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Pelvic Area Measurements in the Management of Replacement Heifers

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Dystocia

Dystocia (calving difficulty) can be a major problem for beef cattle producers in Arkansas, especially with heifers that deliver their first calf as two-year-olds. Dystocia rates as high as 34 percent have been reported in first-calf heifers. The primary cause of dystocia is a disproportionately large calf size or birth weight compared to the pelvic area (birth canal) of the cow or heifer.

Since birth weight is moderately heritable, the selection of bulls with low birth weights and with smoothness, balance and straightness of lines is the most dependable method for reducing dystocia in heifers. Because breeds vary with regard to average birth weight, consider the breed of bull to be used on replacement heifers. There is also a tremendous amount of variation in birth weight among bulls within a breed. As a result, some bulls within most breeds have been identified as "calving-ease" bulls, or are bulls with low expected progeny differences (EPDs) for birth weight.

Another management practice that may assist producers in reducing the incidence of dystocia in first-calf heifers is the use of internal pelvic area measurements. This practice has received considerable attention, but its use is still not widespread among beef cattle producers.

How to Measure Pelvic Area

A sliding caliper device referred to as a Rice pelvimeter[1] is used to measure the pelvic area of heifers. The Rice pelvimeter was specifically designed for taking this measurement, which is determined rectally and results read externally in centimeters (cm).

To measure internal pelvic area, the technician must first clear the rectum of feces. The pelvimeter is then introduced into the rectum inside the cupped, gloved hand of the technician, and pushed into the pelvic inlet with the other hand, taking care not to force the device with undue pressure. The height (vertical measurement) is determined by measuring the linear distance from the approximate midpoint of the top surface of the symphysis pubis to the bottom surface of the midsacrum. Pelvic width (horizontal measurement) is measured as the linear distance between the shafts of the ilia at right angles to where the height was measured (Figure 1). The

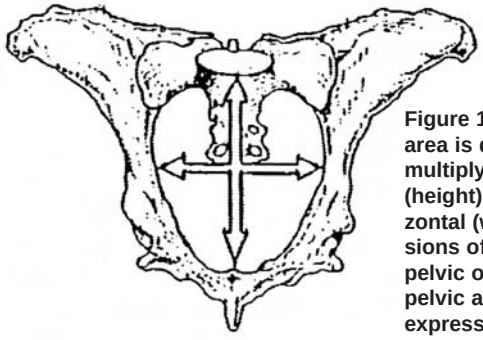

Figure 1. The pelvic area is determined by multiplying the vertical (height) by the horizontal (width) dimensions of the internal pelvic opening. The pelvic area is expressed as cm^2.

[1]Lane Manufacturing Co., Denver, Colorado.

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unit of measure for pelvic area is cm^2 and is calculated by multiplying the height of the pelvic region by the width of the region.

The best time to measure pelvic areas in heifers is prior to their first breeding season when heifers are 12 to 14 months of age. Based on research, ratios have been developed that give an estimate as to what size calf a heifer could deliver at two years of age without assistance (Table 1: adapted from Deutsher, 1987). For example, a 13-month-old heifer with a pelvic area of 140 cm^2 should be able to deliver a 67-pound calf without assistance. It is important to emphasize that this calculation does not predict the birth weight of the calf; it simply predicts what size calf the heifer can deliver without assistance. Pelvic area measurements can also be taken at the time of pregnancy examination and even prior to the time of calving, but the division factors to determine deliverable calf size increase with age.

Table 1. Estimating Deliverable (Without Assistance) Calf Birth Weight Using Pelvic Measurements.

Age of Heifer	Pelvic Area (cm^2)	Division Factor	Est. Calf Size (lb) Without Assistance
12-14 mos.	120	2.1[a]	57
	140	2.1	67
	160	2.1	76
18-19 mos.	160	2.5	64
	180	2.5	72
	200	2.5	80
23-24 mos.	200	3.1	65
	220	3.1	71
	240	3.1	77

[a] Division factor of 2.1 is for 12-14 month old heifers weighing 550-700 lbs. For yearling heifers weighing 750-850 lbs, use a division factor of 2.3.

Examples of Pelvic Area Measurements from Arkansas Heifers

Pelvic areas were measured in 63 Simmental-sired heifers (404 $\pm$ 2 days of age and 765 $\pm$ 11 lbs) at the University of Arkansas Southwest Research and Extension Center near Hope (Table 2). Pelvic area measurements varied greatly, ranging from 156 to 240 cm^2, with an average of 200 cm^2. To obtain a predicted deliverable calf birth weight, pelvic areas of heifers weighing less than 750 pounds were divided by 2.1, and pelvic areas of heifers weighing 750 pounds or more were divided by 2.3. Results indicated that on the average these heifers could deliver (without assistance) a calf with a birth weight of 90 pounds or less.

Table 2. Body Weights and Pelvic Area Measurements in Yearling, Simmental-Sired Replacement Heifers.

Breed of Dam	No. of Heifers	Mean Body Wt. (lb)	Mean Pelvic Area (cm^2)	Deliverable Calf Birth Wt. (lb)
Brangus	21	808 $\pm$ 21[a]	210 $\pm$ 5[a]	94 $\pm$ 2
F1 (Brahman X Hereford)	21	773 $\pm$ 16[a]	207 $\pm$ 4[a]	92 $\pm$ 1
Simmental	21	715 $\pm$ 14[b]	184 $\pm$ 5[b]	86 $\pm$ 2

[a,b] Simmental-sired heifers out of Brangus and F1 dams were heavier and had larger ($P < 0.01$) pelvic areas than those out of Simmental dams.

The pelvic area measurements and deliverable calf birth weights for these 63 heifers were relatively large compared to what would typically be expected in commercial yearling heifers. This was due, in part, to the breed composition and also to the fact that the heifers were implanted as calves. Implanting heifer calves has been shown to increase their yearling pelvic area measurements. However, this increase is no longer evident by the time they are two-year-olds and ready to calve.

Even after accounting for differences due to breed, body weight and pelvic area measurement were closely related ($r = 0.63$; $P < 0.01$), as were hip height and pelvic area measurement ($r = 0.70$, $P < 0.01$). Regression analysis revealed that for every 10 lb increase in body weight, pelvic area increased by 1.9 cm^2; and for every 1 inch increase in hip height, pelvic area increased by 11 cm^2.

In a group of 96 Brangus heifers in Columbia County, Arkansas, heifer body weight and pelvic area were also positively correlated ($r = 0.53$; $P < 0.01$). Average body weight of these heifers at the time of pelvic area measurements was 630 lbs. The distribution of the percent of heifers by pelvic area and deliverable calf birth weight are shown in Figure 2 and Figure 3, respectively.

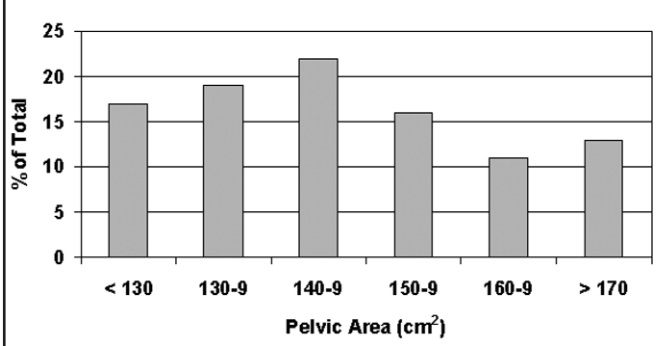

Figure 2. Percent distribution of Brangus heifers (n = 96) by pelvic area measurements (cm^2) from a commercial herd in Columbia County, Arkansas.

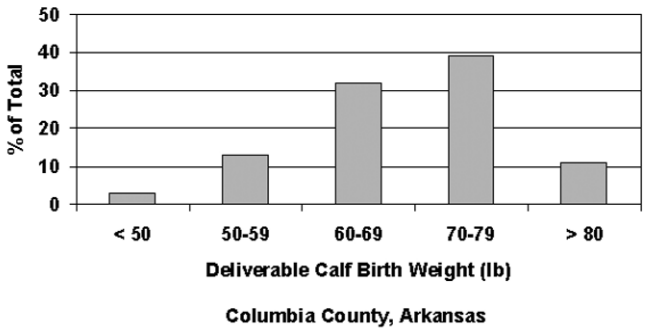

Figure 3. Percent distribution of Brangus heifers (n = 96) by calf birth weight (lb) at which heifers should be able to deliver without assistance.

The wide range of pelvic area sizes observed within and between these two sets of heifers demonstrates the variation found in this trait and emphasizes the need to obtain measurements from each heifer for accurate and meaningful information. Measurement of pelvic areas provides producers with another piece of information about potential reproductive performance of replacement heifers. In particular, heifers with unusually small or abnormally shaped pelvic areas can be identified for culling, or as ones to be closely observed at calving time.

Summary

Birth weight and pelvic area are highly correlated, so some of the potential benefit from larger pelvic size in reducing dystocia may be offset by a correlated increase in birth weight (Benyshek and Little, 1982). Other factors that affect calf birth are gestation length, birth weight of the sire and dam, calf sex and heifer pre-breeding weight.

Assuming that a large heifer will have a relatively large calf, selection against those large heifers with disproportionately small pelvic areas may be warranted; or at the very least, that kind of heifer should be bred to a calving-ease bull. Also, knowing pelvic areas of heifers would allow a producer to pay extra attention to heifers with borderline measurements.

Measuring pelvic areas is not a “cure-all” against calving problems. However, pelvic area measurement is another useful tool that can be used in a total heifer development and management program.

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