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Reducing dystocia with pelvic measurements of heifers and bulls

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Summary

The problem

The major cause of dystocia in two-year-old heifers is a disproportionate large calf at birth in relation to the cow's birth canal (pelvic size). As the ratio of pelvic area to calf birth weight decreases, the degree of dystocia increases. Selection of yearling breeding heifers with large pelvic areas, calculated by multiplying pelvic canal width and height, can reduce the incidence of dystocia. Pelvic area is moderately to highly heritable (about 50 percent) and can be increased in a herd through selection of breeding heifers and breeding bulls.

Pelvic size of sires will be transmitted to their heifer offspring. Considerable differences have been reported in pelvic size of yearling bulls within a breed; therefore, selecting bulls for large pelvic size can increase pelvic size of heifer progeny.

Introduction

How it came to be

Dystocia is becoming a greater problem for beef producers because of increased emphasis on rapid growth rates, heavier weaning and yearling weights, and improving production efficiency. As producers select for more growth, larger calves can be expected at birth, hence more dystocia.

Dystocia can increase calf losses, cow mortality, and veterinary and labor costs, as well as delay return to estrus and reduce conception rates. Studies in Nebraska showed average losses of four percent within 24 hours of birth for calves born unassisted versus 16 percent for those born during dystocia. Also, the subsequent pregnancy rate was lower in cows requiring assistance at calving than for those calving unassisted (85 percent versus 69 percent). Montana research indicated 57 percent of all calf losses were due to dystocia.

Factors Influencing Dystocia

Too many are deadly

Factors that tend to cause calving difficulty include: (1) small, young cow, (2) large, heavy fetus, **(3)** male fetus, (4) small pelvic size of dam, (5) prolonged gestation, (6) large-breed sire, (7) dam too thin or too fat, and (8) improper fetal presentation. Several of these factors are interrelated, which complicates research and methods for reducing calving difficulty.

Dystocia Research

600 heifers recorded

In a study of over 900 two-year-old heifers, calves born unassisted were about seven pounds lighter than those born during dystocia.3 Heifers with small pelvic areas experienced an 85 percent dystocia rate, versus 31 percent for heifers with large pelvic size. In another study, heifers with a small pelvic area had twice the incidence of dystocia as those with above average pelvic area (49 percent versus 24 percent).4

Large cows of large breeds had larger pelvic areas, but also had proportionately bigger calves at birth than other cows, which tended to offset their advantage so selection on cow size was ineffective.6 Research also showed a positive genetic correlation between a heifer's birth weight and pelvic area.7 Other studies showed little relationship between a heifers's pelvic area and weight of its calf at birth.8 Therefore, selecting heifers for large pelvic area, rather than by body weight, should be advantageous.

Heifer weight was positively correlated with pelvic area, but weight was still not a good indicator of pelvic size.4 External width of hooks and length of rump dimensions were also poor indicators of internal pelvic size. Slope of rump and pelvic angles had little influence on dystocia incidence. This work indicated that internal pelvic size had the greatest influence on dystocia of any cow measurements taken.4 Other research confirmed this conclusion.

The ideal time for predicting dystocia in heifers is before they are bred as yearlings; research has shown that yearling pelvic size is the most reliable yearling factor indicating potential difficulty. Pelvic area growth was linear from 9 to 24 months of age in heifers calving at two years of age.9 The correlation between yearling and two-year-old pelvic areas was 0.70.4 Therefore, selection and culling of yearling heifers on pelvic size can be beneficial. ***Continued on Page 130***

What's known about pelvic measurements on bulls

*Since heritability of pelvic openings is 40-60 percent, bulls with large openings should sire daughters with roomier birth canals..

*More bull buyers are asking for pelvic measurements along with performance and other data such as scrotal circumference..

*There appears no correlation between larger pelvic openings and heavier birth. weights. Selection for larger pelvic openings does not automatically increase weigh' of the calf at birth..

*Bulls should be measured between 12 and 15 months of age—typically when fertility tested...

*There seems to be more variation within a breed for this trait than between breeds..

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Table 1. Degree of dystocia in 220 two-year-old heifers, according to yearling pelvic area, calf birth weight and pelvic area: birth weight ratio

	Degree of calving difficulty[a]				
	1	2	3	4	5
Yearling heifer pelvic area (cm^2)	146	141	138	142	132
Calf birth weight (lb)	69	72	75	83	81
Pelvic area: birth weight[b]	2.1	1.9	1.8	1.7	1.6

a-scoring system: 1 = no assistance needed, 2 = slight assistance needed, 3 = moderate assistance needed, 4 = major assistance needed, 5 = Caesarean section needed.
b yearling pelvic area divided by calf birth weight equals ratio.
Deutscher, South Dakota data.

Table 2. Estimating deliverable calf birth weight using pelvic measurements

Time of Measurement	Heifer's age (mo)	Heifer's weight (lb)	Pelvic area (cm2)	Pelvic area: birth weight ratio	Estimated calf birth weight (lb)
Before breeding	12-14	550-700	120	2.0	60
			140	2.0	70
			160	2.0	80
Pregnancy exam	18-19	700-850	160	2.5	64
			180	2.5	72
			200	2.5	80
Before calving	23-24	800-950	200	3.1	65
			220	3.1	71
			240	3.1	77

Pelvic Area: Birth Weight Ratio

What is possible

A 600-pound yearling heifer with a pelvic area of 140 cm^2 can usually deliver a 70-pound calf without major difficulty as a two-year-old. This pelvic area: birth weight ratio is 2 to 1. As the ratio decreases, the degree of calving difficulty increases (Table 1). A Caesarian section would generally be required with a pelvic area of 120 cm^2 and a calf birth weight of 80 pounds, which yields a ratio of 1.5 to 1.

Yearling pelvic areas can be divided by a factor of two to estimate the calf birth weight a heifer can deliver as a two-year-old. If pelvic measurements are taken at the time of pregnancy examination (18-month-old heifers), a factor of 2.5 can be used to estimate calf birth weight. A factor of 3.1 can be used on pelvic areas taken before calving (two-year-old). Table 2 shows the factors (ratios) to be used at the various times that measurements may be taken and for various weights of heifers. If yearling heifers weigh 750-850 pounds, a factor of 2.25 should be used. These factors appear to be good indicators of dystocia, with an accuracy of about 80 percent. Average pelvic area growth has been calculated to be about .27 cm^2/day from yearling to two-year-old heifers.

Pelvic Measurement Uses

The value in practice

If pelvic measurements are obtained before breeding, problem heifers with a small pelvic size can be culled from the herd or mated to easy-calving bulls, while heifers with larger pelvic area can be mated to average-calving bulls. Since larger, heavier heifers do not always have the largest pelvic size, heifers should be measured and mated according to pelvic size. The largest heifers may produce large calves at birth, so large heifers with small pelvic areas may require stricter culling. No adjustments for heifer weight are usually made on pelvic size if heifers are in the weight ranges specified in Table 2. (exception would be 750-850 pound yearling heifers as previously noted.)

If heifers are measured at the time of pregnancy examination, problem heifers can be culled or aborted and sold as feeders. Heifers bred to produce a calf larger than can be delivered through their birth canal can also be marked for close observation at calving.

Field trials in Nebraska have shown favorable results using pelvic measurements to help reduce dystocia. Calving difficulty was reduced by half on a ranch with 900 heifers over a three-year period. The procedure was to breed heifers with a small pelvic size (about 25 percent of the group) to easy-calving bulls, and breed the remainder (75 percent) to average-size Angus bulls. Heifers that calved unassisted had an average pelvic area: birth weight ratio of 2.2, with a five percent calf death loss compared to a ratio of 1.8 for heifers requiring assistance at parturition, with an 11.5 percent calf loss.

Heritability of Pelvic Area

What can be expected

Research studies have reported the heritability of pelvic area as 0.53, 0.60-0.67, 0.44-0.61, 0.36 and 0.68.[10-13] These values indicate that pelvic area is moderately to highly heritable and probably higher than the 0.45 heritability of calf birth weight. This means that both traits will respond to selection, but possibly greater selection pressure could be put on pelvic size. By selecting both bulls and heifers for pelvic size, a herd of cows with a large pelvic area could be developed. This could also help increase growth rate and weaning weights, since a positive genetic correlation exists between pelvic size and growth. Also, the trend to select bulls for small birth weight could be gradually relaxed, allowing greater expression of the 0.60 genetic correlation between yearling weight and birth weight.

Pelvic Size of Bulls

How it matters

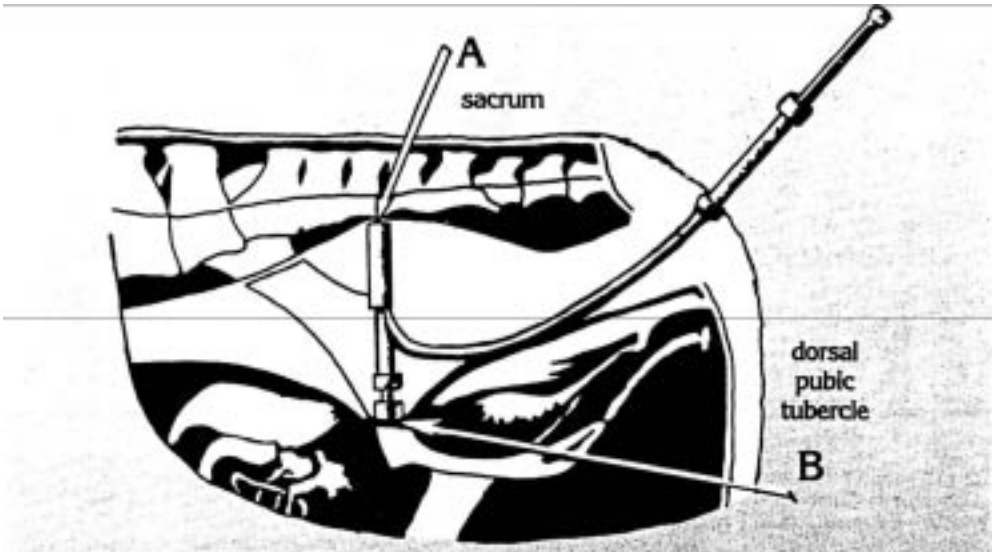
Limited research has been reported on the pelvic size of bulls. Two studies in Nebraska involving 915 yearling bulls of various breeds revealed several interesting points.14

Pelvic areas of bulls are smaller relative to their weight compared to heifers. Yearling bulls weighing 900 to 1,100 pounds averaged 150 to 170 cm^2 in pelvic area which would compare to yearling heifers weighing 650 to 750 pounds. Age and weight of bulls had a significant effect on pelvic size. Growth (adjustment) factors were determined for age (.165cm^2/day) and weight (.0534 cm^2/pound) using bulls ranging from 10 to 14 months old and 800 to 1,200 pounds. However, both age and weight adjustments should not be used on the same bull. Hip height, frame score and scrota1 circumference were positively correlated with pelvic size; however, birth weight was not correlated.

This indicates that selection for increased pelvic size should not give a corresponding increase in birth weight. Research from Montana supports this finding.13

Small differences in pelvic size were noted between breeds in the Nebraska studies, but much variation existed between bulls within breeds. This indicates that bulls with large pelvic areas can be easily selected over the average. Bulls of some blood lines have larger pelvic areas than others.

Colorado research reported a .60 genetic correlation between male and female pelvic area indicating selection for large pelvic size in bulls should result in increased pelvic size of daughter offspring.I5 Seed stock producers are beginning to report pelvic size of bulls and commercial producers are beginning to ask for the measurements. This interest has increased markedly during the last year.



The ends of the Bovine Pelvic Meter are placed on the sacrum dorsad (A) and the dorsal pubic tubercle ventrad (B).

How to Measure Pelvic Area

The mechanics

Pelvic measurements can be obtained with either of two instruments. The Rice Pelvimeter is a metal caliper-type instrument (Lane Manufacturing, Denver, Colo.) available for about $100. The Bovine Pelvic Meter (Dr. Ed Krautmann, Chillicothe, Mo.) is a plastic hydraulic-type meter with a cylinder connected to a recorder by a flexible tubing. This meter costs about $260. Each instrument is used by placing it inside the rectum of the animal and reading the pelvic measurements on the outside.

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 hand and arm. Use of undue force should be avoided during the procedure, since tissues can be torn or injured. Proceed 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. 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 dorsad. Be sure not to slip off the dorsal 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 should be multiplied to give the pelvic area in square centimeters. Practice and experience are needed to get accurate measurements.

No minimum threshold values have been established for yearling heifers, since they can be bred to various bulls for different-sized calves. However, research has indicated that a 650-pound yearling heifer should have a pelvis at least 11 cm wide and 12 cm high, for a 130 cm^2 pelvic area, to deliver a small, 65-pound calf. Heifers with smaller pelvic areas should probably be culled. Also, heifers with an irregular pelvic shape that do not meet the above width or height dimensions should be considered for culling.

Pelvic measurements should be taken two to three weeks before the breeding season and can be incorporated into a total heifer management program. In this program, heifers can be selected for breeding by size and type, pelvic measurements obtained, palpated for ovarian development (puberty), and vaccinated for reproductive diseases, all during one processing through the chute.

This program would help ensure that a high percentage of the heifers was cycling and would become pregnant early in the breeding season, and should help reduce the incidence of dystocia. This program could also aid in an estrus synchronization and A.I. program by determining the percentage of heifers cycling and help in sire selection.

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