especially if facilities are less costly.

Once production costs and break-even prices have been calculated, a marketing decision can be finalized. If price expectations of yearling or slaughter cattle offer more desirable returns compared to marketing calves at weaning, ownership should be maintained. Risk associated with downward price movement can be reduced by using forward contracts if they offer a desirable return.

SIRE EVALUATION BY PROGENY PERFORMANCE

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Summary

Four Angus sires were compared by evaluating performance of their progeny produced from random mating within dam groups of age and sire in a single herd. Within sex groups (steer and heifer), progeny were managed, housed and fed alike, permitting valid comparisons of sire groups. All sires are widely used in the industry, but considerable difference in performance existed between two of the sire groups. This demonstrates that cattle feeders need to be aware of differences between groups of cattle for performance (and thus, profit potential). Differences among groups of feeder cattle are likely more than twice as variable as those demonstrated here because feeder groups of cattle not only are by sires that represent greater differences than those used in this study, but they are from cow herds that also may differ from each other considerably. Thus, profit potential of feeder cattle in sound feedlot programs may yet be considerably variable because of genetic background of the feeder cattle used.

Introduction

Many of the breed associations publish sire summaries for their breed. These summaries provide comparisons among sires for several traits of their progeny. Traits for which sire comparisons are usually made include 205-d weights, 365-d weights, carcass characteristics and estimates of calving ease.

The Angus herd at the Rosemount Station has been involved in a structured sire evaluation of several well known or promising Angus sires. Each year, cows within a sire and age group are randomly assigned to be bred to four sires. Two of the sires (test sires) had been nominated by their owners for evaluation and two of the sires are reference sires designated by the Angus association. These reference sires are used in other herds as well and serve as the base points from which all sires in the national program are compared. Progeny of all sires must be managed and fed alike within sex or management groups for valid comparisons of sires. This report demonstrates that meaningful differences may exist among progeny--even among well known and highly regarded sires. Therefore, cattle feeders certainly should be aware of genetic variation among and within producer groups of cattle they purchase.

Procedure

Cows were grouped according to their sire and age into four breeding groups and randomly assigned to be serviced (artificial insemination) to one of four sires (two reference sires and two test sires) during the breeding season. All cows and calves were managed the same to weaning. At weaning, steer calves and heifer calves were separated.

All heifers were fed a high silage diet until culling and selection at about 14 months. All steers were fed a high silage diet for about 110 days and then fed a higher corn grain diet until slaughter. All diets after 205-d weights were supplemented with a urea-based supplement that contained salt, trace minerals, calcium, phosphorus, sulfur and vitamin A. Carcass data were collected from all steers.

Results

Performance data of heifer progeny of four sires used during the 1980 breeding season are presented in table 1 and steer progeny data are summarized in table 2.

In this year's comparisons, performance of progeny by the two test sires tended to exceed that of progeny by the reference sires. Although differences between sire groups for heifer 205-d or 365-d weights were not significantly different (due to relatively small numbers and large variation), differences did exist among sires for steer progeny. Steer progeny of Test Sire 2 were 41 lb heavier ($P<.05$) at 205 days and 84 lb heavier at 365 days than steer progeny of Reference Sire 2. Steer progeny of Test Sire 2 had carcass weights that were 50 lb heavier. ($P<.01$) at slaughter and averaged 8 days younger at slaughter than steer progeny of Reference Sire 2. Progeny of other sires were intermediate.

TABLE 1. PERFORMANCE OF HEIFER PROGENY OF FOUR ANGUS SIRES (1981-82).

	Sire group			
Item	Reference sire 1	Reference sire 2	Test sire 1	Test sire 2
No. heifers	10	11	9	11
Birth weight, lb	71.0[c]	69.2[c]	70.6[c,d]	80.3[d]
205-d wt, lb	437.9	422.5	460.6	461.5
Avg daily gain, lb[a]	1.79	1.72	1.90	1.86
365-d weight, lb	664.6	668.1	730.5	722.3
Avg daily gain, lb[b]	1.41[c]	1.52[c,d]	1.70[d]	1.63[c,d]

[a]From birth to 205 days of age.

[b]From 205 to 365 days of age.

[c,d]Means in the same row with different superscripts differ ($P<.05$).

TABLE 2. PERFORMANCE OF STEER PROGENY OF FOUR ANGUS SIRES (1981-82).

	Sire group			
Item	Reference sire 1	Reference sire 2	Test sire 1	Test sire 2
No. steers	9	11	18	16
Birth wt, lb	80.9	81.6	79.6	80.9
205-d wt, lb	444.5[c,d]	428.7[c]	450.5[c,d]	469.7[d]
Avg daily gain, lb[a]	1.77[c,d]	1.69[c]	1.81[c,d]	1.90[d]
365-d wt, lb	875.2[e,f]	826.4[f]	871.9[e,f]	910.0[e]
Avg daily gain, lb[b]	2.69	2.49	2.63	2.75
Avg age at slaughter, d	415	428	423	420
Carcass wt, lb	575.9[c,e]	575.3[c,e]	604.8[c,d,e,f]	624.9[d,f]
Fat thickness, in.	.44	.42	.46	.48
Ribeye area, sq. in.	10.8[c]	11.6[c,d]	11.4[c,d]	12.0[d]
Yield grade	2.87	2.65	2.86	2.81
Lean/day of age, lb	.71[c,d]	.68[c]	.73[d]	.75[d]
Marbling score	5.78	5.82	6.28	5.63
Quality grade	12.2	12.6	12.7	12.1

[a]From birth to 205 days of age.

[b]From 205 to 365 days of age.

[c,d] Means in same row with different superscripts differ ($P<.05$).

[e,f] Means in same row with different superscripts differ ($P<.01$).

AN INVESTMENT IN THE FUTURE

Faculty, Animal Science Department
University of Minnesota

Agriculture is the No. 1 industry in Minnesota. Cash receipts in 1980 totaled $6.6 billion. Of this amount, 53.1% was from the sale of livestock (including poultry) and livestock products. Milk sales accounted for 18.5% of total farm income, cattle and calves for 16.6% and hogs for 11.9%. Each dollar of sales from livestock and livestock products in Minnesota generates from $2.50 to $3.00 of income from agricultural related industries. Minnesota is sixth in total livestock production and sixth in production of red meat in the country, first in turkeys, third in swine, fourth in milk production and eighth in cattle and calves. Of the 105,000 farms in Minnesota, 62,000 have cattle, 30,000 have swine, 26,000 keep milk cows and 8,000 have sheep. This important livestock industry of Minnesota must continue to be served by strong teaching, extension and research programs.

MAJOR ADVANCES IN ANIMAL PRODUCTION

During the past 50 years significant increases in production per animal and reduced costs of producing livestock and poultry products have resulted from the application of new techniques produced by University research and implemented through University extension and education programs.

- Eggs produced per hen have doubled
- Beef produced annually per cow has increased from 220 to 490 pounds
- Average milk production per cow has more than doubled
- Production of pork per sow has more than doubled
- Pounds of lard per pig has decreased 50%
- Pounds of feed/pound of broiler has been reduced from 4 to 2
- Pounds of lamb produced per ewe has increased three-fold
- Time required to produce a unit of food has declined 50% or more

BENEFITS TO PRODUCER AND CONSUMER

While advancements in agriculture have been beneficial to producers, the consumer also has been a major beneficiary. Without University extension, research and teaching, food would be a scarce rather than a plentiful commodity.

Livestock and poultry food products provide a large portion of nutrients in the human diet and add to the enjoyment of eating.

Percentage of nutrients in the American diet derived from animal products

Nutrient	%
Protein	70
Calcium	70
Phosphorus	60
Iron	60
Energy	33

Plus significant amounts of vitamins and trace minerals

Food is provided in ample quantities in the U.S. at a reasonable cost. The percentage of disposable income spent for food in 1960 was 20%, in 1970 was 17.2% and 1980 was decreased to 16.6%. Other valuable products derived from animals are clothing, leather goods, pharmaceuticals, medical aids, soaps, waxes, glues, cosmetics, animal feeds and fertilizers.

HOW HAS THE ANIMAL SCIENCE DEPARTMENT CONTRIBUTED TO ADVANCES IN ANIMAL AGRICULTURE?

Extension

Information on latest technologies in animal agriculture is made available to Minnesotans. Meetings, written materials and individual consultation benefit Minnesota farmers, processors, suppliers and consumers in making animals and animal products profitable for producers and preferred items for consumers.

Extension education programs have impacted heavily on Minnesota's livestock industries' prominence in the national and international agricultural scene. Examples of programs are:

- Integration of economically feasible husbandry environmental and cultural practices
- Dairy, Beef and Swine Herd Improvement Programs
- Sound nutrition programs for all species
- Improved milk production practices
- Improved Reproductive Management
- Improved Pasture and Forage Utilization
- 4-H Youth Development
- Improved quality, wholesomeness and consumer acceptance of animal food products

Research

Over the years, scientists of the Animal Science Department have contributed significant technology to the animal industry. Examples are:

a. Beef

- Development of two-phase feeding program for feedlot cattle
- Initiated concept of feeding whole grain to beef
- Economics of housing and management systems
- Improved use of high moisture grains
- Developed year-round confinement management for cow-calf herds
- Improved microbiological safety in modern cooking of roast beef

b. Dairy

- Instrumental in development of frozen semen for A.I.
- Demonstrated effectiveness of modern sire evaluation techniques
- Development of technology for successful use of freeze-dried semen
- Development of storage and feeding systems of colostrum and waste milk for calves
- First to determine effects of stray voltage on animal performance

c. Sheep

- Formulation of successful milk replacers for lambs
- Pioneered early weaning system for lambs
- Infusion of genetic material for improved lamb production
- Developed practical feeding programs for ewes and feeder lambs
- Developed restricted-time grazing concept and less frequent feeding schemes

d. Swine

- Initiated cross breeding concepts for commercial pork production
- Development of technology for successful use of frozen boar semen
- Development of simple pig starters
- Pioneered efforts in improving amino acid balance of swine diets
- Reduction in incidence of porcine stress syndrome

e. Poultry

- Pioneered light management of turkey breeders for year-round production-adopted world wide
- Developed methods for successful A.I. in turkeys
- Pioneered basic amino acid studies with turkeys
- Determined that the W chromosome controlled sex in birds
- Major contributions on effects of mycotoxins on poultry
- Pioneered cytogenetic work in birds and determined chromosome numbers in 50 species

In addition extensive work has been done in forage utilization for beef, dairy and sheep; in preservation of silages and high moisture grains; in breed development; in determining factors affecting behavior; in understanding endocrinological and physiological processes in growth and development; in practical feeding and management systems for all species; in improvement of semen processing and artificial insemination practices; basic information concerning animal metabolism, and many others.

The future holds great promise. Projects now underway will continue to lead to further improvement in efficiency and rate of production. Success of these projects will be enhanced by investment in new improved facilities.

Examples of projects are:

- Genetic engineering to produce specific disease resistant animals
- Cloning of fertilized ova from superior animals to produce identical offspring.
- Maximizing microbial growth from nonprotein and poor quality protein in the rumen. Protein needed from plant sources from ruminant livestock will decrease and production costs will be reduced.
- Improved preservation of nutrients in grains and forages
- Control of sex in offspring. Separation of male and female sperm will permit choices
- Out-of-season breeding of sheep. Frequency of lambing per year will increase reproduction rate in sheep and even-out lamb supply which will facilitate more orderly marketing.
- Selection for efficient growth will improve efficiency of beef production
- Control of broodiness in turkeys will increase egg production
- Increased numbers of lambs per ewe per year from genetic and endocrine control
- Improved knowledge of digestion and metabolism of farm animals. Improvement in efficiency and increased yield of product per animal will result

What are the returns from investment in research?

EACH DOLLAR ADDED TO PRODUCTION RESEARCH ADDS $20, $26 AND $42 TO OUTPUT OF POULTRY, DAIRY AND MEAT ANIMALS, RESPECTIVELY.

TEACHING

The number of students in Animal Science increased four-fold over 10 years. Animal Science, with its nearly 300 students, has the largest undergraduate enrollment in the College of Agriculture. Graduate student enrollment also has increased and currently includes about 85 students.

Graduates of the undergraduate program in Animal Science are leaders in the livestock industry of Minnesota. Many are top farmers in the state and also are active community leaders. Others occupy significant positions in the feed and pharmaceutical industries, breed organizations, artificial insemination firms, extension services, farm cooperatives and related organizations, bank and credit associations, the meat packing industry and in media-related organizations. Many graduates have entered veterinary medicine and are now serving the animal industry. Many have completed graduate school at Minnesota and have given distinguished service in industry, academic work and in governmental agencies.

WHAT ARE THE CHALLENGES?

Future challenges for animal agriculture are great. By the year 2000, U.S. food requirements will increase 33%. Continuing development of technology to meet increasing world food requirements is an enormous task. If progress in animal agriculture is to continue, new exploration and first-rate teaching and extension programs are necessary. The easy questions have been answered; animal technology has become more sophisticated and information that was general in scope must become more exact and detailed. Animal research, extension education and student teaching deal with complicated questions and application of advanced technical knowledge.

Undergraduate education is now sought by persons of varied backgrounds. Over 50% of our present students have urban backgrounds. Many students have not observed or participated in practices used in today's livestock industry. These students need "hands-on" experience in up-to-date facilities to obtain excellent training in modern livestock technology.

THE CHALLENGE TO ANIMAL SCIENCE STAFF IN EXTENSION, RESEARCH AND TEACHING IS:

- To develop educated and well-trained people to serve consumers and the livestock industry.
- To provide answers to questions concerning the unknown in animal agriculture
- To introduce the latest technologies for industry use and to provide information for efficient, economical production.

If these challenges are to be met, extension specialists, teachers and research scientists in Animal Science and allied departments must have modern facilities, good analytical equipment and techniques, and animals maintained in environments conducive to optimum production.

QUESTION: WHAT IS NEEDED?

ANSWER: Funds are needed for construction and renovation of animal facilities. Many of our present animal facilities were built prior to 1920 and are outdated, inadequate or worn out.

At St. Paul

New construction

- Ruminant Nutrition Unit for Beef and Sheep Metabolism Studies
- Dairy Facility for Nutrition and Management Research and Teaching
- Swine Facility for Nutrition Research and Teaching
- Completion of Livestock Arena and Livestock Holding Facilities for Teaching and Service
- Animal Environmental Chambers for Management and Physiology Research

Renovation

- Beef Barn for Teaching and Research
- Dairy Barn for Animal Physiology Research
- Horse Barn for Meat Animal Physiology Research
- Turkey Barn for Poultry Physiology
- Swine Barn for Nutrition, Physiology and Management, Research and Teaching

At Rosemount

New construction

- Beef Feedlot Facility for Nutrition and Management Research
- Dairy Facility for Genetics, Nutrition and Management Research
- Lambing Barn for Genetics Research

Renovation

- Sheep - Lambing Facility for Artificial Rearing
- Swine - Growing Unit and Sow-Boar Unit for Research

A 0.5% reduction in cost of production of livestock and poultry products in Minnesota would pay for construction and renovation in one year. Viewed in another way the cost for swine facilities would be 3¢/pig marketed over 5 years; for beef facilities, 30¢/animal marketed over 5 years; for new dairy facilities, 75¢/cow over 5 years; for renovation of turkey facilities, 1/4¢ over 5 years, and, for sheep facilities, 10¢/lamb marketed over 5 years.

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