RESEARCH REPORT

A Balanced Scale

Caution to breeders: Have all available facts before using pelvic measurements for easy-calving heifer selection.

by R.A. Bellows

Problems with dystocia (calving difficulty) have a major impact on the profitability of a cow herd. The most obvious are losses from calf death and the expenses incurred when handling dystocia.

Research results from Fort Keogh Livestock and Range Research Laboratory, Miles City, Mont., and other research centers clearly show that dystocia, with or without calf death, results in depressed rebreeding performance of the affected dams. Calves that experience severe dystocia problems at birth do not gain as rapidly from birth to weaning.

Sum up all factors, and I estimate dystocia costs the U.S. cattle industry more than $850 million a year.

Much interest has developed in using pelvic measurement to cull heifers with small pelvic openings, and thus prevent costly dystocia cases.

Before you purchase a pelvic measurement tool, however, you should evaluate your decision for both short-term and long-term effects. Be sure that any selection for large pelvic area is in addition to and not in place of selection for optimal size, weight, and above all, fertility.

The short-term results of this selection may be a reduction in severe dystocia problems. The long-term effect, however, will be an increase in weight and frame size in your cow herd. This will be accompanied by an increase in calf birthweight that can potentially cancel any short-term gains made in combating dystocia. Unfortunately, no one has good experimental data on how rapidly these long-term effects will occur.

Most importantly, pelvic measurements must be viewed from a basis of having all the facts available. Be keenly aware that this is a skeletal growth trait. If pelvic measurements are used, use them to prevent selecting animals on either end of the scale — reject both the smallest and the largest.

Presently, the best program for managing dystocia involves:

1. raising the replacement heifer on a management system that allows maximum rates of fertility and skeletal growth;

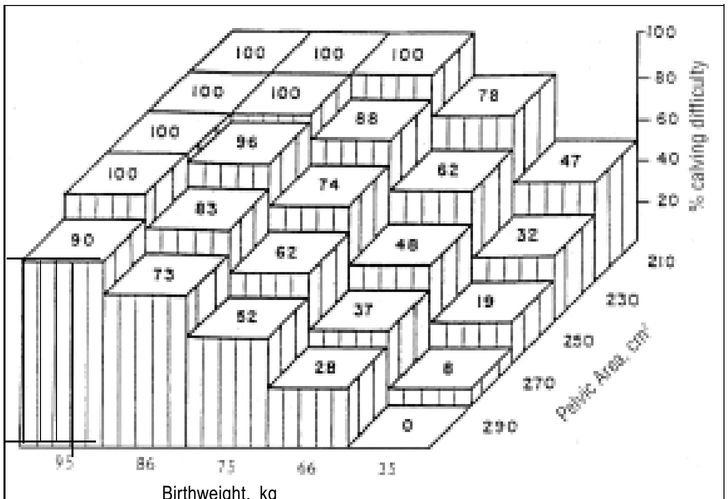

Figure 1. Relationship among pelvic area, calf birthweight and percent calving difficulty,

2. controlling calf birthweight through wise sire selection;

3. not underfeeding or overfeeding pregnant heifers during gestation.

Numerous studies have shown that calf deaths are highest in first-calf heifers, regardless of whether they are two or three years of age at first calving. The same studies show that the incidence of dystocia is three to 12 times higher in first-calf heifers than in mature cows, so this age group will receive major emphasis in this discussion.

Genetic relationships exist among dystocia and calf losses. Heritability estimates of dystocia are in the .1 to .3 range. Dystocia is closely related genetically to birthweight, which indicates selection against dystocia will probably reduce birthweight. Birthweight and dystocia have antagonistic economic relationships since birthweight is positively correlated with postnatal growth and weight at later ages.

Breeders must then make a decision as to how much dystocia they are willing to accept in order to maintain maximum growth rates in calves or how much growth they are willing to sacrifice in efforts to reduce birthweight and dystocia.

Our studies at Fort Keogh show the dam's precalving pelvic area has a significant effect on dystocia. Heifers with larger pelvic areas experienced fewer dystocia problems.

This relationship is shown graphically in Figure 1. Note that as pelvic areas become larger, the incidence of dystocia declined in all birthweight classes. This is an important relationship, but we must study all data available before we draw far-reaching conclusions.

First, our data and that of other scientists, show the following:

1. Larger heifers produce calves with higher birthweights. Remember, high calf birthweight is the most important factor causing dystocia.

2. Larger heifers have larger pelvic areas. However.

3. Heifers with larger pelvic areas produce calves with higher birthweights.

This seemingly circular relationship must also be evaluated in light of data which shows the genetic correlations between heifer size and birthweight and heifer size and pelvic area are relatively larger and positive. These facts are of critical importance when we consider selecting breeding males and females for large pelvic areas.

Fort Keogh Trial

We have conducted research involving Angus and Hereford heifers that were bred to Angus or Hereford bulls to produce reciprocal-crossbred calves. The data were used to rank the importance of various factors involved with dystocia. This work demonstrated that dystocia is affected by two categories of factors: 1) those attributed to the dam; and 2) those attributed to the calf.

Of dam factors, precalving weight and pelvic area were the most important.

All the factors listed were statistically significant. Table 1 shows their relative importance. Note that calf birthweight was the most important. This means that any effort to reduce the incidence of dystocia must include controlling calf birthweight.

However, notice that the precalving weight of the dam also had an important effect on dystocia, indicating that heavier, larger dams had less dystocia. This means that growing the heifer adequately during the two years prior to calving is another important aspect of managing dystocia. Replacement heifers that are not fed and managed properly will be lighter and smaller at calving and experience more dystocia.

Calf sex was also important. The research indicated that heifer calves were associated with fewer calving problems than were bull calves. However, since calf sex is determined at conception, we are not able to do much about this problem unless calf sex control can be achieved.

This isn't an impossible scenario since procedures for sexing semen or embryos appear promising. Production of only female calves from first-calf heifers would potentially reduce dystocia.

Heifer Culling Tool

It has been reported that the incidence of Caesarean deliveries decreased in herds where heifers with the smallest pelvic openings were culled.

Last year, I visited with a Canadian rancher who calves more than 1,000 heifers yearly and who culled heifers with small pelvic dimensions. He obtained a 5 percent reduction in Caesarean deliveries and considered pelvic measuring to be cost effective.

Other ranchers and veterinarians report similar or greater reductions; some report no change. Don't count on pelvic-size culling to eliminate all Caesarean calvings.

Table 1. Relative importance of factors affecting dystocia

Factor	Relative importance value
Calf sex	1.00
Dam precalving weight	1.10
Dam precalving pelvic area	1.16
Calf birthweight	3.05

Table 2. Phenotypic correlations between dam pelvic area at 231 days of gestation and carcass and fetal traits.

	r values
Dam pelvic areas and:	
Live weight	.60**
Hot carcass weight	.43**
Carcass length	.41**
Shank length	.38**
H-bone length	.40**
Rear leg length	.33*
Rib lean weight	.26†
Longissimus dorsi weight	.29†
Fetal:	
Placentome weight	.46**
Avg. placentome weight	.42**
Cannon circumference	.37*

† $P < .10$; * $P < .05$; ** $P < .01$.

Table 3. Phenotypic correlations between dam size and calf dimensions.

	Dam precalving	
	Body weight	Pelvic area
Precalving pelvic area	.58**	—
Calf[a] Birthweight	.40**	.35**
Head width	.31**	.16
Head circumference	.44**	.30**
Heart girth	.30**	.22**
Hip width	.35**	.41**
Body length	.35**	.34**
Leg length	.27**	.35**
Thigh width	.29**	.25**

[a] All data collected at birth.
** $P < .01$.

Remember, culling is a method of selection. If infertile females are culled, you are actually selecting fertile ones; by culling slow-growing animals, you are selecting rapid-growing ones; if you cull animals with small pelvic openings, you are selecting those with large pelvic areas.

If culling heifers with small openings results in a major reduction in severe dystocia problems, the owner needs to critically evaluate his replacement heifer production and breeding program. Are the heifers being fed adequately for maximum skeletal growth? Are they being bred to bulls that produce manageable birthweights?

Our early work at Fort Keogh has shown precalving pelvic area in three-year-old first-calf Hereford heifers to be correlated with body weight (.54) hip width (.41) and rump length (.48). All correlations were highly significant. We interpreted the relationships as indicating heifers with larger skeletal size had larger pelvic dimensions.

Our recent studies also show that a dam's larger pelvic size is associated with larger dimensions of her entire skeleton

(Table 2). Pelvic height, width and area are skeletal growth traits, and there is little likelihood that selection for these traits will result in an increase in pelvic size only. The result will be larger total skeletal size — an increase in frame size.

OtherUniversityResearch

A research study at Colorado State University has shown high positive genetic correlations between pelvic area and both weaning and yearling weights in heifers. In addition, the dam's pelvic area at 231 days of gestation and at calving were positively associated with all skeletal traits plus the calf's placental and skeletal size (Tables 2 and 3).

These results mean that the dam's increased skeletal size will be transmitted to the calf, resulting in higher birthweights. Therefore, producers must be aware of what will accompany selection for larger pelvic areas.

Based on values from the literature, we have calculated that a 10 square centimeter increase in average pelvic area would be accompanied by a .02 decrease in calving difficulty score and a two pound increase in calf birthweight. The effect on dystocia score is small but desirable. However, this calculation indicates there is a real possibility that the accompanying increase in calf birthweight would eventually cancel any gains realized from increases in pelvic area.

This may seem like a premature statement since the literature shows some variation in the relationship between pelvic area and birthweight. University of Georgia animal scientists report the genetic correlation between heifer birthweight and yearling pelvic area to be high (.73) This has recently been studied by Colorado State animal scientists, who report a somewhat lower genetic correlation of .25 between pelvic area and birthweight, but high genetic correlation values between pelvic area and weaning (.73) and yearling weight (.65).

Other values are more variable. University of Missouri animal scientists report a genetic correlation between birthweight and yearling pelvic area of -.36 in Angus and .26 in Simmental heifers.

However, I feel very comfortable concluding that as pelvic area goes up, so will birthweight and mature size.

Bull Selection Tool

What about using pelvic measurements as a selection tool in bulls? Values in the literature indicate that the heritability of pelvic area in either females or bulls averages about .54 Colorado State reported the genetic correlation between pelvic areas in bulls and half-sib heifers was .60.

These values suggest that genetic and phenotypic progress could be made by selecting for larger pelvic areas in both males and females. However, again I am convinced by studying values in the literature, that this selection will be accompanied by larger skeletal size and an increase in frame size.

Recently, interest has developed in using pelvic measurements to predict what size calf would be delivered without difficulty. Using pelvic area alone has been of minor value in predicting dystocia at the Fort Keogh laboratory. The reasons are: 1) we cannot accurately predict individual calf birthweight, and 2) because some dystocia is due to abnormal hormonal changes prior to calving.

Two prediction outcomes must be considered: identifying heifers that will not experience dystocia or identifying heifers that will experience dystocia. We have been slightly more successful (+10 percent) in predicting heifers that will not experience dystocia than heifers that will.

Other scientists have more recently developed computer models with higher accuracy in predicting dystocia. These models include cow age, external body dimensions, pelvic measurements and estimated calf birthweight. We need to watch these developments carefully since the field of computer modeling is very dynamic and will likely lead to valuable breakthroughs in decision making.

Abnormal Pelvics

Pelvic measurements have also been used to detect pelvic openings with abnormal shapes and structures. This certainly can be done successfully, but our data indicate the frequency of abnormalities is low, usually not exceeding one percent of the heifers measured. You should also be aware that there are differing opinions as to the definition of an abnormal pelvic opening.

Editor's note: *R.A. Bellows works as a research physiologist at Fort Keogh Livestock and Range Research Laboratory, Miles City, Mont.* *The author expresses sincere appreciation to the American Angus Association for financial assistance that supported portions of the work reported in this article.*

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