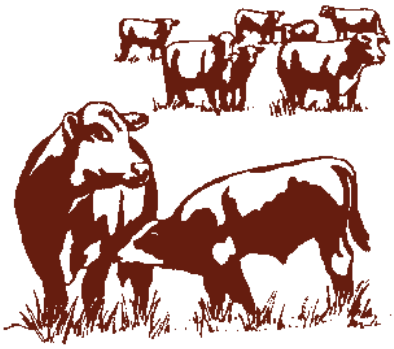
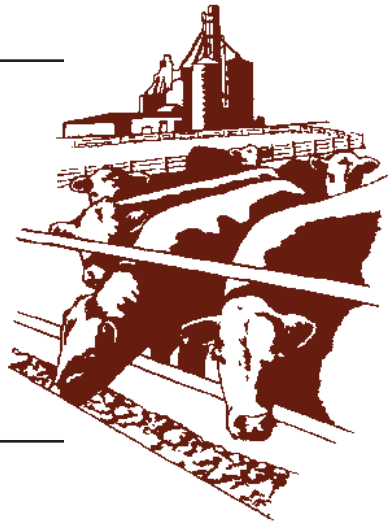


Beef Cattle Handbook



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Pelvic Measurements For Reducing Calving Difficulty

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Calving difficulty results in a major economic loss to beef producers. This loss is estimated at $750 million annually nationwide.

Calving difficulty increases calf death loss, cow mortality, labor and veterinary costs; it delays the return of cows to estrus and reduces conception rates. It also lowers calf weaning weight and market value, which results from breeding of young heifers and cows to easy calving bulls to reduce calving difficulty.

Studies show calf losses of four percent within 24 hours of birth for calves born unassisted, compared to 16 percent for calves requiring assistance. Montana research indicates 57 percent of all calf losses were due to dystocia (calving difficulty).

Calving difficulty is becoming a greater concern for beef producers because of the increased emphasis on rapid growth rates, heavier weaning weights and improving cow efficiency. As producers select bulls for more growth, larger calves at birth and more calving difficulty can be expected.

Importance of Pelvic Measurements

Many factors are associated with calving difficulty, including: small first-calf heifer, large fetus, male fetus, small pelvic size of dam, long gestation, heavy birth weight sire, dam too thin or too fat, and abnormal fetal presentation at calving. Research indicates the major cause of dystocia is a disproportion between the calf size at birth (birth weight) and the cow's birth canal (pelvic area).

Figure 2 shows the relationship of calf birth weight and cow pelvic area to the incidence of dystocia in 2-year-old heifers in a study in Montana. An Oklahoma study showed calves born unassisted were seven pounds lighter at birth compared to those born with assistance (Belcher, 1979). Heifers with small pelvic areas experienced an 85 percent difficulty rate compared to 31 percent difficulty for heifers with large pelvic areas. South Dakota research showed heifers with below average pelvic areas (less than 140 cm2) had twice the incidence of dystocia as those with above average pelvic areas (49 percent versus 24 percent, Deutscher, 1975).

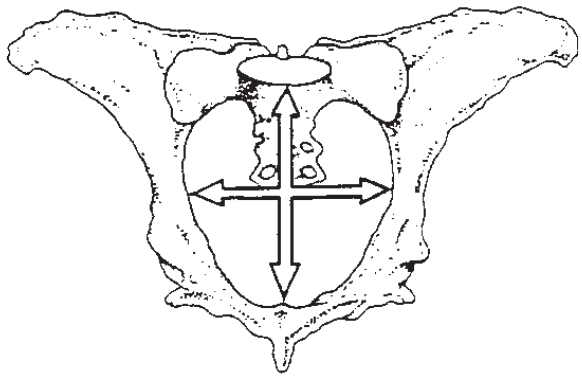


Figure 1. Vertical and Horizontal Measurements are Obtained to Determine Pelvic Area.

Large framed cows tend to have large pelvic areas, but also have proportionately heavier calves at birth, which offsets any advantage of less calving difficulty. Selecting a cow on size alone seems ineffective.

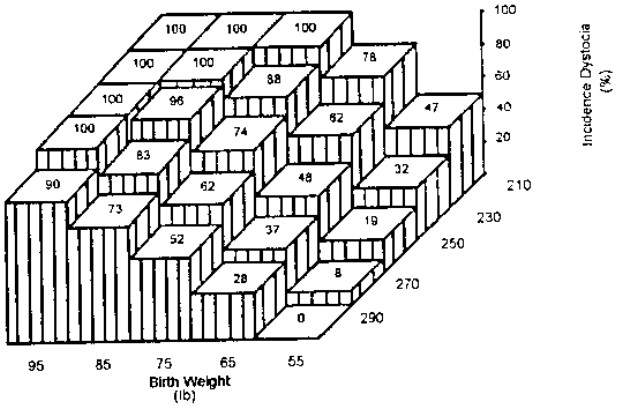


Figure 2. Relationship of Heifer Pelvic Area, Calf Birth Weight and Incidence of Dystocia in 600 Two-year-old Heifers. (Bellows 1983)

A low relationship has been found between a heifer's pelvic area and the birth weight of her calf. Selecting heifers with a large pelvic size, rather than by body weight alone, should be advantageous and should not increase calf birth weight.

In general, heifer weight and age have a positive relationship to pelvic area, but weight is not always a good indicator. Two heifers of equal weights can have considerably different pelvic areas.

External dimensions such as width of hooks and length of rump are not good indicators of pelvic area or calving difficulty. Neither are slope of rump and pelvis structure. Research shows that pelvic area has the most influence on dystocia of all cow measurements evaluated.

The best time for identifying heifers with a high potential for dystocia is before breeding. Pelvic area has been found to be the most reliable yearling trait indicating potential difficulty. Studies show that pelvic area growth is linear from 6 - 24 months in heifers calving at two years of age. Obtaining pelvic measurements on yearling heifers and culling those with small pelvic areas can reduce dystocia.

Pelvic Area and Calf Birth Weight Relationship

Research shows that calf birth weight in relation to the cow's pelvic area determines the degree of calving difficulty. Using research data from South Dakota and Nebraska, a pelvic area and calf birth weight ratio (factor) has been

developed. The ratio was derived by dividing the heifer's pelvic area by the birth weight of the calf she delivered. Figure 3 shows that as the ratios decreased, the degree of calving difficulty increased (Johnson and Deutscher, 1988).

Heifers with ratios of 2.1 or greater before breeding had little or no calving difficulty, while heifers with ratios of 1.9 or less required substantial assistance using a calf puller. These ratios are useful in predicting which heifers mayrequire assistance delivering a certain size calf.

Pelvic measurements can be obtained on a heifer before breeding and the pelvic area divided by a ratio (factor) of 2.1 to estimate the calf birth weight the heifer can deliver as a two-year-old without having substantial difficulty. For example (Table 1), a 600 pound yearling heifer with a pelvic area of 140 centimeters should be able to deliver, as a two-year-old, a 67 pound calf without difficulty (140 â 2.1 = 67). Heifers with larger pelvic areas can deliver larger birth weight calves. However, a heifer with a smaller pelvic area such as 120 cm2 probably would require a Caesarean to deliver a 75 pound calf (120 â 75 = 1.6 ratio) as shown in Figure 3.

Pelvic measurements can be obtained at the time of pregnancy exam but the ratio (factor) of 2.7 should be used to estimate calf birth weight of 18 to 19 month old, 800 pound heifers (Table 1). If heifers vary considerably in weight at the time of obtaining the measurements, different ratios should be used. Table 2 shows the ratios (factors) to be used for various weights and ages of heifers. These ratios appear to be good indicators of dystocia, with an accuracy of about 80 percent.

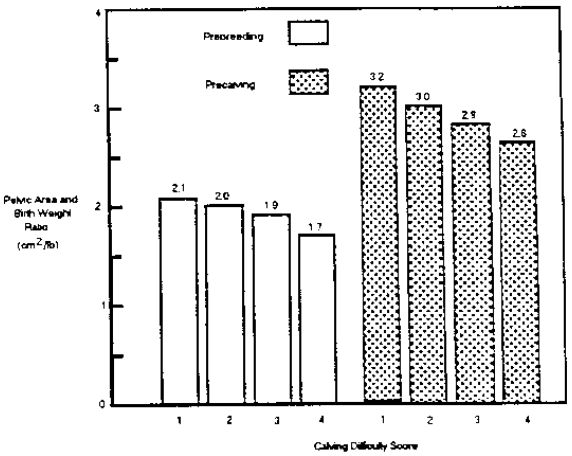


Figure 3. Pelvic Area and Calf Birth Weight Ratios Prebreeding and Precalving in Relation to Calving Difficulty Scores. (Scores were 1 - no Assistance, 2 - Slight Assistance, 3 - Moderate Assistance, 4 - Major Assistance or C-section.)

Using Heifer Pelvic Measurements

If pelvic measurements are obtained before breeding, potential problem heifers with a small pelvic size can be culled from the herd. Many producers are culling the smallest 10 to 15 percent from their herds. Since the larger, heavier heifers do not always have the largest pelvic area, all heifers should be measured and mated according to pelvic size.

Research indicates that a normal 600 pound yearling heifer should have a pelvis at least 11 centimeters wide and 12 centimeters high to deliver a 63 pound calf. Heifers with a smaller width or height dimension should be considered for culling.

Average pelvic area growth has been calculated at 0.27 cm2 per day from yearling to two years of age in

Table 1. Using Pelvic Measurements to Estimate Deliverable Calf Size (Birth Weight).

Time of Measurement	Heifer Age, months	Heifer Wt, lb.	Pelvic Area, cm2	Pelvic Area/ Birth Wt Ratio	Estimated Calf Birth Wt, lb.
Before breeding	12-13	600	140	2.1	67
			160	2.1	76
			180	2.1	86
Pregnancy exam	18-19	800	180	2.7	67
			200	2.7	74
			220	2.7	82

Table 2. Pelvic Area/Calf Birth Weight Ratios for Various Heifer Weights and Ages to Estimate Deliverable Calf Birth Weight.

Heifer Weight, lb.	Age at measurement, months			
	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

heifers, and continues at a slower rate until the cow reaches maturity. Some producers may wish to adjust pelvic areas of heifers to a standard 365 days of age. This can be accomplished by using the growth factor of 0.27 cm^2 per day.

However, in a group of puberal heifers, no adjustment is warranted, since all heifers could theoretically become pregnant early in the breeding season and have about the same number of days to develop before calving. Heifers with small pelvic areas as yearlings usually have the smallest pelvic areas at calving.

Pelvic measurements should be taken two - three weeks before the breeding season and can be incorporated into a total heifer management program. This program involves selecting heifers for breeding by size and type, obtaining pelvic measurements, palpating for ovarian development (puberty), and vaccinating for reproductive diseases, all during one processing through the chute.

Such a program helps ensure that a high percentage of the heifers are cycling and could become pregnant early in the breeding season, resulting in reduced incidences of dystocia. The program would also aid in an estrous synchronization and AI program by determining the percentage of heifers cycling, and assist in sire selection for reducing difficulty.

If heifers are measured at the time of pregnancy examination, small problem heifers could be culled, or aborted and sold as feeders. Bred heifers predicted to have a potential problem, could also be marked for close observation at calving.

Heritability of Pelvic Area

Research has estimated the heritability of pelvic area to range from 36 percent to 92 percent with an average of 61 percent (Deutscher, 1989). These values indicate that pelvic area is a highly heritable trait and may be higher than the 45 percent heritability for calf birth weight. This means both traits will respond rapidly to selection. Birth weight does not appear to be highly correlated with pelvic area; so selection for pelvic size should not give a corresponding significant increase in birth weight. By selecting both bulls and heifers for pelvic size, a herd of cows with large pelvic areas could be developed. However, selecting only for pelvic size would probably result in an increased mature cow size.

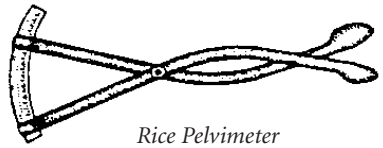
Using Bull Pelvic Measurements

Pelvic size can be readily transmitted from the sire to the resulting progeny. In a Colorado study, a 0.60 genetic correlation was found between male and female pelvic areas, indicating selection for large pelvic size in bulls should result in increased pelvic size of daughter offspring (Green, 1988).

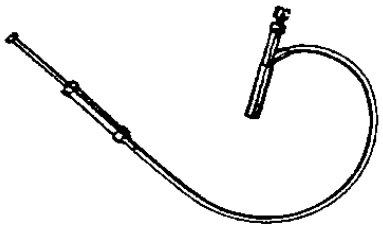
Nebraska research on 915 yearling bulls indicated only small differences in average pelvic size among breeds, but a large variation existed among bulls within a breed. For example, two yearling Simmental bulls

of similar age and weight had pelvic areas that differed by 60 centimeters (160 vs 220 centimeters). Bulls of some blood lines appear to have larger pelvic areas than others.

Pelvic areas of bulls are smaller than heifers of the same weight and age. Yearling heifers weighing 650 - 700 pounds average about 160 cm^2 in pelvic area; while



Rice Pelvimeter



Krautmann - Litton Bovine Pelvic Meter

Figure 4. Instruments to Measure Pelvic Area in Cattle.

yearling bulls weighing 900, 1000, and 1,100 pounds average about 150, 160 and 170 cm2, respectively, in pelvic area.

Age and weight of bulls influence pelvic area. Estimates of pelvic growth rates have been 0.25 cm^2 per day of age and 0.09 cm^2 per pound of body weight in bulls ranging from 10 to 15 months old and 700 - 1400 pounds across many breeds (Siemens, 1990). These values can be used to adjust a set of bulls to a given standard, but both age and weight adjustments should not be used on the same bull.

Pelvic areas should be adjusted to an average age or weight of bulls in the group so comparisons on genetic potential can be made. The Beef Improvement Federation recommends adjusting to a common age. For example, adjusting to 365 days of age, the adjusted pelvic area (PA) of a bull is: Adj. PA = actual PA + .23 x (365 minus actual age).

Seedstock producers are beginning to report pelvic area of bulls along with other reproduction and performance traits. This information allows buyers to select bulls with various traits important to their herd, including pelvic area.

The best time to measure bulls is when they are yearlings, or at the end of their performance feeding test. The measurements can be obtained by a veterinarian in combination with the breeding soundness exam (fertility evaluation).

How to Measure Pelvic Area

Pelvic measurements can be obtained with several instruments (Figure 4). The Rice Pelvimeter is a metal inside-caliper-type instrument (Lane Manufacturing, 2075 So. Balentia St., Unit C, Denver, Colorado 80231) available for about $130). The Bovine Pelvic Meter (Jorgensen Labs, Inc., 2198 West 15th St., Loveland, Colorado 80538) is a hydraulic-type meter with a cylinder connected to a recorder by a flexible tubing. This meter costs about $350. A new instrument, the Equibov Bovine Pelvimeter, (Equibov, 205 Harris Street, Rockwood, Ontario, CAN, NOB2KO) is an electronic micrometer with a digital display and costs about $425. Instructions for operating each of the instruments should be read and followed. Each instrument is designed to be placed in the rectum of the animal and the pelvic measurements are read on a scale outside the animal.

Measurements may be obtained by a veterinarian or experienced producer. A thorough understanding of the birth canal, pelvic structure and reproductive tract is needed. Practice and experience are necessary before accurate measurements can be obtained. Repeatability estimates have ranged from 85 - 95 percent. Veterinarians are providing the measurement service for a fee of $1.25 - $3.00 per animal, depending on size of group.

The general procedure is to restrain the animal in a chute with light squeeze. A comfortable, normal standing position is best. Feces should be removed from the rectum and the instrument carefully carried into the rectum with the hand. Use of undue force should be avoided during the procedure, since tissues can be torn or injured. Proceed forward with instrument to the pelvic inlet.

Obtain the width of the pelvic inlet at its widest point, between the right and left shafts of the ilium (Figure 1, see page 1). This is the horizontal diameter of the pelvis. Then, obtain the height of the pelvic inlet, between the dorsal pubic tubercle on the floor of the pelvis and the sacrum (spinal column) on the top (Figure 1). Be sure to not slip off the pubic tubercle ventrad or miss the spinal column dorsad. This measurement should be the smallest dimension between these points and is the vertical diameter of the pelvis. The two measurements are read in centimeters and multiplied together to give the pelvic area in square centimeters.

Conclusion

The relationship of calf birth weight to heifer pelvic area is the major factor influencing the degree of dystocia. Heifers can be measured for pelvic size and the small ones culled to reduce the incidence of dystocia. Pelvic area is highly heritable, so selecting breeding bulls with large pelvic areas can increase pelvic size of heifer offspring.

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