## COW/CALF MANAGEMENT

# Minimizing Calving Difficulty in Beef Cattle

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Calving difficulty (dystocia) contributes heavily to losses in production in beef cow/calf herds. The obvious losses are due to calves or cows that die at or soon after calving. Less noticeable losses are due to delayed rebreeding, more open females, an extended calving season and increased labor costs. While occasional dystocia is almost unavoidable, through proper management, cattlemen can minimize dystocia. Both genetics and environment (nutrition) must be controlled to minimize dystocia.

As noted in Table 1, approximately 70% of those calves that are lost between birth and weaning, are born dead or die within 24 hours of birth, most of these losses are related to calving difficulty. Research at the U.S. Meat Animal Research Center (MARC) in Clay Center, NE has shown that calves that experience calving difficulty are about four times as likely to be born dead or die within 24 hours of birth than those born without difficulty (16 vs 4%). In two separate MARC studies that involved several thousand cows, 20% and 11.7% of those calves that experienced difficult births died, while 5% and 3% of those born unassisted died. Montana researchers observed that 57% of all calf losses in research herds were due to dystocia, while a summary of Michigan cow/calf producer records indicated that 67.6% of all calf losses were related to dystocia. Dystocia also contributes to delayed rebreeding. In the Nebraska study, 54% of cows that experienced calving difficulty bred back during a 45 day AI breeding season, while 69% of unassisted cows did. Including the clean-up period, pregnancy rates were 69 and 85% for assisted and unassisted cows, respectively. Services per conception were similar between treatments, indicating that calving difficulty caused delayed return to estrus, not less fertile estrus periods.

**Table 1.** Factors that reduce calf crop percentage

| FACTORS | PERCENT |
|---|---|
| COWS FAIL TO BECOME PREGNANT | 17.4 |
| CALVES LOST DURING GESTATION | 2.3 |
| CALVES LOST AT BIRTH | 6.4 |
| CALVES LOST BIRTH TO WEANING | 2.9 |
| TOTAL LOSSES | 28.9 |
| NET CALF CROP PERCENTAGE | 71.1 |

## UNDERSTANDING THE CAUSES OF DYSTOCIA

Many factors influence the incidence of dystocia, including:

- Age of dam
- Calf birth weight
- Dam's pelvic area
- Sex of calf
- Size of the dam
- Gestation length
- Breed and genotype of sire
- Breed and genotype of dam
- Condition of dam
- Nutrition of the dam
- Shape of the calf
- Position or presentation in the uterus
- Geographic conditions
- Other unknown factors

Most of these factors can be grouped into two classifications:

- Factors affecting size and shape of the calf
- Factors affecting the ability of the dam to give birth

The interaction between these groups of factors determines the incidence of dystocia. In general, dystocia will be observed when the size of the fetus is incompatible with the size of the pelvic opening of the cow, when the fetus is abnormally presented (breech birth, head or foot back, etc.), or when the cow does not experience normal parturition due to weakness, stress or hormonal abnormalities. By far the most common cause is the fetus is too large or the dam is too small. However, much can be done to ensure that fetus size is compatible with the opening of the dam's pelvis.

### Age of Dam

First-calf heifers account for the majority of calving difficulty and associated calf losses. This is true despite the fact that most first-calf heifers are observed more closely, and assisted more readily at calving than mature cows. While this will come as no surprise to cow/calf producers, understanding this bit of information can be of use. High rates of dystocia among first calf heifers and young cows are mostly due to the fact that they are smaller at first parturition than at subsequent calvings but other factors may contribute. Among these are the fact that the pelvic opening changes slightly in shape as the first calf is born, and that many of the females that experience calving difficulty as 2 yr olds are culled.

Table 2. Effect of age of dam on incidence of calving difficulty

| | Location | |
|---|---|---|
| | Nebraska | Colorado |
| Age of dam | Percent calving difficulty | |
| 2 yr | 54 | 30 |
| 3 yr | 16 | 11 |
| 4 yr | 7 | 7 |
| 5 and older | 5 | 3 |

Note in Table 2 that this held true in herds in two locations (MARC and Colorado State University), with differing incidences of dystocia. The difference in incidence of dystocia between the two locations is probably a result of mating to larger, exotic breed sires at MARC, while the CSU cows were mated to British breed sires.

## Calf Birth Weight

The emphasis on increased weaning weight and growth rate, and resultant increase in frame size in the past few decades has resulted in dramatic increases in birth weight of beef calves. Typically, calf birth weight is highly related with incidence of dystocia. Table 3 includes data to describe this.

Table 3. Effect of birth weight on ease of calving in percentage Simmental females, Virginia

| ITEM | UNASSISTED BIRTH | HAND PULL | MECHANICAL PULL | CAESAREAN |
|---|---|---|---|---|
| COWS | 68 | 34 | 16 | 2 |
| % OF TOTAL | 57 | 28 | 13 | 2 |
| BIRTH WT (LB) | 81 | 88 | 100 | 121 |

Among dams of similar age (in this case all were 2 yr old), birth weight of the calf is the trait most highly correlated with incidence of dystocia (Table 4).

Table 4. Effect of various traits on dystocia in Hereford and Angus heifers

| | BREED OF DAM | |
|---|---|---|
| TRAIT | HEREFORD | ANGUS |
| CALF BIRTH WEIGH | .54 | .48 |
| SEX OF CALF | -.47 | -.26 |
| PRE-CALVING PELVIC AREA | -.18 | -.22 |
| PRE-CALVING WEIGHT OF DAM | -.01 | -.20 |
| GESTATION LENGTH | .25 | .10 |

Bellows et al., 1971, Montana. Note: correlations of 1.0 or -1.0 are perfect correlations, reflecting direct cause and effect situations. In this example, the nearer a correlation is to 1.0 or -1.0, the greater the influence that the trait has on dystocia. A correlation of 0.0 indicates that two events are unrelated.

Birth weight is related to length of gestation. Birth weight will increase .3-.1.0 lb/day, near the end of gestation. As birth weight increases, the percentage of assisted births will increase .7-2.0% per pound of birth weight. The effect of birth weight on dystocia should be thought of as a "threshold" type of effect. In other words, while reducing birth weight will reduce the incidence of calving difficulties in some herds, beyond a certain point, continuing to reduce birth weight will not continue to reduce dystocia, within a given cow size. Put another way, in a herd that has little trouble calving, increasing birth weight slightly will increase dystocia, but after a while dystocia will be at a high rate and will only increase further with large increases in birth weight.

The point where birth weight is just large enough that a slight increase will substantially increase dystocia is called the threshold. Since birth weight is highly correlated to growth traits, a producer may strive to "challenge" his/her cows by choosing matings that will result in birth weights near the threshold in that particular herd. This practice will keep dystocia at a manageable level and result in maximum calf performance.

## Breed of Sire

Research has shown that birth weight does not account for all of the variation in dystocia between groups of calves out of similar cows.

Table 5. The effect of breed of sire on birth weight and calving difficulty

| | | CALVING DIFFICULTY, % | |
|---|---|---|---|
| BREED OF SIRE | BIRTH WT, LB | ALL AGES | 2 YR OLD COWS |
| HEREFORD-ANGUS | 74 | 11 | 41 |
| JERSEY-X | 66 | 5 | 15 |
| SOUTH DEVON-X | 79 | 27 | 68 |
| LIMOUSIN-X | 80 | 24 | 72 |
| CHAROLAIS-X | 85 | 34 | 74 |
| SIMMENTAL-X | 84 | 29 | 66 |

Calves were produced by mating Hereford and Angus cows to Hereford, Angus, Jersey, South Devon, Limousin, Charolais and Simmental sires. Data are adjusted to similar cow age and equalized for sex differences.

The obvious implication of this is that differences in calf shape or some other calf-related factor would also account for variation in incidence of dystocia. While data to clearly prove this theory are difficult to obtain, few cattlemen would dispute that calf shape affects ease or difficulty of birth. Research in Germany has demonstrated a high correlation between chest girth at 330 days of age in Simmental sires and calving difficulty of their subsequent progeny. An extreme example would be the relatively high incidence of calving observed in most of the double muscled beef breeds, or double muscled bloodlines within breeds that have the trait. It is commonly thought that cattle that are smooth in appearance (smooth, correct shoulder placement, freedom from coarse muscling), sire calves that are born more easily than the opposite type, even if birth weights do not differ. While this is likely true, some breeders have taken this to extremes,which has reduced productivity in other ways.

## Breed of Dam

Table 6 includes data from several years of research at MARC that characterized F1 half-blood cows of several breeds, all of which were out of purebred Hereford or Angus cows. In general, half-blood cows of most breeds did not differ from Hereford x Angus cows, which were used as controls in each cycle of the experiment. However, Jersey, Brahman and Sahiwal (a Zebu breed) F1 cows did experience slightly less calving difficulty than the other crosses. Other research supports the conclusion that dairy and Zebu breeds require less assistance at calving. Two year old dairy x beef females experienced 21% calving difficulty compared to 37% for beef x beef females in the study of Belcher and Frahm (1979). Differences between breed of dam are most likely due to differences in relative pelvic area, muscling or fatness.

Table 6. The effect of breed on dam on calving difficulty

| BREED OF COW | ASSITED BIRTHS, % |
|---|---|
| CYCLE 1 ( 2- 8YR OLD COWS) | |
| HEREFORD-ANGUS-X | 10 |

| | |
|---|---|
| JERSEY-X | 4 |
| LIMOUSIN-X | 9 |
| SOUTH DEVON-X | 12 |
| SIMMENTAL-X | 14 |
| CHAROLAIS-X | 12 |
| CYCLE 2 ( 2- 7YR OLD COWS) | |
| HEREFORD-ANGUS-X | 17 |
| RED POLL-X | 19 |
| BROWN SWISS-X | 11 |
| GELBVIEH-X | 15 |
| MAINE ANJOU-X | 15 |
| CHIANINA-X | 11 |
| CYCLE 1 ( 2- 5YR OLD COWS) | |
| HEREFORD-ANGUS-X | 19 |
| TARENTAISE-X | 14 |
| PINZGAUER-X | 19 |
| SAHIWAL-X | 4 |
| BRAHMANS-X | 3 |

## Dams Pelvic Areas

Pelvic area has received considerable attention recently as a trait that is related to dystocia however, not all researchers agree on the importance of this trait. Research at South Dakota State University has shown that the incidence of calving difficulty is more than twice as high in heifers with below average pelvic areas, compared to above average. In an Oklahoma study, 85% of heifers with small pelvic area experienced calving difficulty, while 31% of heifers with large pelvic areas had difficulty. Table 7 describes the relationship between pelvic area of heifers, birth weight and incidence of dystocia. These estimates result from calculations based on data collected from calving 600 first calf heifers.

Table 7. Relationship between heifer pelvic area, calf birth weight and incidence of dystocia, %

| BIRTH WT, LB | PELVIC AREA ($CM^2$) AT CALVING | | | | |
|---|---|---|---|---|---|
| | 210 | 230 | 250 | 270 | 290 |
| 55 | 47 | 32 | 19 | 8 | 0 |
| 65 | 78 | 62 | 48 | 37 | 28 |
| 75 | 100 | 88 | 74 | 62 | 52 |
| 85 | 100 | 100 | 96 | 83 | 73 |
| 95 | 100 | 100 | 100 | 100 | 90 |

Bellows, 1983, Montana

Just like birth weight, pelvic area is a threshold trait. If the pelvic area of a female is large enough for the calves that she will have, there would be no advantage in a larger pelvis. An example of this is the work of Naazie et al. (1990, Table 8). Records of 547 2-yr old cows of three breed types were analyzed and pelvic area contributed only slightly to explaining the calving difficulty observed. In this study, however, the average pelvic area of the females was extremely large. Note that while pelvic area was not an important factor, the ratio of birth weight/pelvic area was an extremely important factor. Since the pelvic area of all females was large, birth weight, dam weight and the ratio of those traits were the most important factors. Note also that the ratio of birth weight/dam's hip height was virtually unrelated to calving difficulty. This brings up another

point. Although pelvic area is highly correlated to frame size (large cows have large pelvises), the correlation is not perfect. There are no external measurements that accurately predict pelvic area. Pelvic area should be directly measured, it should not be assumed that all large framed females will have large pelvises or that all small females will have small pelvises. An example of this is the Jersey breed, small cattle which have very large pelvises, compared to other breeds of similar size.

Table 8. Correlations between various traits and incidence of calving difficult in first-calf heifers

| TRAIT | CORRELATION |
|---|---|
| CALF BIRTH WT | .47** |
| SIRE BIRTH WT | .05 |
| DAM BIRTH WT | .09* |
| DAM WT AT CALVING | -.19** |
| CALF BIRTH WT/DAM WT AT CALVING | .52** |
| DAM CONDITION | -.08* |
| DAM'S PELVIC AREA | -.07 |
| CALF BIRTH WT/DAM'S PELVIC AREA | .49** |
| CALF BIRTH WT/DAM'S HIP HEIGHT | -.01 |

Naazie et al., 1990, * = $P < 0.05$, ** = $P < 0.01$

Deutscher (1988) has estimated the weight of calf that can be delivered by heifers without requiring assistance, based on their pelvic area (Tables 9, 10). In general, heifers with a pelvic area/birth weight ratio of 2.1 or greater (pelvic area measured at breeding) required little or no assistance, while all of those with ratios of 1.9 or less experienced difficult births. Thus, a heifer with a pelvic area of 140 cm at breeding could deliver a 67 lb calf, if pelvic area was 160, 76 lb, if 180, 86 lb. If pelvic area is measured at time of pregnancy exam, a ratio of 2.7 should be used. As shown in Table 10, if a group of heifers varies widely in age at time of measurement, various ratios should be used.

Table 9. Using pelvic measurements to estimate deliverable calf size

| TIME OF MEASUREMENT | PELVIC AREA, $CM^2$ | DELIVERABLE BIRTH WT RATIO | BIRTH WT, LB |
|---|---|---|---|
| BEFORE BREEDING | 140 | 2.1 | 67 |
| | 160 | 2.1 | 76 |
| | 180 | 2.1 | 86 |
| PREGNANCY EXAM | 180 | 2.7 | 67 |
| | 200 | 2.7 | 74 |
| | 220 | 2.7 | 82 |

Table 10. Pelvic area/calf birth weight ratios for various heifer weights and ages to estimate deliverable calf birth weight

| | AGE AT MEASUREMENT, MONTHS | | | |
|---|---|---|---|---|
| HEIFER WEIGHT, LB | 8-9 | 12-13 | 18-19 | 22-23 |
| 500 | 1.7 | 2.0 | -- | -- |
| 600 | 1.8 | 2.1 | -- | -- |
| 700 | 1.9 | 2.2 | 2.6 | -- |
| 800 | -- | 2.3 | 2.7 | 3.1 |
| 900 | -- | 2.4 | 2.8 | 3.2 |
| 1000 | -- | 2.5 | 2.9 | 3.3 |
| 1100 | -- | -- | -- | 3.4 |

Deutscher, 1988.

These data are interesting in explaining dystocia but may be of little practical value to producers since birth weights cannot be predicted. Nonetheless, a producer who has an idea of what the birth weights will average in his herd can use these guidelines. The bottom line on pelvic area is this: females with very small pelvises that carry large calves will experience calving difficulty every time, no exceptions. On the other hand, females with large pelvises, that have small calves will have very low (but not zero) incidence on calving difficulty. Since pelvic area is highly heritable (estimates average 55%), producers that would like to reduce the incidence of dystocia in their herds should select against small pelvises (this is not the same as selecting for large pelvises, which is probably not required). In some herds, this will produce dramatic improvements, in others little effect will be observed. In two large purebred herds, culling of heifers with small pelvises has reduced dystocia among 2 yr old females to 4-5%. In these herds, as many as 10% of replacement heifers were culled due to inadequate pelvic area in the first few years of using pelvic measurements. However, after a few years, very few females failed to meet pelvic area selection criteria. A producer who would like to reduce the incidence of calving difficulty in his herd should consider pelvic measurements.

## Pre-calving Nutrition and Condition of the Dam

Some cattle producers feel that limiting the feedthat cows get prior to calving will reduce calf birth weight and dystocia. Research at MARC has shown that while birth weight can be reduced due to limited cow nutrition, calving difficulty is actually increased in the underfed cows with the lighter calves (Table 11). Since underfeeding cows prior to calving will also delay return to estrus, this practice should be avoided.

Table 11. Effect of pre-calving energy intake on calf birth weight (BW) and incidence of calving difficulty (CD)

| | PRCALVING ENERGY INTAKE | | | | | |
|---|---|---|---|---|---|---|
| | LOW | | MEDIUM | | HIGH | |
| BREED | BW | CD | BW | CD | BW | CD |
| HEREFORD | 57 | 29 | 62 | 20 | 66 | 25 |
| ANGUS | 58 | 23 | 61 | 13 | 62 | 12 |
| AVERAGE | 58 | 26 | 61 | 17 | 64 | 18 |

TDN intake was 10.8, 13.6, and 16.9 lb/hd/d. ADG was 0.6, 1.4, and 2.0 for 90 days prior to calving.

Table 12. Effect of pre-calving energy level on birth weight and dystocia in 2 year old cows, MARC

| ENERGY LEVEL | BIRTH WT, LB | DYSTOCIA, % |
|---|---|---|
| LOW (10.8 LB TDN) | 58 | 26 |
| MEDIUM (13.7 LB TDN) | 62 | 17 |
| HIGH (17.0 LB TDN) | 64 | 18 |

Laster, 1974.

Table 13. Effect of pre-calving energy level on birth weight and dystocia in 2 yr old cows, Montana

| ENERGY LEVEL | COW WT, LB | BODY WEIGHT, LB | DYSTOCIA, % |
|---|---|---|---|
| LOW (7.5 LB TDN) | 725 | 59 | 40 |
| HIGH (13.9 LB TDN) | 811 | 63 | 36 |

Bellows and Short, 1978.

## Abnormal Presentation or Delivery

Most calves are presented with the front feet first and the nose resting on the front legs. Occasionally, the fetus will be backwards, breech (buttocks first), head to one side or the other, or have one or both front legs back or a knee bent. Often, large calves will result in hip or shoulder

lock. These abnormal presentations usually require some degree of assistance. Although abnormal presentations are thought to be repeatable (cows that have an abnormally presented fetus once are more likely to do so again), there is little that can be done to reduce the relatively small percentage of calves that experience dystocia due to abnormal presentation.

## Development of Replacement Heifers

The simplest way to avoid the high incidence of dystocia in first-calf heifers is to not calve any. However purchasing only mature replacement females is seldom feasible or desirable. Thus, most cattle producers will regularly calve a group of first-calf heifers despite the expected calving troubles. Steps can be taken to reduce dystocia in first-calf heifers. Replacement heifers must be fed to grow and develop rapidly enough so that they cycle and become pregnant early enough to calve at 24 months of age. A further advantage of this is that they will be as close to their mature skeletal size as possible, when they calve for the first time, which will help to reduce calving problems. As a rule of thumb, heifers should weigh at least 65% of their expected mature weight at time of first breeding, and 85% of mature weight at first calving. Heifers should be weighed occasionally and diets adjusted to produce desired gains without making heifers too fat.

Table 14. Recommended weight of replacement heifers at breeding and first calving, by expected mature weight

| EXPECTED MATURE WEIGHT | WEIGHT AT BREEDING | WEIGHT AT FIRST CALVING |
|---|---|---|
| 900 | 585 | 765 |
| 1000 | 650 | 850 |
| 1100 | 715 | 935 |
| 1200 | 780 | 1020 |
| 1300 | 845 | 1105 |
| 1400 | 910 | 1190 |

## Reducing Dystocia

Producers need to consider both genetics and management in attempts to reduce dystocia. Management advice would include mating heifers so that they calve earlier in the season than cows, so that they can be given extra attention, and feeding cows properly through consideration of nutrient requirements and condition scores. In addition, producers should know when and how to give assistance and when a veterinarian should be called.

Genetic solutions are more complicated. Birth weight is the trait of most interest. When possible, the birth weight Expected Progeny Difference (EPD) should be considered in bull selection. EPD's have been shown to be more accurate indicators of performance, including birth weight, than actual performance data. Although specific guidelines are impossible to give for all situations, some general recommendations can be listed. Remember that the average BW EPD in each breed differs. A bull with a 0.0 lb BW EPD in one breed may sire calves with vastly different birth weights than a bull with a 0.0 lb BW EPD in another breed. Do not be as concerned with the exact numbers, which may change from one year to the next, as with the bull's rank within the current or active sires within the breed. The following table includes guidelines for selecting bulls based on the current sires list within breeds. For example, small to moderate heifers should be mated to bulls of small breeds with BW EPD's that rank them in the lower 1/2 of the breed, or only to the lowest 10% of large breed bulls.

| Type of Female | Small Breed Bull | Large Breed Bull |
|---|---|---|
| Small to Moderate Heifer | Lower 1/2 | Lower 10% |
| Large Heifer | Lower 2/3 | Lower 1/2 |
| Small to Moderate Cow | Lower 2/3 | Lower 2/3 |
| Large Cow | No Restriction | Avoid Extremes |

Birth weight is not the whole story, however. Some breeds also calculate a calving ease EPD, which is highly related to BW EPD, but actually a better predictor of calving ease. Some breeds also calculate a Maternal Calving Ease EPD, which is an indication of the ease with which the daughters of a bull will give birth, when they are old enough to calve. This is a particularly important consideration since birth weight and growth performance are highly correlated. If low BW EPD bulls are used for several generations, the growth performance of a herd could suffer, due to this correlation. Also, the subsequent daughters may be more susceptible to dystocia than their dams, due to small size. Thus if bulls can be identified that will calve easily, and produce daughters that calve easily, dystocia will be reduced, not just postponed until the next generation.

If EPD's are not available, consider the actual birth weight of a bull. While not as accurate as an EPD, the actual birth weight is useful, since birth weight is moderately heritable. Consider the age of a bull's dam, as it will affect his birth weight. Actual birth weights should be adjusted to a "mature dam equivalent". For bull calves out of 2 yr old dams, add 8 lb to their birth weight,; 3 yr old dams, add 5 lb; 4 yr old dams, add 2 lb; 5-10 yr old dams, no adjustment, 11 yr old dams and above, add 3 lb.

## Summary

Here are some general recommendations to reduce dystocia:

- Mate virgin heifers and small cows to bulls that will sire small calves. Consider breed, birth weight Expected Progeny Difference, actual birth weight and physical structure of the bull when making mating decisions.
- Feed heifers well enough to weigh at least 85% of their expected mature weight at first calving.
- If calving difficulty is a problem in your herd, measure pelvic area in replacement heifers and cull those that are too small. Required size will differ from one breed to the next but in general, heifers of medium sized breeds should have pelvises of at least 160 square centimeters at breeding, those of large breeds, 180 or more.
- Do not retain daughters of cows that have a record of calving difficulty.
- Begin breeding heifers 21 to 30 days earlier than cows so that they can be observed more at calving time. Feed the herd late in the day during calving season so that more will calve in daylight.
- Record a calving ease score for all calves that are observed at birth. If calving ease or difficulty changes over time, consider reasons for this.

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