5-1979

Causative Factors and Some Consequences of Dystocia in Two-Year-Old Heifers

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CAUSATIVE FACTORS AND SOME CONSEQUENCES OF DYSTOCIA IN TWO-YEAR-OLD HEIFERS

by

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A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Animal Science
(Livestock Management)

Approved:

UTAH STATE UNIVERSITY
Logan, Utah

1979

ACKNOWLEDGMENTS

I would like to recognize Bryce Stringam, director of Desert Farms Ltd. of Alberta, for his help and direction while I was associated with the Knight Ranch.

I would like to express my gratitude to Dr. James A. Bennett, my major professor, for allowing me the opportunity of working under his direction and guidance on this masters program. To Dr. Paul R. Grimshaw and Dr. Donald V. Sisson, members of my committee, thank you for your time, suggestions and help.

I would like to thank my parents who helped in many ways to make this year of education a reality.

Finally, to my wife Evelyn, for her support and encouragement during this year of study, I give my thanks and love.

Delyn Jensen

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ABSTRACT

Causative Factors and Some Consequences

of Dystocia in Two-Year-Old Heifers

by

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Utah State University, 1979

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Causative factors and some consequences of dystocia were examined in 3923 parturitions among Hereford and Angus x Hereford crossbred two-year-old heifers. Fifty percent of the parturitions required some assistance. Minor assistance was required in 34.5% of the parturitions and major assistance involving use of a calf puller, in 15.1%. Caesarean section and foetotomy were rendered in 0.3% and .05% of the cases, respectively. Abnormal presentation at birth, which included leg back, head back, backwards, hiplock and breech, was observed in only 2.9% of the births and therefore is a minor contributor to dystocia. The major causes of dystocia were not specifically identified in this study. Sex of calf had a definite influence upon the degree of calving difficulty with male calves requiring more assistance in both minor and major assistance categories. Crossbred heifers had a higher percentage of unassisted births (62.4% vs 36.7%) than Hereford heifers.

Ninety and eight-tenths percent of all calves born were alive at 30 days postpartum. Of the 9.2% that died, 6.2% died at birth or within 24 hours after birth. Losses were particularly heavy in this early period among those to whom major assistance had been given, with 71.5% of all deaths in this group being in this early period. Death loss rate was higher in this group throughout the 30 day postpartum interval with a total death loss of 38.6% as compared to a loss of 3.8% and 3.4% for the minor assisted and the unassisted groups, respectively. Among the kinds of abnormal presentations, death loss was greatest among breech presentations with a 66.7% loss. Backward presentation ranked next followed, in order, by head back, hiplock and leg back. Loss from leg back, 21% was relatively low. Increases in degree of severity of dystocia was accompanied by increases in time required to complete the birth process. Labor duration and sex of calf were correlated with male calves requiring a longer parturition than female calves, 104 minutes vs 88 minutes, respectively.

(58 pages)

INTRODUCTION

Cattle producers recognize the economic significance of having a high percentage of the females in the herd in full production. In attempts to maximize reproduction, increasing numbers of western producers have adopted the practice of breeding heifers to first calve at two years of age rather than at the traditional three years of age.

It is obvious that if a cow could produce her first calf at two years of age, and a calf each following year, her lifetime production would be greater than that of a cow that calved first as a three-year-old and also produced a calf each year thereafter, if both are retired from the herd at the same age. However, if calving at two years of age imposes such a stress that subsequent reproductive performance is impaired, little, if any, economic advantage could be realized. Indeed, the decrease in subsequent reproduction might be sufficiently great to result in an economic disadvantage.

A cattle producer must, then, in making management decisions weigh the economic significance of the stress associated with calving first at two years of age against the costs of the extra year of maintenance associated with not getting the first calf until the heifer is three years of age.

The stress factors associated with calving at two years of age are of wide scope. Nutritional needs of the two-year-old heifer are proportionately greater than the three-year-old heifer. Cattle mature at approximately five years of age with some variation among genetic strains. Absolute and relative growth rate, of both skeletal parts and fat-free body mass, is much faster in a two-year-old heifer than in the three-year-old. Gestation and lactation imposes severe nutritional requirements. Nature has established that in cattle gestation and lactation needs will take precedent over growth and reproduction. It follows then that if the available feed is not adequate, in quantity and quality, two-year-old heifers that have produced calves may be retarded in growth and may fail to rebreed. It has been established also, however, that cattle have remarkable ability in compensatory growth when a period of ample nourishment follows a period of scarcity.

In the past two decades crossbreeding among beef cattle has become a general practice in much of the range area of North America. Crossbreeding offers potential increases in growth rate and earlier puberty. To capitalize on these potentials, as well as to attempt to more nearly maximize returns on the greatly inflated capital investment in a cattle enterprise, cattlemen have gradually started to provide better nourishment to the cow herd. This has been brought about by increased supplemental feeding as well as by improved range management. The cattleman, in turn, demands higher production and higher reproduction from the herd.

It is widely accepted that heifers, calving at approximately two years of age, frequently have difficulty in delivering the calf even under good nutrition and management. Assistance is often required to save the life of the calf and/or of the cow. Even when the heifer is able to give birth to the calf unassisted, it is often observed that labor is of longer duration than in older cows. Prolonged labor may adversely affect survival potential of the calf and also the length of the post-partum recovery period of the cow. This could influence the cow's ability to mother the calf and also her ability to breed back and conceive early.

The purpose of this study was to examine calving in two-year-old heifers and determine the rate of occurrence of dystocia and determine the causes and some of the consequences of dystocia. Specific objectives of the study were:

1. Determine rate of occurrence of dystocia and factors contributing to dystocia in two-year-old heifers.

2. Determine mortality rates and time of death among calves that did, or did not, experience dystocia.

3. Measure parturition duration and its influence upon cow and calf.

4. Examine some management practices as a means of reducing dystocia and minimizing calf death loss.

LITERATURE REVIEW

Dystocia

Dystocia, abnormal labor, results from several causes and occurs to some extent, among cows of all ages. Dystocia may be of several types. It could involve an extremely hard, yet successful labor; a markedly prolonged successful labor; or an unsuccessful labor under which delivery of the calf is impossible for the dam without assistance, regardless of the duration or intensity of labor.

Dystocia and Age of Dam

The rate of occurrence of dystocia is closely related to the maturity of the dam. Laster et al. (1973) reported that dystocia, in Hereford and Angus dams four years of age and older, occurred in 4.95% of all parturitions. Dystocia in two and three-year-old dams was 49.57% and 13.54%, respectively. Brinks et al. (1973) and Moore et al. (1956) reported similar results from straightbred Hereford and Angus dams. Burfening et al. (1978) reported dystocia occurred in 11.30% of dams 4 years of age and older bred to purebred Simmental bulls. Two and three-year-old dams experienced dystocia in 46.5% and 19.5%, respectively, of the parturitions recorded.

Causes of Dystocia

Factors causing dystocia in beef heifers are often complex and some are interrelated. Rice et al. (1972) classified and ranked the causes of dystocia as follows: (1) relative fetal oversize or disproportion between fetal size and the maternal pelvic opening; (2) abnormal presentation, position, and posture; (3) Uterine inertia and failure of the cervix to dilate; (4) miscellaneous or unknown causes.

Birthweight and Pelvic Size

The calf must come through the birth canal, without complications, in order for natural birth to occur. Difficulties occur if the calf is big or the pelvic opening is relatively small. Rice et al. (1972) reported that calf birth weight was the single most important factor associated with dystocia. Dam pelvic area was the second most important factor. Price (1974) in a study involving two-year-old Hereford heifers, obtained the following data pertaining to birth weight of the calf and pelvic area of the dam. All heifers with pelvic openings of less than 150 sq. cm. had difficulty giving birth to calves weighing 51-60 pounds. Heifers with pelvic openings of 151-160 sq. cm. and giving birth to calves weighing 51-60 pounds, experienced 58% calving difficulty. The occurrence of calving difficulty was 43% in heifers having a pelvic opening between 161-170 sq. cm. and calves weighting 51-60 pounds. Heifers having a pelvic opening of 221-230 sq. cm. gave birth to calves weighing 71 to 80 pounds and experienced no calving difficulty. Calving difficulty declined as pelvic area increased. Rice et al. (1972) reported that heifers with pelvic areas less than 200 sq. cm. and those with pelvic areas greater than 200 sq. cm. had dystocia rates of 68.7% and 28%, respectively.

Smith et al. (1976) reported that dystocia levels increased linearly with birth weight. An increase of 1 kg of calf birth weight results in 1% increase in assisted parturitions, he concluded. Clay Center (1976) reported that calving difficulty increased linearly with birth weight across and within breed group. In the averaged, over all age-of-dam groups, each 1 pound increase in birth weight was associated with an increased calving difficulty of 0.74%. The increase in calving difficulty associated with increased birth weight was 10 times greater in two-year-old heifers than in mature cows.

Influence of Calf Sex

The effect of calf sex on birth weight has been well documented. Laster et al. (1973) reported male calves were heavier at birth than females, 35.12 kg compared to 32.10 kg. Koch et al. (1959), Lasley et al. (1961), Ellis et al. (1965), all agree with these findings. Dystocia, as influenced by the sex of the calf, was shown to be 28.4% for male calves and 16.9% for female calves, in Laster's (1974) study. Sagebiel et al. (1969), and Bellows et al. (1971), in their studies, also found that male calves were heavier, and dystocia was found to occur with greater frequency in male births as compared to female births.

Calf Presentation

Abnormal presentation has been found to contribute to dystocia. Williams (1948) concluded that 95% of bovine births were anterior presentations. This observation, in relation to births in two-year-old heifers, may vary. Sloss et al. (1967) reported that posterior presentation was the cause of 12% of the dystocia in 635 cases of dystocia in a Devon herd of two-year-old heifers in Australia.

Wiltbank et al. (1965) reported that posterior presentations were more common in excessively fat heifers. Clay Center (1976) reported that 1.6% of all births in two-year-old heifers, for their 1970-71 calf crop, were in the posterior presentation position.

Arthur (1966) stated that the calf presentation observed at birth, is determined no later than the seventh month of gestation. Russe, (1965) in his study of parturition in beef cattle, noted that changes of presentation position during the last month of gestation are unlikely, changes in position and posture could occur up to one day prior to parturition. Dystocia could result from these late changes of position or posture, he speculated.

Management and Dystocia

Bellows (1971a) suggests the following factors contribute to calving problems in two-year-old heifers; (1) pre-calving weight of the dam; (2) pelvic area; (3) sex of calf; (4) birth weight of calf; (5) gestation length.

Genetic Influence on Dystocia

Genotype of sire and dam has a marked effect on dystocia. This factor becomes more important, as crossing the large European breeds with the British breeds of cattle, increase in popularity among cattle producers (Rice et al. 1972).

Sire Effect

Clay Center (1976) released the following information, collected from a study involving Hereford and Angus two-year-old dams bred to sires of seven breeds. The sires were Hereford, Angus, Jersey, South Devon, Limousin, Simmental, and Charolais. The calving difficulties of the matings were as follows: Hereford x Hereford, 53.10%; Hereford x Angus, 38.4%; Angus x Angus, 37.30%; Angus x Hereford, 45.5%; Jersey x Hereford, 19.7%; Jersey x Angus, 14.5%; South Devon x Hereford, 46.4%; South Devon x Angus, 64.4%; Limousin x Hereford, 82.5%; Limousin x Angus, 67.2%; Simmental x Hereford, 88.9%; Simmental x Angus, 59.5%; Charolais x Hereford, 78.4%; Charolais x Angus, 76.5%. It was concluded that sire breeds showed important differences in the levels of calving difficulty. Charolais and Simmental crosses had larger birth weights and more calving difficulty. Jersey crosses were lightest at birth and experienced much less calving difficulty than other crosses. Bellows (1971a) points out that the heritability of birth weight is 0.48. This means that sire selection could be effective in controlling birth weight. A sire with a low birth weight will tend to sire calves with a low birth weight, and low birth weights mean reduced calving difficulty.

Dam Effect

Pelvic area is influenced by genetics, age, and body weight. Bellows (1971a) recorded the following measurements in Hereford cows (Table 1). In another study Bellows et al. (1971) compared breed, body weight and pelvic area among two-year-old heifers (Table 2). The results showed that crossbred heifers are slightly larger in pelvic area than either of the straightbred parent groups, at equal or lighter weights. Rice et al. (1972) reported that dystocia could be predicted in three-year-old heifers from their pelvic areas. Heifers

Table 1. Age differences in pelvic area and body weight.

Age	Pelvic Area (sq. cm.)	Body Wt. (lbs)
2	250	813
3	292	1023
4 and 5	332	1045

Table 2. Straightbred and crossbred heifers compared.

Breed	Age (days)	Weight (lbs)	Pelvic area (sq. cm.)
Angus	360	588	153.0
Hereford	386	596	157.2
Angus x Hereford	368	585	159.3

with pelvic areas less than 230 sq. cm. suffered 70% dystocia, whereas heifers with pelvic areas greater than 230 sq. cm. experienced only 12% dystocia. The pattern for two-year-old heifers was not so clearly defined, but in one group of Hereford heifers it was found that a 69% dystocia rate occurred in heifers with a pelvic area less than 200 sq. cm. and 28% from heifers having pelvic areas greater than 200 sq. cm. Data used by Rice at al. (1972), from other stations involved in the study of pelvic areas, showed a high correlation between pelvic area and dystocia.

Gestation Length

Length of gestation is highly heritable and has a significant effect on birth weight. The calf grows throughout the gestation period. The longer the gestation period, the greater the weight of the calf (Bellows et al. 1971). Gerlaugh et al. (1951) in comparing the gestation period of a herd of purebred Hereford dams and a herd of purebred Angus dams, found that the Hereford had a gestation period 3.3 days longer than the Angus (285.4-282.1). The crosses, and reciprocal crosses of Hereford and Angus had an intermediate length gestation (283.1). Bellows et al. (1971) indicated that the fetus could gain 1.1 kg per day during the late stages of gestation. Length of gestation was found to be highly significant in relation to birth weight (Lasley et al. 1961).

Genotype of the calf does not account for more than 40% to 50% of the variability in birth weight (Rice et al. 1972). Environment, including maternal environment, therefore, accounts for the remainder of the variation in birth weight. Jobert et al. (1958) conducted a study involving crossing small Dexter cattle (average mature cow weight 295 kg) and large Devon cattle (average mature weight 715 kg). The normal birth weight of the Dexter calves is 52 pounds, while the normal birth weight of South Devon calves is 97 pounds. The mean birth weight of the Dexter-South Devon cross was 73.4 pounds, while the birth weight of the South Devon-Dexter cross was 59.1 pounds. The conclusion was that if maternal environment is optimal, the fetal birth weight will be expressed at its genetic potential. If the maternal environment is restricted, the fetal birth weight will also be restricted.

Nutrition and Dystocia

The feeding of first calf heifers during pregnancy is of major importance. The question is, will the gestation feed level increase calf birth weights and create more calving difficulty? Bellows (1971b) conducted a study to determine the effects of gestation feed level on calf birth weight, and calving difficulty. The study involved crossbred Angus-Hereford heifers bred to a single Angus sire. The low level ration was 8 pounds of hay plus 4 pounds of grain daily (7.0-7.5 pounds of total digestible nutrients or TDN). The high level ration was 16 pounds of hay plus 8 pounds of grain (13.8 to 14.0 pounds of TDN) daily. The results showed that the heifers on the high feed level weighed 127 pounds more than the heifers on the low feed level at parturition.

Calves born to the heifers on the high feed ration weighed 72 pounds at birth, calves born to the heifers on the low level of feed weighed 63 pounds at birth, a difference of 9 pounds.

The calving difficulty percentage, averaged from a score of 1 (no difficulty) to 4 (extremely difficult), showed the low fed dams with a score of 1.9 and the high fed dams with a score of 2.0, essentially the same score. Laster (1974), and Tudor (1972) report similar findings.

Other studies indicate that only in excessively fat heifers are difficulties, and deaths, of both dam and calf, markedly increased (Wiltbank et al. 1965, Tatusck et al. 1961, Pinney et al. 1961).

Wiltbank (1978) suggested feeding heifers to gain 100 to 120 pounds the last 120 days of gestation. Albaugh (1972) stated that larger cows have larger calves but fewer calving problems.

Consequences of Dystocia

Calf mortality, at or near the time of birth was 4 times greater (20.4%) in calves experiencing dystocia than in calves having a normal birth (5.0%) (Laster and Gregory, 1973). Smith et al. (1976) reported death losses of 11.5% in difficult births. Losses of calves requiring little or no assistance were 3.1%. Age of the dam had no significant influence on calf mortality in parturitions involving dystocia (Laster and Gregory, 1973).

Albaugh (1972) reported a mortality rate of 2.4% for two-year-old Hereford heifers bred to Hereford bulls. Moore et al. (1956) reported 5% of the Hereford two-year-old heifers died at parturition in his study.

A difficult parturition can affect subsequent reproduction performance. Brinks et al. (1973) stated that Hereford heifers experiencing calving difficulties as two-year-olds weaned a 63% calf crop as three-year-olds. Heifers having no calving problems as two-year-olds, weaned a 77% calf crop, and the calves were 21 kg heavier than the calves produced by the heifers that experienced dystocia. Laster et al. (1973) found that dystocia affected conception rate and the percentage exhibiting estrus. In their study involving Angus and Hereford heifers, heifers that calved without difficulty had 68.3% detected in estrus, and a 66% conception rate. Heifers that did experience calving difficulties had 59% detected in estrus, with a conception rate of 50.6%. These data were gathered over a

45 day artificial insemination period.

Observations on the Course of Labor

Arthur (1966) in discussing bovine obstetrics divided parturition into three stages: (1) cervical dilation; (2) rupture of the allanto-chorin and expulsion of the fetus; (3) expulsion of the fetal membranes. Cervical dilation, in two-year-old heifers, can take up to 24 hours, the mean was 6 hours, he reported. Dufty (1972), observing labor duration and expulsion of the fetus, reported a mean of 1 hour and 52 minutes and a range of 17 minutes to 6 hours and 31 minutes, for completion of this stage of labor. The third stage, expulsion of the fetal membranes after delivery of the calf, occurs 0.5 hours to 8 hours after birth, he found.

METHODOLOGY

Introduction

The data for this study were collected over a seven year period (1972-1978) on the Knight Ranch in southern Alberta, Canada. The ranch is located 50 miles south of Lethbridge, Alberta. The Knight Ranch is situated on a geographical prominence known as the Milk River Ridge, and comprises one unit of 82,000 acres. The north fork of the Milk River forms the southern boundary of the ranch, with the exception of one 12 section pasture on the south side of the river. The elevation of the ranch is 4700 feet above sea level as compared to 3000 feet at Lethbridge. Pastures are native range, with areas of tame or improved pastures. Rough fescue, Western wheat grass, Speargrass, Blue lupine, Pasture sage, Sheep fescue and Idaho fescue are the chief forage species found in the native range. Alfalfa, Russian wild rye grass, Orchard grass, Crested wheat grass, Intermediate wheat grass, and Sanfoin were used separately or in a pasture mix in the areas planted to improve pasture. Improved pastures accounted for 10,000 acres of the range used for grazing.

Alfalfa hay, oats, and barley grain are raised on the ranch, and were the feeds used during the winter.

Heifer Calves

The mature cows begin calving the second week of April, with a calving period of 80-105 days. These cows are Angus-Hereford crossbreeds. One half of the cows are bred to Charolais bulls. This is a terminal cross, with all calves of this breeding being sold. The other half of the herd is bred to Angus or Limousin x Angus sires, unless the dam is 3/4 Angus. In this case, these cows will be bred to a Polled Hereford bull. All replacement heifers are selected from cows bred to the Angus, Limousin x Angus or Hereford sires. The heifers, upon which the data for this study was obtained, were produced under the above breeding system.

Breed and Numbers

The heifers studied were, commercial Herefords, and Angus x Hereford crossbreds. The following table shows the year, breed, and numbers used in the study.

Table 3. Year, breed and number of heifers.

Year	Breed		Row Total
	BWF[1]	Hereford	
1972	394	158	552
1973	541	11	552
1974	707	0	707
1975	680	0	680
1976	448	0	448
1977	451	0	451
1978	532	0	532
	3753	169	3923

[1]BWF - Angus x Hereford, black with white faces.

Preweaning and Weaning

During the first week of October all potential replacement heifer calves were given a booster vaccination for blackleg, malignant endema, and enterotoxemia. They were also vaccinated for Infectious Bovine Rhinotracheitis and treated for cattle grubs with a pour on insecticide product. The preweaning treatment involved 900 to 1000 calves, and weaning occurred three weeks after treatment. At weaning, the calves were sorted into three groups. Groups 1 and 2 had 425 calves each. These were the larger, thriftier calves. Group 3 consisted of the smaller heifers, and in this group any small steers, not sold, were placed. The calves were held in large, well bedded corrals for one week. Their rations consisted of second cut alfalfa and whole oats. After one week, the calves were turned out to graze in the alfalfa fields next to their corral and shed areas. They were gathered, checked, and locked into their shed area every evening. Open fronted sheds, bedded with straw, provided shelter for the calves. Sheds were bedded once a week or more often if the bedding became wet or excessively soiled. Water was provided by springs, and ran continuously through the water tanks. Ice on the tanks was never a serious problem. The concentrate was fed in stationary troughs with adequate space available for each animal.

The ration consisted of whole oats, and baled alfalfa (second cut), plus late fall grazing in the alfalfa fields. The desired weight gain for the wintering period of Nov. 1 to April 1, (151 days) was 1 pound per day. The ration, for the years 1972-1976, was fed once a day, in the morning. The system was changed in 1977, and for the years 1977 and 1978, the hay ration was divided between a morning feeding, and a late afternoon feeding. This second feeding was made when the calves were locked into their shed areas for the night.

A salt and mineral mix was offered free choice.

The heifers were checked twice daily for sickness. Health problems included pneumonia, the most common disease, coccidiosis, footrot, and bloat. Most pneumonia losses occurred 7-21 days after weaning. To reduce this problem of pneumonia, a prevention program was introduced in 1977. This program consisted of adding a sulfa based antibiotic to the drinking water of the calves. The treatment was initiated 7 days after weaning, and was continued for 7 days.

Selection of Replacements

Replacements were selected, depending on weather conditions during or near the first week of April. The criteria for selection were: (1) size; (2) weight; (3) quality; (4) soundness. The heifers were approximately 12 months of age at this time, and the desired weight was 600 pounds, minimum. The goal was 675 to 700 pounds at the start of the breeding period. Bulls were put out with the heifers June 15, thus the heifers had 75 days, from selection date to breeding, to reach the desired weight goal.

Identification

Heifers were year branded when they were selected for the replacement herd. A hot-iron brand was used, the last digit of the year the heifer was born was applied on the left hip. This year brand would also be used as a culling identification in her mature years.

Spring and Summer Pasture

The total number of replacements varied from year to year, but the pasture system remained the same for all years of the study. In mid-April the replacements were driven 8 miles to a 3 section pasture of native range. Water was provided by lakes and a small stream that flowed from March until late June. During the first week in May the heifers were moved into a fresh pasture, identical in size, feed, and water supply. The last week of May, the heifers were driven back to ranch headquarters, a final selection of replacements made, and the heifers selected for breeding moved into a tame pasture. Here they would remain through the breeding season. On June 15, the bulls were put in with the heifers for the breeding period, June 15 to August 15. The bull to heifer ratio was set at 1 to 20. Ten percent of the required number of bulls were held back, and then these fresh bulls were turned into the herd midway through the breeding schedule. Any injured or crippled bulls were replaced by sound animals. Breed of sire for the years 1972 to 1974 was Angus. In 1975 Limousin x Angus sires were introduced into the breeding program.

At the conclusion of the breeding season the heifers were moved into a fresh pasture. Any heifers observed in estrus were removed and later sold. In mid-September the bred heifers were treated for cattle grubs, using a pour on insecticide, and ear tagged with a number that would be used for identification at calving.

Health Problems

Some lameness, diagnosed as foot rot, occurred during each year of the study. Treatment consisted of an injection of long-acting penicillin, and drenching the infected area between the toes with a commercial foot-rot remedy. Inorganic iodine, (80% active ingredients) was mixed with the mineral mix at the rate of 1/2 pound per 200 pounds of mineral mix. Pulmonary emphysema was also a problem, accounting for a loss of 2-4 animals per year. Treatment as prescribed by a veterinarian was largely ineffective. Bloat was a very minor problem even though the heifers were grazing on tame pasture with alfalfa as one of the major plant species.

Care of the Pregnant Heifer - Fall and Winter

In mid-September, following the tagging and treatment for warble grubs, the bred heifers were trailed back to their spring pasture. Here they grazed until the first week in December. They were then moved to a fresh field where they could be watched more closely, and feeding of a supplement was started. For the years 1972-1975 a commercial beef pellet (17% protein) was fed, at the rate of 4 pounds per day. If grazing conditions became unfavorable, baled alfalfa hay was fed. Beef pellets were replaced by whole oats (8 pounds per day) in 1976, and hay was fed commencing January 1, regardless of grazing conditions. Hay was fed earlier if the heifers were unable to graze because of deep snow.

The heifers were trailed back to the ranch headquarters in late February, and were kept there until after they had calved.

Calving Facilities

Calving facilities consisted of the following: (1) a large drylot capable of handling up to 300 heifers, with floodlights for night surveillance; (2) hay stacked in the yard, with feed panels along all sides of the stack; (3) automatic waters; (4) calving barn; (5) sheds and corrals for mothering cows and calves, and for protection from spring snow storms; (6) small holding pasture; (7) loading chute in the corral system.

Calving Barn

The calving shed was a multi-purpose wooden quonset, with a cement floor. The quonset served as a storage shed for tractors during the winter, but was designed so that 16 box stalls, 8 down each side, could be set up. Pens were numbered to aid in identification of, and location of the heifers when they were calving.

Calving Procedure

One week prior to the expected calving time, 200 of the heifers that exhibited external signs of approaching parturition were put into the drylot area. Periodic checks, at 3 to 4 hour intervals, were made on a 24 hour basis. This time check was reduced to 1/2 hour intervals when calving started.

The following procedure was used in handling the heifer during parturition. At the first appearance of the amniotic membrane, or fetal placenta, the heifer was moved into the calving shed, and placed in a boxstall. In the record book provided, the pen number, cow number (read from her ear tag), and the time of day was recorded. The heifer was then left alone. The progress of the labor was observed so that assistance could be provided if necessary. The criteria used in diagnosing dystocia were: (1) one hour of labor, with strong contractions, but no part of the fetus visible; (2) inability of the heifer to move the fetus from an observed position, after one hour of labor; (3) appearance of just one front foot, or appearance of the hind feet.

Assistance, in conditions 1 and 2 as described above was given after the 1 hour observation period. In condition 3 assistance was given immediately when presentation position was observed.

Every birth was ranked, by code, according to the degree of parturition difficulty experienced by the heifer. The code was: (1) no assistance; (2) minor assist (3) major assist (calf puller used); (4) caesarian; (5) wire saw foetotomy. The following information was also recorded after the birth of the calf: (1) sex of calf; (2) time of delivery; (3) type of presentation (normal, front leg back, head back, backwards, hiplock, and breech). The calf's basic responses were also noted. The observations recorded were, was the calf strong and healthy, weak and unable to get up, and could the calf find the udder and nurse. Information on the cow was also recorded. The data included: (1) death of the cow; (2) was she weak; (3) was she paralysed; (4) did a uterine prolapse occur following parturition; (5) were her mothering instincts normal, or did she try to deliberately hurt the calf. Survival of the calf was recorded. If death occurred, time of occurrence was noted: (1) at birth or shortly after; (2) within 1-24 hours; (3) within 25-48 hours; (4) 49 hours to 30 days. If death occurred after 49 hours up to 30 days, cause of death was recorded if the herdsman was able to accurately establish the cause. Some of the causes of death were: (1) scours;

(2) pneumonia; (3) chilling; (4) starvation; (5) or unknown.

The cow and calf were kept in the boxstall for 8-10 hours following parturition, and then moved to the mothering sheds. They were held there for two days and then allowed to go into a small holding pasture. Not more than 100 cows and calves were allowed in the pasture at any one time. Those judged to be well mothered up, were moved to the larger pastures used for spring grazing. This pattern of mothering up the pairs was used from 1972-1976. In 1977-1978, all cow and calf pairs, if judged to be well mothered up, were hauled by trailer, to the large pastures when the calf was two days old. The pastures had corral facilities and a large shed for the cows and calves to use in stormy weather.

Postpartum Care

Cows with calves, even on pasture, were fed 18-20 pounds of baled alfalfa hay daily. This was supplemented with whole oats or rolled barley if the temperature was below freezing, or if it snowed. All supplemental feeding was stopped when temperatures moderated and sufficient grass was available for the cows.

Disease and Mothering Problems

Cows and calves were checked twice a day (morning and late afternoon) to detect scours, pneumonia or starvation in the calves, and infection or tight udders in the cows. Cows that had experienced dystocia, were treated with uterine bolus at parturition, but were watched closely in the pastures. Sick animals were treated with antibiotics in the field. If special treatment was needed, the cow and calf were taken back to the ranch, confined, and treated.

Sanitation and Disease Prevention

Sterile, shoulder length, plastic gloves were used when performing any uterine examination. These gloves were also used when repositioning a calf, assisting during parturition, or treating the cow with uterine boluses. Obstetrics chains were washed in disinfectant between uses. Boxstalls were cleaned, sprinkled with slacked lime, and bedded with fresh straw after each parturition use.

Calves were given 2 cc., intramuscular, of Vitamins ADE before leaving the calving shed. Calves were also ear tagged, with a number corresponding to that of their mother, so future identification and pairing was possible, before leaving the calving shed.

Calf Adoption

If the dam was sick, lacked milk, refused to claim the calf, or died, the calf was transplanted onto a receptive dam.

Missing Data

Length of labor was not included in the observations for 1972-1973. Also it was not possible to collect the calving data on heifers that calved significantly earlier than the main group or outside of the calving yard.

Statistical Methods

The statistical computations were made by using the Statistical Package for the Social Sciences (SPSS, Nie 1978), available on the Utah State University computer, Barrows 6700. This statistical package performed chi-square or analysis of variance, as appropriate, on the data. Chi-square was used to test count data significance for those factors where expected values were available. Analysis of variance was applied to the other variable data. Duncan's multiple mean tests were applied to the means to determine significant differences.

RESULTS AND DISCUSSION

Type of Presentation and Degree of Calving Assistance

As shown in Table 4, 50% of the 3923 calves were born unassisted. Of the other 50%, 34.5% required only minor assistance, while 15.1% required use of a calf puller and major help while only 0.3% were caesarean sections and 0.05% wire saw foetotomy. To a great extent, as pointed out in the methods section of this paper, it is a management decision as to when minor assistance is given, but the decision to use the calf puller and the other major types of assistance are largely forced decisions.

The level of occurrence of difficult parturition and the levels of different degrees of assistance compare closely in value with the 56.9% unassisted births reported by Laster et al. (1973), and 59.1% reported by Clay Center (1976). Major assists levels of 38.3% and 39.4%, respectively, were reported by Laster et al. (1973) and Clay Center (1976). Laster et al. (1973) stated that caesarean sections were needed in 3.3% of the births while foetotomy was not used as a method of correcting dystocia. Clay Center (1976) data reveals 1.3% of the births were completed through the use of caesarean section. Sloss et al. (1967) used foetotomy as an obstetrical procedure to correct dystocia in 12% of the cases he treated in a study completed in Australia.

An inspection of Table 4 reveals that 97.1% of all calves born showed normal presentation at parturition. Of those with abnormal presentation, leg back, and backwards were most common with each making up 1% of the calves born. Head back occurred in 0.5% of the calves, hiplock in 0.3% and breech 0.2% of all calves born. Literature comparisons were not available for the head back, leg back, hiplock and breech. Bellows (1971b), in discussing dystocia, reported abnormal presentations occurred in 3% of the parturitions. No breakdown of types of presentation was given. Posterior presentation occur in 5% of bovine paturitions according to Williams (1948). Clay Center (1976) reported that 2.5% of the parturitions in a study group of Hereford heifers were posterior presentations. Laster and Gregory (1973) reported that posterior presentation occurred in 1.45% of the birth in a group of two-year-old Angus heifers.

No parturitions were completed unassisted if calf presentation was not normal (Table 4). The decision to immediately give assistance when abnormal presentation was discovered may account for this. Presentation of the fetus in a breech position required major assistance to complete the parturition in all recorded cases (Table 4). Posterior presentation ranked next in severity and 94.7% of the fetuses presented in this position required major assistance, 2.6% required minor assistance and 2.6% required a caesarean section to correct the dystocia (Table 4). The head back presentation and the leg back required major assistance in 75% and 44.7% respectively, of the cases recorded.

Table 4 also reveals that among those calves with normal presentations, 51.5% required no assistance; 34.7% required minor assistance and 13.4% required major assistance or use of the calf puller. Those

Table 4. Influence of type of presentation upon the degree of calving assistance required.

Type of Presentation	Degree of Calving Assistance: Unassisted	Minor Assist	Major Assist	Caesarean Section	Foetotomy	Raw Sum
Normal (Count)	1961	1323	512	11	1	3808
Row PCT	51.5	34.7	13.4	0.3	0.1	
Col PCT	100.0	97.8	86.2	84.6	50.0	
PCT of TOTAL	50.0	33.7	13.1	0.3	0.0	97.1
Leg back (Count)	0	21	17	0	0	38
Row PCT	0.0	55.3	44.7	0.0	0.0	
Col PCT	0.0	1.6	2.9	0.0	0.0	
PCT of TOTAL	0.0	0.5	0.4	0.0	0.0	1.0
Head back (Count)	0	3	15	1	1	20
Row PCT	0.0	15.0	75.0	5.0	5.0	
Col PCT	0.0	0.2	2.5	7.7	50.0	
PCT of TOTAL	0.0	0.1	0.4	0.0	0.0	.5
Backwards (Count)	0	1	36	1	0	38
Row PCT	0.0	2.6	94.7	2.6	0.0	
Col PCT	0.0	0.1	6.1	7.7	0.0	
PCT of TOTAL	0.0	0.0	0.9	0.0	0.0	1.0
Hiplock (Count)	0	5	5	0	0	10
Row PCT	0.0	50.0	50.0	0.0	0.0	
Col PCT	0.0	0.4	0.8	0.0	0.0	
PCT of TOTAL	0.0	0.1	0.1	0.0	0.0	.3
Breech (Count	0	0	9	0	0	9
Row PCT	0.0	0.0	100.0	0.0	0.0	
Col PCT	0.0	0.0	1.5	0.0	0.0	
PCT of TOTAL	0.0	0.0	0.2	0.0	0.0	.2
Column Sum	1961	1353	594	13	2	3923
PCT of TOTAL	50.0	34.5	15.1	0.3	.05	100.

values are obviously only slightly different from the values for all calves born. This indicates that normal presentation of the calf gave only a slight benefit as far as avoiding dystocia is concerned. Factors other than abnormal presentation are, then, the major contributors to dystocia.

The data collected in this study do not permit identification of all of these factors. Size at birth, body conformation and size of pelvis in the heifer, are, undoubtedly all important contributors. Rice et al. (1972) concluded that birth weight was the single most important factor associated with dystocia, and pelvic area of the dam was second. Smith et al. (1976) stated that dystocia levels increased linearly with birth weight. An increase of 1 kg of birth weight resulted in 1% increase in assisted parturitions. In relating pelvic area to dystocia, Rice et al. (1972) reported that heifers with pelvic areas less than 200 sq. cm. and those with pelvic areas greater than 200 sq. cm. had dystocia rates of 68.7% and 28%, respectively.

Sex of Calf

Sex of calf had a definite influence upon degree of difficulty experienced at calving, with male calves requiring more assistance (Table 5). Unassisted births occurred in 58.3% of the female births, but in only 41.3% of the male births. In the minor and major assistance categories a lower percentage of females required these levels of assistance, 30.4% vs 39.6% in minor assistance and 11.0% vs 18.7% in major assistance. Although the number of caesarean sections required was small in both sexes, more were required among the males.

Only one foetotomy was performed in each sex group (Table 5).

These values compare reasonably well with those reported in the literature. Laster and Gregory (1973) reported 67.1% and 46.7% of the females and males born unassisted or with minor assist. Major assistance was given to 30.5% of the females and 46.2% of the males, caesarean section was needed to correct dystocia in 1.1% of the female calf births and 5.5% of the males. Calf sex influences birth weights and male calves are heavier than females, 31.0 kg vs 28.8 kg (Laster and Gregory, 1973). The influence of birth weight on calving difficulty was referred to earlier in the results.

Genotype of Dam

During the first year of the project both straightbred Herefords and Angus x Hereford crossbreds heifers were in the herd. For all other years of the study Angus x Herefords crossbred heifers made up the study herd. Table 6 shows the comparative calving difficulties for the two genotypes.

The genotype of dam was significant in all categories. The crossbred heifers had a higher percentage of calves unassisted and a lower percentage required minor assistance, and a lower percentage required major assistance that involved the use of the calf puller (Table 6). Unassisted parturitions occurred in 62.4% of the crossbred heifers, but only 36.7% of the Herefords calved unassisted. Minor assistance was given to 30.5% of the crossbreds and 45.6% of the Herefords. The Herefords required major assistance in 17.1% of their parturition, while the crossbreds had a 7.1% level of major assistance. This

Table 5. Degree of dystocia experienced as related to sex of calf.

Kind of Assistance	Sex of Calf	
	Female (%)	Male (%)
Unassisted	58.3	41.3*
Minor Assistance	30.4	39.6*
Major Assistance	11.0	18.7*
Caesarean	.30	.40
Foetotomy	.05	.05

*P<.05 indicates significant sex differences between characteristics.

Table 6. Genotype of dam influence.

Genotype of Dam	Levels of Calving Difficulty									
	Un-assisted		Minor Assist.		Major Assist.		Caesarean		Foetotomy	
	No.	%	No.	%	No.	%	No.	%	No.	%
Angus X Hereford	246	62.4	120	30.5	28	7.1	0	0	0	0
Hereford	58	36.7*	72	45.6*	28	17.1* (17.7)	0	0	0	0

*P<.05 indicates significant genotype of dam influences between characteristics.

parallels results obtained by Laster et al. (1973) and Sagebiel et al. (1969) in studies comparing genotype of dam and calving difficulties. Sagebiel et al. (1969) reported severe difficulties in 18.2% of the parturitions in two-year-old Hereford heifers, in this study group, but only 9.6% of the crossbred group required major assistance.

Survival and Mortality

Survival, mortality rates and time of death as related to dystocia are shown in Table 7. Serious birth difficulties that require major assistance involving calf pullers was associated with a loss of 38.6% of the involved calves. Survival among calves that required only minor assistance was only slightly less than among those calves that were born unassisted. Times at which death occurred was also very similar in the two groups. Among those calves that had required major assistance death losses were heavier at each measurement period than in the unassisted or minor assistance group.

The heavy concentration of death losses in the group requiring major assistance, however was at, or shortly after, birth. At this period deaths among those requiring major assistance amounted to 27.6% of all calves born in the major assistance categories. These earlier deaths equalled 71.5% of all deaths in this group. Losses among those requiring caesarean sections or foetotomy were all in the early postnatal period.

Table 7, also, reveals that 90.8% of all calves born survived leaving a total death loss of 9.2% for calves from these two-year-old heifers.

Laster and Gregory (1973) in reporting mortality due to dystocia, measured from birth to 24 hours, found that 8.45% of the calves from unassisted parturitions died. Calves requiring major assistance suffered a 16.6% mortality rate which is in close agreement with 15.1% as found in this study. The losses, due to dystocia, which necessitated a caesarean section were 22.85%. This is a significant difference from

Table 7. Survival, mortality and dystocia.

	Unassisted	Minor Assist.	Major Assist.	Caesarean	Foetotomy	Weighted Row Average
	%	%	%	%	%	
Survived	96.7	96.2	61.4	7.7	0	90.8
Died at or Shortly after birth	1.0	0.7	27.6	92.3	100.0	5.3
Died within 1-24 hours	0.4	0.4	3.5	0.0	0.0	0.9
Died within 25-48 hours	0.1	0.3	2.2	0.0	0.0	0.5
Died 49 hours to 30 days	1.9	2.4	5.2	0.0	0.0	2.5
Total for deaths within group	3.4	3.84	38.6	92.3	100.0	

the 92.3% reported in this study. Caesareans, in this study, were performed only as a last resort after all other attempts to deliver the calf had failed. Death of the fetus had often already occurred prior to the performing of the caesarean.

The relationships of types of presentations to survival are presented in Table 8. Breech presentation, with a 66.7% death loss had the highest level of fatalities. These deaths all occurred at, or shortly after, birth. Backwards presentation ranked next with 52.7% death loss and was closely followed by head back at 50.0%. Hiplock showed 30.0% loss and leg back was the least fatal of the abnormal presentations with 21.0% fatalities.

The distribution and significance of these losses are shown in Table 9. Values in this table were obtained by multiplying the percentage of births for each dystocia classification by the level of death within the classification. As indicated in Table 9, death losses in those calves requiring major assistance amounted to 5.83% of all calves born, whereas, losses in the unassisted and minor assisted groups were 1.7% and 1.33% of all calves born, respectively. Although losses among those requiring caesarean sections and foetotomy were very high 92.3% and 100%, respectively (Table 7) the rate of occurrence is so very low that only 0.277% and .05% of all calves born resulted in deaths in these two categories.

It seems that under the management system in this study, dystocia of a degree requiring minor assistance imposes no appreciable added stress. Consequently, survival is approximately equal to that for calves that were born unassisted. The more serious degrees of dystocia,

Table 8. Type of presentation as related to calf survival status.

	Calf Survival Status					
Type of presentation	Survived	Died at or shortly after birth	Died 1-24 hours postpartum	Died 25-48 hours postpartum	Died 49 hrs. to 30 days postpartum	Total deaths
	%	%	%	%	%	%
Normal	91.8	4.5	0.8	0.4	2.5	8.2
Leg back	78.9	15.8	2.6	0.0	2.6	21.0
Head back	50.0	45.0	0.0	0.0	5.0	50.0
Backwards	47.4	36.8	5.3	5.3	5.3	52.7
Hiplock	70.0	30.0	0.0	0.0	0.0	30.0
Breech	33.3	66.7	0.0	0.0	0.0	66.7

Table 9. Weighted death loss distribution among categories of dystocia.[a]

	Dystocia Categories				
	Unassisted	Minor Assist.	Major Assist.	Caesarean	Foetotomy
% loss x % occurrence	1.7	1.33	5.83	.277	.05

[a]Derived from categorized death loss values from Table 7 and levels of assistance values from Table 4.

however, were associated with much higher losses.

Parturition Duration and its Effects

Parturition is a sequential physiological process that, without complications, required an average of 74.8 minutes in these heifers (Table 10). All degrees of dystocia increased the length of time involved with parturition. Increased severity of dystocia was accompanied by increases in time required to complete the birth process. The levels of these increases are illustrated in Table 10, with minor assistance cases requiring 107.1 minutes, major assistant cases 121.8 minutes, caesarean sections 209.4 minutes and foetotomies 135 minutes.

The amount of the increase in time for delivery is partially a result of the time associated with management making a decision. The other portion of the increased time required is due to time being used in the process of rendering assistance. This is directly related to the degree of severity of dystocia. Consequently the more

Table 10. Length of labor and dystocia.

	Count	Labor mean minutes	Standard error of the mean
Unassisted	987	74.83[a]	± 1.9
Minor Assist	923	107.09[a]	± 2.5
Major Assist	412	121.82[a]	± 4.2
Caesarean	9	209.44[b]	±36.9
Foetotomy	2	135.0[ab]	±45.0

Values having no superscripts in common differ at the $P \leq 0.5$ level.

serious the dystocia becomes the longer the duration of parturition will become.

Comparative duration for the caesarean and foetotomy cases reflect management decisions to a major degree.

Dufty (1972) in studying bovine parturition, stated that the mean interval between rupture of the amnion and normal delivery was 112 minutes (16 observations; range 17 minutes to 391 minutes). No record of time was kept on heifers experiencing dystocia in his study. Laster and Gregory (1973) concluded that 90% of the calves lost at parturition due to dystocia, died because: (1) assistance was provided too late; (2) degree of difficulty; (3) the time required to remove the calf was excessive.

Survival

Table 11 compares length of labor and survival or death of the calf. Calves that were alive following parturition were subjected to the stress of parturition for a shorter length of time than those

Table 11. Length of labor and survival.

	Count	Labor mean minutes	Standard error of the mean
Survival	2111	93.6	± 1.6
Died at or shortly after birth	120	130.0	± 8.9
Died (1-24 hours)	24	135.4	±24.6
Died (25-48 hours)	14	135.7	±24.4
Died (49 hrs to 30 days)	64	107.5	±10.7

that died, either at or shortly after birth, or during any of the recorded time frames included in this study. The parturition duration is shown in Table 11. Calves that survived were delivered in 93.6 minutes. Those dead at birth or that died shortly after birth required 130.0 minutes. Those that died within 1 to 24 hours required 135.4 minutes, those that died within 25 to 48 hours, required 135.7 and those that died after 49 hours through 30 days required 107.5 minutes. No values were found in the literature for parturition duration comparisons.

Calf Response

Parturition duration and calf response are compared in Table 12. Calves categorized as normal, (were up and nursing within one half hour) were delivered in 94.6 minutes. This time is very similar to that recorded in Table 11 on calves that survived. Weak calves (those needing assistance to stand and nurse, or that needed to be bottle fed), were under parturition stress 114.1 minutes. This time length

Table 12. Length of labor and calf response.

	Count	Labor mean minutes	Standard error of the mean
Normal	2155	94.6	± 1.5
Couldn't find udder	5	52.0	±19.1
Weak	45	114.1	±13.6

approaches the time of 121.8 minutes, the time required to complete a major assist (Table 10). The stress of a major assist and length of time involved to complete the labor appear to be factors contributing to this calf response. Five calves that were observed to have difficulty in finding the udder of their mother, had a parturition duration of 52 minutes (Table 12). Assistance, by the attendant, was needed for several days to save the calves experiencing this problem. The question arises, is there a minimum time for parturition duration, which if not reached, results in the failure of natural instincts being triggered in the calf, the lack of which might contribute to its death.

Sex of Calf

Calf sex, which is a factor of dystocia, was also shown to be highly significant when compared to parturition duration. Table 13 reveals that male calves had a longer parturition duration than did female calves (104.28 vs 88.47).

Table 13. Length of labor and sex of calf.

	Count	Labor mean minutes	Standard error of the mean
Male	1180	104.28^{a}	±2.3
Female	1133	88.47^{b}	±2.1

Values in same column having no superscripts in common differ at the $P \leq .05$ level.

Length of Labor and its Affect on the Dam

Length of labor and its resulting effect on the dam was compared in two areas, mothering instinct and physical condition of the dam after parturition. Table 14 refers to the mothering instinct of the dam. No significant differences were found among the groups. It should be noted that the cow that deliberately damaged the calf had a very short parturition length. The dams, in the study, were, as a group, very good mothers as indicated by the count totals in Table 14.

The effect of labor length of the cow's physical responses is shown in Table 15. Cows classed as weak following delivery did have a significantly longer labor than cows in which physical responses were classified as normal (169.3 vs 95.6 minutes). No literature comparisons are available for this information.

Table 14. Length of labor and mothering.

	Count	Labor mean minutes	Standard error of the mean
Normal	2313	96.5	± 1.5
Wouldn't claim calf	13	92.4	±23.7
Accidental damage to calf	1	60.0	
Deliberate damage to calf	1	15.0	

Table 15. Labor length and cow response.

	Count	Labor mean minutes	Standard error of the mean
Normal	2305	95.6^{a}	± 1.5
Weak	22	169.3^{b}	±22.9
Died	4	155.0^{ab}	±38.2

Values having no superscripts in common differ at the $P \leq .05$ level.

Management Affects

One change in management practices involved changing the genotype of sires with which the heifers were mated. Angus bulls sired the calves for the first three years and Limousin x Angus crossbred bulls sired the calves for the last four years of the study. Effects of years are confounded with genotype of sire effects so a definite measure of sire effects is not possible. However, the differences are sufficiently large to give some confidence that genotype of sire did affect levels of calving difficulty.

Table 16 shows the comparative dystocia levels for the two sire genotypes. Overall averages show higher levels of dystocia for calves sired by Limousin x Angus bulls. The differences in level are more pronounced in males than females. As pointed out earlier in this paper more calving difficulty occurs with male calves. However, the use of Limousin x Angus bulls appeared to increase levels of dystocia by 10.1% in males and 4.4% in females for combined categories of dystocia. For those calves requiring major assistance the increase was 6.1% and 2.6% for male and female calves, respectively.

A weighted average, with male and female calves combined within sire genotypes over all years, shows 8.2% (53.9% vs 45.7%) more calves required assistance, for all types of assistance, for the Limousin x Angus sired calves. A similar comparison in the major assistance category indicates 4.3% (17.2% vs 12.9%) more calves involved in the Limousin x Angus sired calves.

Part of the economic significance of this difference associated

Table 16. Genotype of sire influence upon levels of dystocia.

		Levels of Dystocia			
		Total of all assisted births		Major assists	
Year	Genotype of Sire	% Males	% Females	% Males	% Females
1972	Angus	53.9	35.7	13.9	6.3
1973	Angus	56.6	40.4	14.4	11.0
1974	Angus	50.3	38.5	18.5	11.9
Weighted Average		53.3	38.2	15.8	9.9
1975	Limo x Angus	65.3	54.2	25.6	17.0
1976	Limo x Angus	57.7	33.2	15.9	6.3
1977	Limo x Angus	64.7	42.6	14.0	8.1
1978	Limo x Angus	64.1	45.0	28.6	16.5
Weighted Average		63.4	42.6	21.9	12.5

with genogype of sire is apparent from application to the data collected in this study. If all of the 3923 calves produced, had been sired by Limousin x Angus crossbred bulls 17.2%, or 675, would have required major assistance. If Angus bulls had sired all the calves 12.9%, or 506, would have required major assistance. This gives a difference of 169 calves requiring major assistance. As shown in Table 4, 38.6% of the calves requiring major assistance died prior to 30 days of age. This would give a differential death loss associated with sire genotype of 65 calves. At 1979 price levels these calves, if alive, would have a value at birth to 30 days, of at least $150.00 and a weaning value of approximately $450.00.

In addition to the loss, the Limousin x Angus sired calves required more minor assistance. While this did not increase death loss it did require more man hours of labor and gave corresponding cost increases.

The cattle manager, in his decision making, would need to balance these increased costs associated with using the Limousin x Angus against the expected increase in weaning weight, possible higher survival rate from 30 days to weaning, and comparative selling price.

Clay Center (1976) concluded that sire breed showed important differences for level of calving difficulty and preweaning weights and growth rates of their progency. Hereford x Angus, South Devon, and Limousin crosses were similar for these traits and intermediate between the Jersey-sired calves and the heavier, more growthy Charolais and Simmental crosses. Calving difficulty in the Charolais cross calves from two-year-old Angus x Hereford dams was 74%, over all categories of difficulty. Limousin sires on Hereford x Angus dams gave 72% calving difficulty, while Angus sires on Hereford x Angus dams gave 51%.

The second management practice examined concerned the method of moving the heifers and their new-born calves to pasture. During the first five years of the study cows and calves were grouped and driven from the calving area to the range pasture. During the last two years the cows and their calves were loaded in a truck and hauled to the pasture at approximately 36 hours postpartum. The pastures were approximately 2 miles from the calving area.

Management involving method of moving the cattle to pasture is confounded with years which prevents making a fully proper comparison. However, the levels of death losses, shown in Table 17 suggests a definite advantage for hauling the cows and calves to pasture. Average yearly losses under the driven system was 19.4 as compared to 10.5 when hauled. As shown in Table 17 losses in only one of the five years, when calves and their mothers were driven, was comparable to losses under the hauling management system. In all other years, losses under the driven system were almost double those under the hauling system.

Table 17. Calf losses under two methods of moving to pasture.

Method of moving	Year	Died 49 hrs to 30 days postpartum	Total taken to pasture
Grouped and driven	1972	3.57%	504
	1973	1.92%	521
	1974	4.42%	634
	1975	3.39%	590
	1976	5.06%	415
Average		3.65%	532
Hauled by truck	1977	1.62%	431
	1978	2.99	469
Average		2.33%	450

SUMMARY AND CONCLUSIONS

Causative factors and some consequences of dystocia were studied in 3923 parturitions in two-year-old heifers. Data were collected for the years 1972 through 1978. Hereford and Angus x Hereford crossbred dams were used in 1972. During the six remaining years, 1973-1978, Angus x Hereford heifers were used. Angus sires were used the first three years of the study and Limousin x Angus crossbred sires were used for the last four years. Of the 3923 observed births among two-year-old heifers, 50% required some form of assistance. Minor assistance was required by 34.5% and major assistance by 15.1%. The need for caesarean section and foetotomy was rare with only 0.3% and .05% respectively, being required.

Abnormal presentation was observed in only 2.9% of the births. Assistance was immediately provided in all of these cases. The most common types of abnormal presentation were leg back and backwards. Each of these occurred in 1% of all births. Head back was present in 0.5%, hiplock in 0.3% and breech in 0.1%.

The fact that 50% of the calves required assistance at birth combined with the fact that only 2.9% were abnormally presented indicates that the major causes of dystocia are causes other than abnormal presentation. These major causes were not all identified in this study. Observations and results of other studies reported in the literature would indicate that size of calf at birth and pelvic opening size in heifers are pertinent.

Sex of calf had a definite influence upon degree of calving difficulty experienced, with male calves requiring more assistance. Unassisted births occurred in 58.3% of the female births, but in only 41.3% of the male births. Minor assistance was needed in 30.5% of the female births and 39.6% of the male births. Major assistance was provided for 11.0% of the female and 18.7% of the male births. Completion of parturition by caesarean section was needed in .25% of the female births and .36% of the male births. Foetotomy, for male and female calves, was .05%.

Genotype of dam was significant in all categories examined. Crossbred heifers had a higher percentage (62.4% vs 36.7%) of unassisted births than Hereford heifers. Crossbreds had a lower percentage (30.5% vs 45.6%) of calves requiring minor assistance as compared to Herefords. In the major assistance category, crossbred heifers again required fewer major assists than did Hereford heifers with 7.1% compared to 17.7% needed.

The most fatal type of abnormal presentation was breech with which there was a death loss of 67.7% among calves experiencing this problem. Backwards presentation ranked second in this respect with 52.6% death. Head back, hiplock and leg back presentations were fatal in 50%, 30% and 21.0%, respectively, of the calves experiencing dystocia for these reasons.

Dystocia of a degree requiring minor assistance imposed no appreciable added stress. Consequently, survival was approximately equal to that for calves that were born unassisted (96.7% vs 96.2%). The more serious degrees of dystocia, however, were associated with much higher losses. Death followed in 38.6% of the calves that had required major assistance. Twelve of the thirteen caesarean sections cases were terminal.

Ninety and eight-tenths percent of all calves born survived through the 30 day period of the study. Of the 9.2% that died, 6.2% died at or within 24 hours of birth. Losses were particularly heavy in this period, birth to 24 hours, among those that had required major assistance with 71.5% of all deaths in this group being during the time period. There was no appreciable difference in survival or time of deaths among those calves that required minor assistance as compared to calves born unassisted.

Increased severity of dystocia was accompanied by increased time required to complete the birth process. The amount of the increase in time for delivering is partially a result of the time associated with management making a decision. The other portion of the increased time is due to time being used in the process of rendering assistance.

Labor duration and sex of calf were found to be significant with male calves experiencing a longer parturition than females, 104 minutes vs 88 minutes, respectively.

Genotype of sire and calving difficulty could not be accurately determined. However, the increase in dystocia after Limousin x Angus bulls were introduced into the program, as compared to when Angus bulls were used, suggests that genotype of sire did affect levels of calving difficulty.

Methods of moving cattle to pasture were examined even though it was recognized that method and years were confounded. The levels of death loss suggests that there is a definite advantage obtained by hauling the cows and calves to pasture, rather than grouping, and driving them after the calves are one week old.

The transition of the fetus from the stable uterine environment to that of a separate existence is a hazardous transition. The number of problems either, in-utero or during birth, may interrupt the struggle for life, with death resulting. It is the responsibility of the producer to acquire the skills and knowledge to resolve quickly and skillfully, the problems that occur during parturition.

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