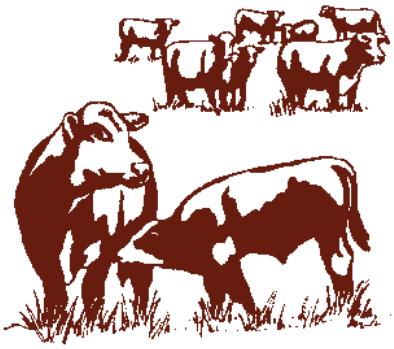
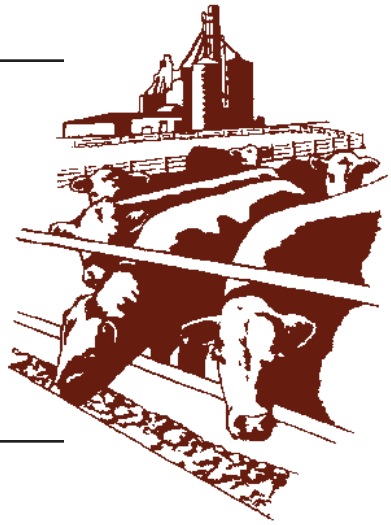


Beef Cattle Handbook



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Calving Difficulty in Beef Cattle: Part I[1]

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Calving difficulty (dystocia) can increase calf losses, cow mortality, and veterinary and labor costs, as well as delay return to estrus, and lower conception rates. In two studies at the United States Meat Animal Research Center (MARC), Clay Center, Nebraska, calf losses within 24 hours of birth averaged four percent for those born with little or no assistance, compared to 16 percent for those requiring assistance. Calf mortality increased by a 0.35 percent per pound increase in birth weight. In a Hereford herd at the United States Livestock and Range Research Station, Miles City, Montana, 57 percent of all calf losses were reported to be due to dystocia.

Researchers at MARC noted that the number of cows detected in estrus during a 45-day Artifical Insemination period was 14 percent lower in those requiring assistance than in those calving with no difficulty. Conception to A. I. was six percent lower in cows experiencing dystocia than in those without dystocia. Pregnancy rate after the entire breeding season (70 days) was 16 percent lower in cows that had been assisted (85 percent versus 69 percent). At Miles City, pregnancy rate among cows that had caesarean deliveries was 26.6 percent lower (52.4 percent versus 79.0 percent) than the herd average.

Factors Affecting Dystocia

The numerous factors that are believed to influence calving difficulty are listed below. As will be noted later, several of these factors are interrelated.

1. Age of dam
2. Calf's birth weight
3. Sex of calf
4. Pelvic area
5. Gestation length
6. Cow size
7. Shape of calf
8. Breed of sire
9. Breed of dam
10. Hormonal control
11. Uterine environment
12. Geographic region
13. Season of year
14. Environmental temperature
15. Nutrition of dam
16. Condition of dam
17. Implants and feed additives
18. Feeding time
19. Exercise
20. Other unknown factors

This bulletin (Part I) covers the first 14 factors. The second bulletin (Part II) covers the remainder of these factors, and finishes with a discussion of calving time and genetic management.

Age of Dam

Table 1 is a summary of calving data from MARC and Colorado State University (CSU), relating age of dam to calving difficulty. This data illustrates that age of dam has a profound effect on the incidence of dystocia. First-calf, two-year-old heifers represent the greatest source of

[1] (Authors' note: This bulletin is first in a series of two on calving difficulty).

trouble to the beef herd owner. Difficulty in two-year-olds is three to four times as high as in three-year-olds, and three-year-olds have about twice as much difficulty as four-year-olds. By the time a cow reaches 4 - 5 years of age, dystocia problems are minimal. Calving difficulty in MARC Hereford and Angus cows was higher than in CSU Hereford cows, presumably because the former tended to be mated to larger continental sires, whereas the latter were mated only to Hereford sires.

Table 1. Effect of Dam's Age on Calving Difficulty

Dam's age (years)	Research station	
	MARC	CSU
	% calving difficulty	
2	54	30
3	16	11
4	7	7
5 and over	5	3

Calf's Birth Weight and Sex

Table 2 is taken from a Miles City study correlating calving difficulty with several traits in two-year-old Hereford and Angus heifers. A perfect correlation would be 1.0; anything over 0.40 was highly significant; 0.18 to 0.40, significant; less than 0.18, nonsignificant. Birth weight of the calf was the trait most highly correlated with calving difficulty, followed by sex of calf. Pelvic area, gestation length, and cow weight had considerably less influence. Much of the influence of sex of calf is believed to be indirect, through its effect on increased calf size. However, after correcting for birth weight, differences in dystocia between sexes still remain, suggesting that other factors besides fetal size may be involved.

Table 2. Effect of Various Traits on Dystocia in Hereford and Angus Heifers

Trait	Breed of cow	
	Hereford	Angus
	Correlation with dystocia	
Calf's birth weight	.54	.48
Calf's sex	-.47	-.26
Pelvic area, precalving	-.18	-.22
Gestation length	.25	.10
Cow wt., precalving	-.01	-.20

As birth weight increases, percent assisted births increases 0.7 - 2.0 percent per pound of birth weight. Compared to heifer calves, bull calves have a slightly longer gestation length, weigh 5 - 12 pounds more at birth, and exhibit a 10 - 40 percent higher assistance rate. Several researchers have reported that calves requiring assistance weigh 5 -7 pounds more than those born without assistance. Research has also shown that the impact of birth weight on dystocia is much greater in two-year-old cows, and that as cows become older, birth weight assumes less significance.

Pelvic Area

It is generally agreed that a major cause of dystocia is the disproportion between the size of the fetus and the pelvic opening of the dam, especially in first-calf heifers. This disproportionality is illustrated in Table 3, which is a summary of data from CSU. As birth weight increased and pelvic area declined, calving difficulty increased. Relative to the amount of variability in the two traits, changes in birth weight were considerably greater than changes in pelvic area. Unfortunately, phenotypic correlations between pelvic area and calving difficulty are not high, averaging only -.20 (*Table 2*).

Table 3. Effect of Birth Weight and Pelvic Area on Calving Difficulty in First-calf Heifers

Calving difficulty score	Yearling pelvic area (cm2)	Calf birth wt. (lb)
1 (no assistance)	151	72
2 (minor assistance)	145	77
3 (major assistance)	141	82
4 (caesarean)	131	94

Heritability estimates for pelvic area are moderate to high, averaging about .50. This means that selection for larger pelvic size can be quite effective. However, several studies have demonstrated a positive relationship between pelvic area and body size (weight and frame) from birth to 18 months. Consequently, selection for increased pelvic area without some constraint on body size could possibly result in a parallel increase in birth weight and mature size and little change in calving ease. Therefore, it has been recommended by several researchers that selection for increased pelvic area be conducted within a size category.

It is agreed among many authorities that pelvic size should be viewed as a threshold trait and that heifers below a certain minimum pelvic area should be culled. Pre-breeding minimum culling levels for pelvic area may range from 140 - 180 square centimeters depending upon the breed, herd, environment and other factors. Based on Miles City data; pelvic measurements have limited usefulness in predicting dystocia on an individual basis, but can be significant herd-wide. Their research shows that a 10 square centimeter increase in pelvic area would be accompanied by a two-pound increase in calf birth weight and a 0.02 decrease in calving difficulty score.

Many purebred breeders now measure pelvic areas on their yearling bulls and publish the data in their sale catalogs. Because the genetic correlation between male and female pelvic area is high (.60), selection for increased pelvic size in bulls should result in increased pelvic size in heifer progeny. However, as noted above,

selection for increased pelvic size should not be conducted without some constraint on birth weight. If no attempt is made to control birth weight, selection for increased pelvic size by itself may not be very effective. Ideally, pelvic areas in sale catalogs should be adjusted to a standard age such as 365-days. Beef Improvement Federation (BIF) suggests the following age adjustments be used: .25 and .27 square centimeters per day of age for yearling bulls and heifers, respectively.

Gestation Length

As shown in *Table 2*, gestation length is not highly correlated with dystocia. Using Simmental field data, Cornell researchers reported similar results. They found the correlation between birth weight and calving difficulty to be somewhat higher than the correlation between gestation length and calving difficulty (.40 versus .26). They concluded that sire differences in gestation length are not particularly useful predictors of differences in calving ease and that birth weight is a better, and more frequently recorded, predictor of calving ease. Nevertheless, using short-gestation sires has two important advantages: (1) calves are older and heavier at weaning time; and (2) because calves are born earlier, the cows have more time to recover and rebreed on schedule.

Cow Size

As indicated in *Table 2*, smaller heifers tend to have a higher incidence of dystocia than larger heifers but the correlations are low (-.01 and.20). In Alberta research, it was reported that the ratio of calf birth weight to dam weight was the most important factor affecting dystocia, accounting for 28 percent of the total variation in calving difficulty. Calf birth weight by itself accounted for 18 percent of the total variation, and dam's pelvic area accounted for less than one percent of the total variation. If one reviews all of the research that has been conducted on calving difficulty, no more than 50 percent of the total variation in dystocia can be explained by factors that can be defined or measured. In many studies, only 20 - 30 percent of the variation can be explained by quantifiable traits.

Shape of Calf

Many cattle producers believe that differences in a newborn calf's shape can have an important effect on ease of delivery. For example, a slender, lighter-muscled, finer-boned calf theoretically should be born more easily than a thicker, heavier muscled, coarser-boned calf of the same weight. However, researchers at MARC were unable to find any calf shape measurements significantly correlated with calving ease, even though they believe that such relationships likely exist. Data from Germany showed a relatively high correlation (.62) between chest girth at 330-days of age in Simmental sires and the calving difficulty of their progeny. In France, it was reported that the calf's body length and rump width were significantly correlated with calving difficulty in two-year-old cows, and that selection of French beef breeds based on muscle development and growth rate early in life had led to an increase in birth weight and calving difficulty. In a Virginia study, researchers concluded that selection for calf shape, independent of birth weight, would not be expected to reduce dystocia. In summary, calf shape probably plays a role in dystocia but it is extremely difficult to quantify.

Breed of Sire

Research at MARC and elsewhere has demonstrated that significant differences exist between breeds of sires in calving difficulty and birth weight. In Cycles I, II and III (1970-76) at MARC, average assistance rates and birth weights of half-blood calves sired by 16 diverse breeds ranged from 2.9 - 20.4 percent and from 68.6 - 90.6 pounds, respectively. In Cycle IV (1986-89), the ranges were 0.3 - 9.2 percent and 71.3 - 90.2 pounds. In general, birth weights and assistance rates increased as mature size and growth rate increased.

Breed of Dam

Breed of dam effects on dystocia and birth weight do not follow a consistent pattern, except for Zebu-influenced females. Data from many sources clearly demonstrate that as the percentage of Zebu breeding increases in the dam, birth weight and dystocia decline. In Cycles I, II and III at MARC, Brahman- and Sahiwal-sired F1 dams exhibited assistance rates of only one and two percent, respectively, compared to a range of 7 - 17 percent for 14 European breedtypes.

Uterine Environment

Researchers at MARC reported that fetal growth during the last 20 percent of gestation is dramatically lower in Brahman than in Charolais cows, which helps explain the lower birth weights of calves from Brahman-influenced dams, as noted above. They provided evidence which suggested that this difference is due to differences in uterine blood flow and function of the utero-placental tissues. Research at Miles City has likewise shown that diverse breeds of dams differ greatly in the growth rate of the fetuses they are carrying.

Hormonal Control

Several hormones are associated with parturition (e.g., ACTH, cortisol, estrogen, prostaglandin, progesterone, oxytocin and relaxin). Increased blood levels of relaxin prior to parturition have been shown to enhance cervical and pelvic dilatation, resulting in normal delivery of the fetus. Unlike some species, circulating blood concentration of relaxin in cows remains consistently low during the last days of pregnancy. Iowa research has shown that injecting first-calf heifers with relaxin within the last 5 - 6 days before calving significantly reduces the incidence of dystocia. Cows can be induced to calve within 48 - 60 hours by injecting them with a corticosteroid or a prostaglandin within ten days of parturition. However, such treatments commonly result in difficult calvings and retained placentas. When the Iowa researchers combined

relaxin with either dexamethasone (a corticosteroid) or cloprostenol (a prostaglandin), these problems were reduced significantly. Whether hormonal control of parturition can become a practical management strategy remains to be determined.

Geographic Region

Hereford cows of comparable genetic make-up were moved from Miles City, Montana, to Brooksville, Florida, and vice versa. Ten years after this switch was made, birth weights in the Montana herd that had been moved to Florida had declined from 81 pounds to 64 pounds. Conversely, birth weights in the Florida herd that had been moved to Montana had increased from 66 pounds to 77 pounds. Other studies have yielded similar results, indicating that calves of comparable genotype will be born lighter in the south than in the north.

Season of Year

Research has shown that calves born in the fall of the year are generally lighter in weight and experience less dystocia than those born in the spring.

Environmental Temperature

Prolonged exposure to high environmental temperatures will result in reduced birth weights, which can, in turn, lower the incidence of dystocia. There is less information on cold stress. However, the available data have shown that low environmental temperatures are related to heavier birth weights and increased calving difficulty. It is likely that differences observed between geographic regions and seasons of the year, as discussed above, are related to differences in environmental temperature.

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