

# INTEGRATED HEIFER MANAGEMENT: CRITICAL SUCCESS FACTORS

**Stephen Boyles**  
OSU Beef Extension Specialist

## THE GOALS OF A HEIFER MANAGEMENT PROGRAM

Producers are anticipating the future biological and economic performance of their herd when replacement heifers are selected. Heifers that will become profitable should:

1. Become pregnant within the first 25 days of the breeding season
2. Give birth to a live calf with little difficulty
3. Raise the calf to an average weaning weight
4. Breed back in the first 45 days of the breeding season
5. Continue to produce calves every year for 6 to 9 years

## REFERENCE POINTS

Top cattle producers are calving 50-60% of their total cow herd by 21 days, 80-90% by 42 days and 90-100% by 60 days. If the percentage calving early declines in the calving season, it may be an indication of inadequate nutrition for the genetically changed (higher milking) herd. The producer may need to change the nutrition program or the breeding program. On the average, 86% of females exposed actually wean a calf. A producer with a calf crop lower than this should examine the reasons for reduced reproduction. Table 1 are some average values for when calving occurs in a calving season.

Table 1. Calving Distribution and Weaning Weights for 66,606 Calves

Cycle	Weaning Wt.	WDA <sup>a</sup>	Potential Weight Loss <sup>b</sup>	Number of Calves	Percent of Total
Early <sup>c</sup>	531 lbs.	2.35	---	2901	4.3%
Cycle 1	520 lbs.	2.48	-11 lbs.	28627	43.0%
Cycle 2	496 lbs.	2.53	-24 lbs.	23356	35.1%
Cycle 3	458 lbs.	2.53	-38 lbs.	7761	11.7%
Cycle 4	424 lbs.	2.53	-34 lbs.	2856	4.3%
Late Season	395 lbs.	2.56	-29 lbs.	1105	1.6%

<sup>a</sup>Weight per day of age (lbs.)

<sup>b</sup>Calculated by subtracting previous cycle weight

°Defined as any cow that calved before the 2nd three year old or older cow calved within the herd.

One should calculate the percentage of yearling heifers, 1st-calf-heifers and mature cow weaning a calf since a low percentage in a specified age group may indicate problem areas. The highest incidence of open females occurs in 2-year-old heifers. If over 4% of mature cows fail to get pregnant during the breeding season, it may indicate inadequate nutrition, disease problems or bull fertility problems. Correspondingly, if over 20% of yearling heifers are open after a 45-day breeding season or over 10% after a 60-day breeding season, the heifer development program should be evaluated.

Values have been calculated for critical success factors utilizing 45,832 North Dakota beef cow records (Table 2). Bench mark values for each critical success factor are as follows (1) Calf production time 199 days, (2) Weight per day of age 2.7 lbs., Birth weight 86 lbs, average daily gain 2.37 (3) Percentage of females calving within 42 days : Heifers - 86%, mature cows - 83% (4) replacement rate 17.2%. The average cow age was 5.3 years. Lower rebreeding rates for heifers compared to mature cows are the normal through the second calf.

If greater than 2% of the cow herd aborted during the second and third trimester, a reproductive disease may be present. Calf death losses greater than 3% of the calves born are generally management related.

Table 2. Average North Dakota Beef Cow Performance

Calf Production Time (Nursing Period)	199 days
Birth Weight	86 lbs
Weight Per Day of Age	2.73 lbs
Average Daily Gain	2.37 lbs
% of Heifer calving early	19 %
% of Heifers calving within 21 days	66 %
% of Heifers Calving within 42 days	86 %
Average Cow Age	5.3 years
Replacement Rate	17.2 %
Adjusted 205 day Weight	583 lbs
Actual Weaning Weight	537 lbs

Steers	510 lbs
Heifers	564 lbs
Bulls	
Frame Score	5.4

This section has been titled REFERENCE POINTS. Information has been presented on actual production information on large cattle populations. Educators/consultants need to have some understanding on the current level of herd performance of each herd she or he is working with. The following are some baseline values that may be helpful in reviewing a herd with a producer to evaluate where management changes to improve herd performance might be needed.

Table 3. Cow/Calf Production Evaluators

	<b>Goal</b>	<b>Monitor</b>	<b>Action</b>
<b>Reproduction</b>			
Calf Crop (%)	>90	85-90	<85
60 Day Preg. Rate (%)	>95	90-95	<90
1st 20 Day Preg. Rate (%)	>65	55-60	<50
Median Calving Date	17	18-25	>25
<b>Herd</b>			
Average Cow Age	5-6	4-5, 6-7	<4, >7
Body Condition Score	4.5-6	4-4.5	<4
Mid-Gestation	5-6	4.5-5	<4.5
<b>Calving</b>			
Dystocia	<5	6-7	>8
Adults (%)	<15	20-25	>25
<b>Heifers (%)</b>			
Gestational Losses (%)	<2	2-3	>3

Perinatal Mortality (%)	<5	5-9	>10
Cow Death Loss (%)	<2	3-4	>5
Culling Rate (%)	15-20	10-14, 21-25	<10, >25
<b>Calf</b>			
ADG (lbs.)	>2.25	2-2.5	<2
Adult	>2	<1.75	<1.75
<b>Heifer</b>			
Weaning (%)	100	90-95	<90

### THE PRODUCTION PHASES OF HEIFER MANAGEMENT

The management of first calf heifers affects their performance for the rest of their lives. The selection and development of replacement heifers can be divided into four phases or production periods:

1. Weaning/Selection
2. Growing
3. Breeding
4. Rebreeding

### WEANING/SELECTION

**SIRE SELECTION:** Most of the improvement in a cow herd will come not from direct selection for replacement heifers, but from selection for their sires. The typical traits such as birth weight, growth, and structural correctness continue to be important. However, another trait that has been found to be important is scrotal circumference of the bull. Research studies have found a favorable correlation (.71) between sire scrotal circumference and sibling heifer age at puberty. In another words, as sire scrotal circumference increases, sibling age at puberty decreases. A rough estimate is that one centimeter increase in testicular circumference will give you approximately four to five days earlier age of puberty. The variation of one centimeter increase in testicular circumference on reduction in age at puberty has been from 0.75 to 10 days. The variation is probably due to environmental effects such as nutrition and weather. Data in Table 4 illustrates how as scrotal circumference increases, heifer age a puberty decreases:

Table 4. Bull Testicular Size and Heifer age at Puberty

Breed	Scrotal Circumference of Yearling Bulls (cm)	Heifer Age At Puberty (days)
-------	--	------------------------------

Gelbvieh	34.8	341
Braunvieh	34.3	347
Red Poll	33.5	352
Angus	32.8	372
Simmental	32.8	372
Hereford	30.7	390
Charolais	30.5	398
Limousin	30.2	398
AVERAGE	32.4	368

\*Use caution in interpreting the data as actual breed differences since bulls within breed vary in scrotal circumference.

Heritability estimates for female reproductive traits are generally low, while heritability estimates of testicular traits are moderate to high. Table 5 shows a further association of scrotal circumference with other reproductive traits in heifers and cows:

Table 5. Correlation of Female Reproductive Traits with Sire Scrotal Circumference.

Trait	Correlation with Scrotal Circumference
Age at first conception as yearling heifers	.69
Heifer pregnancy rate	.64
Calving interval	.12

In summary, selection for bull scrotal circumference may improve a number of female reproductive traits.

**HEIFER SELECTION:** Heifers can be sold at weaning or anytime thereafter. Select at least 20% excess and continue growing the heifers until breeding. A second selection at yearling age is helpful. Although some emphasis should be placed on growth, reproductive measures such as reproductive tract scores and pelvic measurements should receive priority. Let the bull select the heifers you keep by maintaining a relatively short breeding season (45 days). Pregnancy diagnosis 45 to 60 days after the breeding season provides another opportunity for culling. A

final selection can be made after heifers wean their first calf. Weaning weight of the first calf is a fairly good, though not foolproof, indicator of future production.

**GROWTH TRAITS:** The traditional method for choosing replacements is picking the big ones at weaning. Traditional selection is simple and is not necessarily all bad. If growth is needed, selection on size will provide it. The bigger heifers are generally older, and thus selection is from the earlier calving cows. It also may (or may not) select heifers of heavier milking cows. Heavier and older heifers are more likely to cycle and breed early and be well on their way to having acceptable lifetime performance.

However, there are problems with the traditional method of selection. Some of the heaviest heifers at weaning may be fat and offer the potential of poor lifetime milk production due to fat deposits in the udder. Some big heifers are fast growing due to an endocrine imbalance and are subfertile at breeding.

The biggest problems traditional heifer selection is "frame creep". This is the gradual increase in mature cow size over time resulting from the use of larger frame bulls and retention of their daughters. The larger, higher maintenance dams may be too big for the feed resources. If nutrition does not change, these cows may suffer reproductively.

Selecting heifers for larger actual weight will generally result in a more uniform group capable of reaching pubertal weight at about the same time. So long as their sires and grandsires are not too big, there is little danger that selecting the larger heifers will cause significant "frame creep". Be careful not to mistake frame for weight. Framey heifers with below average body condition may be "hard keepers" later in life.

Growth is an important trait in heifer selection but there are other important traits. What are those traits?

**MATERNAL/PRODUCTION TRAITS:** The traits that are important in replacement heifers are the maternal traits: early puberty, fertility, calving ease, milk, soundness (longevity), temperament and efficiency. Early puberty is highly heritable ( $H^2 = 50\%$ ) and related to early first pregnancy. Calving ease is important because it affects the time required for rebreeding. Soundness traits (feet, legs, udders, eye, etc.) are highly heritable and are related to longevity and productivity. Genes for mastitis resistance have been identified; selection for bloat resistance have been accomplished; evidence has been developed indicating genetic differences in the incidence of fescue toxicity.

**HEIFER SELECTION WITH CROSSBREEDING SYSTEMS:** Hybrid vigor is important but is not everything. Producers should not overlook good replacement prospects just to gain a little more hybrid vigor. Keeping heifers of terminal sires may cause "frame creep".

**TIME WHEN BORN:** Adjusted 205-day weights and ratios provide a better estimate of the true genetic differences in preweaning growth of the calves and milking ability of the cow than do actual weaning weights. Late-born calves with light, actual weaning weights can still have excellent adjusted 205-day weights and ratios.

Caution, some heavy milking cows may not meet nutritional requirements through the available forage. The calving intervals for these cows will generally exceed 370 days. Selecting replacement heifers out of these cows could eventually cause an increase in open cows. Heifers with the heavier actual weaning weights are more likely to cycle early and calve early as 2-year-olds. Therefore, actual weaning weights may do a better job of identifying the heifers and cows that will be the most productive. Seldom should heifers be selected as replacements that have low actual weaning weights, but high adjusted weights and ratios.

Seedstock producers are selling the "genetics" for growth and milk. The adjusted weights and other genetic indicators such as pedigree EPDs become more important. However, seedstock operators should not produce cattle that are not adaptable to their customer's resources. If seedstock producers are having trouble keeping their heaviest milking cows in the early part of the calving season, they need to be aware of the impact that the some of these cows could have for their commercial bull buyers.

**FRAME SIZE:** Frame size will probably not be a major consideration if appropriate mature size was part of the sire selection program. However, monitoring of frame score and mature cow size is advisable to prevent "frame creep" (Table 3).

Table 6. Relationship of Frame Score and Hip Height to Estimated Mature Cow Weight.

Frame Score	Hip Height (inches)			Estimated Cow Weight
	7 months	12 months	Maturity	
1	35	39	44	880
2	37	41	46	955
3	39	43	48	1030
4	41	45	50	1100
5	43	47	52	1175
6	45	49	54	1250
7	47	51	56	1320
8	49	53	58	1395
9	51	55	60	1470

Yearling weights are a more accurate predictor of growth potential than weaning weights. Yearling hip heights are more accurate for predicting mature size than weaning hip height. Heifers with the heaviest yearling weights tend to be the largest framed. Maximum acceptable frame scores may need to be established to match cow size with feed resources.

**IMPLANTS:** Currently there is the only one implant cleared for use in potential replacement females and should not be used in calves less than 45 days of age. Because of the potential negative effect implants have on fertility, producers should check on prior implanting status when buying replacement heifers. Most replacement heifers come from calves born early in the calving period. Consideration should be given to implanting only the late-born heifer calves as a compromise to take advantage of increased weaning weights at market.

**CREEP FEEDING:** The effect of creep feeding replacement heifers depends on frame size and creep intake. Full feeding a high energy creep to medium frame suckling heifers may decrease subsequent milking ability because of the fat deposition in the developing udder. However, data collected on large frame heifers is unclear as to the effect of creep feeding on milking ability. It is safe to say that creep feeding will decrease milking ability in any frame size heifer if excessive fleshiness becomes apparent.

**COST OF PRODUCTION:** Cost of production to weaning will vary from farm to farm. Costs of production may range from \$280 to \$380.

#### GROWING PHASE

**PUBERTY:** Puberty is defined in heifers as the time when they first ovulate and show an estrus or heat period. The process involves sensitivity to and regulation of hormones and receptors in the brain (specifically the hypothalamus) and the sex organs or ovaries in females.

Heifers born early in the calving seasons are usually heavier at weaning and reach puberty earlier than heifers born late in the calving season. Heifers must reach puberty by 13-14 months of age to calve as two-year-olds. Puberty is influenced by age, weight and breed. Table 7 contains estimated ages and weights for crossbred heifers.

Table 7. Age and Weight at Puberty for Crossbred Heifers of Different Breeds.

Breeds	Age, days	Weight, lbs.
Jersey - X	308	518
Gelbvieh - X	326	626
Brown Swiss - X	332	615
Pinzgauer - X	334	611
Red Poll - X	337	580
Tarentaise - X	349	622
South Devon - X	350	639
Hereford-Angus - X	357	622

Main-Anjou - X	357	672
Simmental - X	358	666
Limousin - X	384	679
Chianina - X	384	699
Charolais - X	384	703
Sahiwal - X	414	642
Brahman - X	429	712

Puberty occurs when heifers reach about 65% of their mature weight. Mature weight of heifers can be estimated from sale receipts of cull cows of similar genetics or by measuring hip height and using Table 6 to predict mature weight.

Individual weights rather than group weights should be considered for replacement heifers. If a group of similar breed-type heifers averages 650 pounds, that may mean some only weigh 500 pounds and are not ready for breeding. Heifers born in a short calving season should be relatively uniform in weight and would not need to be fed in different groups to reach the desired weight. North Dakota data suggests that deworming can improve uniformity of performance.

Montana research indicates that conception rate is higher on the third estrus compared to the first. Getting heifers to target weights a month prior to the breeding season may increase the percentage conceiving early in the breeding season.

**TARGET WEIGHT CONCEPT:** The Target Weight Concept is a method to control the amount of gain. We thereby assure the heifers attain enough gain to attain puberty but also avoid getting them too fat. Rates of gain not lower than 1 lb. or greater than 2.0 lbs. per day reflect the needs of most of our current cattle population. For example, a heifer weighs 450 lbs. at weaning and has a target puberty weight of 675 lbs. There are 200 days between weaning and breeding. We would actually prefer her to reach puberty weight at least 2 to 3 cycles before breeding (160 days).

$$(675-450)/160 = 1.4 \text{ lbs of gain per day.}$$

Rations can be formulated to meet the nutritional requirements for this amount of gain. The rate of gain need not be constant over the entire period, as long as the target weight is reached. The gain can be increased through supplementation during the winter feeding period if previous experience on the farm tells us that heifer gains on pasture just prior to the breeding season are less than adequate. Heifers going to adequate pasture, prior to breeding can be expected to gain from .75 to 1.4 pounds daily. The use of ionophores (Rumensin or Bovatec) in supplements can cause earlier puberty due to increased gains if the total ration is balanced. Knowing forage quality means knowing whether protein, energy or both must be supplemented. Computer ration

balancing services are available through the county extension offices and probably through the local feed dealer.

If a scale is available, it is helpful to weigh the heifers every 30 to 60 days to insure they are on target. If all heifers cannot be weighed, 10 to 20 percent that are representative of the group could be weighed to estimate how the whole group is performing. Diets can be slightly modified in response to observed performance.

**PELVIC AREA:** Research from the Miles City Research Center indicates that out of 13,296 females calving, 41% of calf deaths occurred with first-calf heifers; 57.6% of the deaths occurred within 24 hours of birth; calving difficulty accounted for 37.9% of the deaths. There are many factors associated with calving difficulty such as birth weight, gestation length, shape of calf, the dam too thin, too fat, or abnormal fetal presentation. Research indicates that one cause of dystocia is a disproportionate size between the calf and the cow's birth canal (pelvic area). Death losses are 4-5 times greater for assisted calves compared to unassisted calves. Calving ease can be an all or nothing situation: if you have calving problems, chances are you will have problems rebreeding and decrease the percentage of heifers weaning calves. Pelvic measurements taken prior to breeding can be used to cull potential problem heifers from the herd.

Pelvic measurements are taken by measuring the vertical and horizontal opening of the birth canal. By multiplying the width by the height, the pelvic area is determined. Measure pelvic area in heifers 2-3 weeks before they are bred. The main objective of pelvic area measurement is to cull those heifers that may experience calving difficulty due to inadequate volume to the birth canal. If calving difficulty has been a problem with heifers, culling 5 to 15% of the heifers with smallest pelvic areas should help.

$$\text{Height (cm) x Width (cm) = Total Pelvic Area (cm}^2\text{)}$$

A typical yearling heifer will have a pelvic area of 140 to 170 cm<sup>2</sup>. Pelvic area of heifers should be adjusted to a constant age by using the growth factor of .25-.27 cm<sup>2</sup> per day. To accurately compare heifers within a group, the pelvic areas should be adjusted by the following formula: Adjusted 365-day pelvic area = actual pelvic area + ((.27 x (365 - actual days of age)). For example, a 385-day old heifer with a 160 cm<sup>2</sup> pelvic area would have a 365-day adjusted pelvic area of 154.6 cm<sup>2</sup>.

Pelvic areas can be used to estimate the calf birth weight the heifer can deliver as a two-year-old without having substantial difficulty. For example a 600 lb yearling heifer with a pelvic area of 140 cm<sup>2</sup> should be able to deliver a 67 lb calf without difficulty (140 / 2.1 = 67). If pelvic measurements are taken at pregnancy check time (18 to 19 months), the ratio increases to 2.7. The heritability of pelvic area range from .36 to .68. Height estimates tend to be more heritable than width estimates. But area is more heritable than height or width.

Selection for pelvic area should be done within a size category. Allowing size and pelvic area to increase together will likely allow birth weight and pelvic area to increase in a parallel fashion.

**PELVIC AREAS OF BULLS:** The pelvic areas of bulls affect the pelvic areas of their offspring. The pelvic area of a yearling bull increases approximately .25 cm<sup>2</sup> per day. To accurately compare bulls within a group, the pelvic areas should be adjusted by the following formula: Adjusted 365-day pelvic area = actual pelvic area + ((.25 x (365 - actual days of age)). A 355-day-old bull with a 165 cm<sup>2</sup> pelvic area would have an adjusted pelvic area of 167.5 cm<sup>2</sup>. Avoid using bulls with small pelvic areas (less than 160 cm<sup>2</sup> as yearlings) to generate replacement heifers.

**REPRODUCTIVE TRACT SCORE:** Age at puberty is difficult to measure, but an alternative trait, reproductive tract score, can serve the purpose. Reproductive tract scoring should be done when 25 to 50% of the heifers are thought to be cycling or 30 days before the breeding season. The ovaries and uterus of heifers are examined by rectal palpation and assigned a score of 1 through 5 (table 5). A 1 is a heifer that has a small immature tract and is not cycling and a 5 is a heifer that has a palpable corpus luteum and is cycling. The heritability of reproductive tract scores is approximately .30. Reproductive tract scoring will require a skilled technician, highly trained in palpation techniques.

Table 8. Description of Reproductive Tract Scores

Reproductive Tract Score	Uterine Horns	Ovaries			Follicle diameter
		Approximate Size			
		Length (mm)	Height (mm)	Width (mm)	
1	Immature, <20 mm diameter - no tone	15	10	8	<8 mm
2	20-25 mm diameter - no tone	18	12	10	8 mm
3	25-30 mm diameter - good tone	30	16	10	8-10 mm
4	32-35 mm diameter - good tone, erect	32	18	12	>10 mm Corpus luteum possible
5	>35 mm diameter - good tone, erect	>32	20	12	>10 mm Corpus luteum present

Reproductive tract scores and pelvic measurements are relatively new tools that can help improve the reproductive performance of the herd. Shortening the breeding season or simply palpating for pregnancy 45 to 60 days after the breeding season are also tools for increasing reproductive performance.

**COST OF PRODUCTION THROUGH GROWING PHASE:** The cost of production through the growing phase will be approximately \$400 to \$550. However, the producers own costs of production are more accurate.

## BREEDING PHASE

Breed heifers to calve 20 to 30 days ahead of the cow herd. This program allows the heifers more time to rebreed after calving. Normally a young, light bull should be used to breed heifers. This reduces the risk of injury to the heifer at breeding as the heifer must support less weight than if she were bred by a mature bull. About 60 days after removing the bull, palpate and cull open heifers. Heifers that calve later will likely calve late the rest of their lives or miss at least one pregnancy. Another advantage of breeding heifers before the cow herd is that the producer can spend more time checking and assisting heifers with calving difficulty.

**BULL SELECTION:** The traditional "heifer" bull was a yearling that did not cause physical injury to the heifers during the mount of natural service. However we must also be concerned with the impact of the bull on calf birth weights. Ideally, we are looking for bulls that sire easy delivery calves that grow rapidly. Unfortunately, the negative correlation of these traits makes the combination hard to find. Even when yearling bulls with low birth weight EPDs and high growth EPDs are located, they should be tested for a year due to low accuracies of the EPDs before they are used on large numbers of heifers. There are probably several high growth, easy calving bulls with high accuracy EPDs available in most breeds. Using these mature bulls on yearling heifers through artificial insemination provide one of the most logical applications for AI.

**ESTRUS SYNCHRONIZATION:** Recent surveys indicate that less than 5% of the beef cows in the United States are bred by artificial insemination (AI), and only half of the cattle producers practice that practice AI use any form of estrus synchronization to facilitate AI programs. To increase the adoption of estrus synchronization, educators/consultants need to promote practices that will increase chances of success. To avoid problems when using an estrus synchronization system, females should be selected for the program when:

1. Adequate time has elapsed from calving to the time synchronization treatments are imposed. (cows)
2. Females are in average of above average body condition (scores of 5 or higher on a scale from 1 to 9)
3. Minimal or preferably no calving problems were experienced. (cows)
4. Replacement heifers are developed to prebreeding target weights that represent at least 65% of their projected mature weight.

There are three approaches to estrus synchronization currently available. These include prostaglandins, Syncro-Mate-B<sup>TM</sup>, or a combination of a progesterone-like compound with a prostaglandin. The most recent program for synchronizing estrus in heifers is the MGA-Prostaglandin system. Melegestrol Acetate (MGA) is an oral progestin widely used to suppress estrus in feedlot heifers. MGA can be fed with a grain or protein carrier and either top-dressed onto other feed or batch mixed with larger quantities of feed. Feed MGA at .5 mg per head per

day for 14 days. When fed at the recommended level, MGA will suppress heat during the feeding period. Females that fail to consume the required amount on a daily basis will prematurely return to estrus during the feeding period. Failure of the system may be due to lack of adequate bunk space for all animals to eat at once. Limited success may also be experienced when trying to feed on the ground. High quality, palatable feed is critical for consumption. Animals should be observed for signs of estrus during the feeding period to determine how the feeding system is working.

Most heifers show estrus (heat) 48 to 72 hours after MGA withdrawal, and this may continue for 6 to 7 days. Females that exhibit estrus during this period should not be inseminated or exposed for natural service. The first heat after MGA withdrawal is normally a low fertility heat. The following systems may be used after MGA withdrawal:

1. Expose females to bulls 15 to 18 days after MGA withdrawal. No more than 15 to 20 females per one bull should be used. Only bulls in peak reproductive condition should be used. Relying on one yearling bull to breed all females is probably too optimistic.
2. Administer a prostaglandin (Lutalyse™, Bovilene™, Estrumate™) 17 days after MGA withdrawal. This system is better suited to the use of AI than natural service since many more females come into heat at one time.
3. The third system is an extension of the first prostaglandin system. In some cases, up to 20% of the females that should respond to the first prostaglandin injection fail to do so. A second injection of prostaglandin can be administered 11 days after the first injection. Females that have been inseminated after the first injection should not be reinjected.

**PRIOR TO CALVING:** A 2-year-old heifer should weigh about 85% of her mature weight at first calving. They have approximately 280 days to gain the weight from breeding to calving. Bred heifers should gain about 0.7-1 lb/day from breeding to calving. Heifers may reach the target weight coming off good pasture in the fall. Heifers need only maintain their weight through the winter. Feed levels have to be increased if they have not reached their target weight by fall. It is important to provide enough feed without getting the heifers too fat at calving time. They should be at condition score 6-7 at calving.

For those heifers weighing in excess of their target weight at 18 months of age, how should they be handled?. The grazing season for these heifers could be extended with protein supplementation being provided. Do not stay out on pasture, however, until body condition starts decreasing.

Inadequate nutrition creates more calving difficulty in heifers than excess nutrition. Some feel that the heifer should be limited in feed before calving so the fetus will not become too large, and consequently reduce calving difficulty. In fact, limiting nutrients to the heifer usually only slightly affects calf birth weight. The heifer will sacrifice body condition and arrest growth before diverting many nutrients from the fetus. Her thin condition affects her breed-back performance. In addition, data from Colorado shows that thin heifers have lower levels of colostrum, and consequently their calves are more susceptible to scours. Excessive nutrition

often gets the blame for what is really calving problems via improper bull selection. Excessive protein has not consistently increased calving difficulty. Excessive energy can create calving difficulty. Research studies indicate calf birth weight can be increased 8-10 lbs through nutrition without increasing calving difficulty.

## REBREEDING

Breeding heifers at puberty is usually easier than rebreeding them after their first calf. The greatest portion of females being culled for failure to rebreed are first-calf heifers. The main reason this failure is nutritional stress. First-calf heifers need more energy, protein and minerals after calving than mature cows because they are still growing. Feed analysis will greatly assist in how to feed these females.

Early calving heifers have more time to rebreed and have their second calf with the rest of the cow herd. Research has demonstrated that the average interval from calving to first estrus is 49 days in older cows and 67 days in young cows suckling calves.

## CALVING AS TWO-YEAR-OLDS VERSUS THREE-YEAR-OLDS

If your customers are calving heifers as 2-year-olds, as most of them are, then you probably need to do so as well. A 15-year study in Oklahoma did not show that heifers calving as 2-year-olds "wear-out" sooner than heifers calving as three-year-olds. The study did show that calving as 2-year-olds resulted in an additional 300 lbs. of beef produced over their lifetime compared to heifers first calved as 3-year-olds. However, more calving difficulty may be expected with 2-year-olds than 3-year-olds. Using good management such as including pelvic measurements, adequate nutrition, and the proper bulls, should minimize calving difficulty problems.

## SUMMARY

There are three or four things that you can do to improve reproductive efficiency. They are:

1. Cull open females
2. Breed them to calves as 2-year olds
3. Shorten your calving season
4. Select for larger testicle sires