USE OF PELVIC DIMENSIONS OF YEARLING BEEF BULLS AS SELECTION CRITERIA TO IMPROVE CALVING EASE

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SUMMARY

The purpose of the research reported here was to determine if pelvic dimensions of yearling beef bulls could be used as indicator traits in selecting for calving ease. Test gain over 140 days, end-of-test weight and pelvic dimensions of 3291 yearling beef bulls collected over four years from three test stations in Manitoba were first analysed to determine significant environmental effects. Breed group, station, year and their interactions as well as bull age were all significant effects on growth and pelvic dimensions. Growth and pelvic dimensions were adjusted for significant environmental effects and correlations were calculated. Pelvic dimensions were significantly associated ($P < .05$) to bull growth traits indicating that larger, faster growing bulls had larger pelvic dimensions. Expected Progeny Differences (EPD's) for maternal and direct calving ease, weaning gain and yearling gain were available for 907 of the bulls. Pelvic dimensions were significantly ($P < .05$) associated to weaning gain and yearling gain EPD's. There was no association, however, between pelvic dimensions and calving ease EPD's. This research indicates that pelvic dimensions of yearling beef bulls has little value as an indicator trait for calving ease either as expressed by their own calves or by their daughters' calves.

INTRODUCTION

Early identification of beef bulls that could improve calving ease in beef cattle herds is difficult because calving ease has a low heritability. One approach to this problem is to use high heritability indicator traits -- pelvic area is one such candidate. It is known that pelvic area measurements are, like other skeletal dimensions of animals, medium to high in heritability (Benyshek and Little 1982), so that bulls with large pelvic dimensions should have relatives with large pelvic dimensions. If pelvic dimensions are related to calving ease, female relatives should have easier calving. Bulls with large pelvic dimensions may, on the other hand, have a negative impact on calving ease of their own offspring if the calves have larger pelvic areas and larger external dimensions which may cause difficulty in calving.

Recent studies by Basarab et al. (1993) and Naazie et al. (1989) suggested that there may be some value (though limited) to using pelvic dimensions as culling criteria for beef heifers. No corresponding studies have been reported for young beef bulls. The purpose of the present study was to determine if pelvic dimensions had any value as an indicator trait for culling beef bulls due to expected effects on calving ease. To do this we studied the association between pelvic dimensions of yearling bulls and their Expected Progeny Differences (EPD's) for calving ease. Direct calving ease EPD's give an indication of the ease with which a bull's own calves will be born. Maternal calving ease EPD's indicate the expected ease with which daughter's calves will be born. Associations between pelvic dimensions and other growth traits were also assessed.

MATERIALS AND METHODS

Analysis of test station performance. Data on growth traits and pelvic measurements were obtained from three test stations operating in Manitoba (Douglas, Roblin and Gunton) over the years 1988 to 1991. There were 3291 bulls with test station performance records with 12 breeds represented in these data. The test station traits that were studied included test gain, end-of-test weight, pelvic width and height, and pelvic area (as the product of pelvic width and pelvic height. Gain on test was measured over a 140 day test period, and end-of-test weight and pelvic dimensions were measured when the bulls were about a year of age. For purposes of analysis, breeds were grouped according to size category: Group 1 included Charolais, Maine Anjou and

Simmental; Group 2 was made up of Angus, Hereford and Shorthorn; and Group was made up of Blonde d'Aquitaine, Gelvieh, Limousin, Pinzgauer, Salers and Tarentaise. Analyses were done to determine the effects of breed group, station, year and age of bull on growth and pelvic dimensions. The bull performance records were then adjusted for significant environmental effects for use in subsequent analyses. Adjustment of the performance records in this way amounted to expressing age-adjusted bull records as deviations from their contemporary group averages.

EPD's of bulls. EPD's for bulls were obtained in 1992 from Agriculture Canada through the provincial (Manitoba) Livestock Performance Testing Board. EPD's used in this study included direct and maternal calving ease EPD's, direct and maternal weaning gain EPD's, and yearling gain EPD's. Calving ease EPD's were in score point units, an arbitrary scale where more positive scores indicate easier calvings. These EPD's were based on home-test data. Of the 3291 bulls with test station performance, 907 were found to have EPD's. Correlations between EPD's and test station performance (pelvic measurements and growth performance, adjusted for environmental effects) were calculated. Correlations were homogeneous across breeds so the correlations were pooled.

RESULTS

Test station performance. Station, year, station x year interaction and breed group were found to be significant (P<.05) factors affecting bull test gain, end-of-test weight and pelvic dimensions. Feeding programs were similar for the three stations, but there were other environmental effects unique to each station in each year that caused differences in growth performance of the bulls. Interaction of breed group with station and year was significant (P < .05) for all traits but accounted for only a small amount of variation. Breed group of bull was an important source of variation in growth and pelvic dimensions with larger, faster growing breeds having larger pelvic dimensions. The regression of pelvic area on age of bull was significantly different from zero (P<.05) with an average of .22 cm^2 day^{-1} and was different among breed groups (P < .05).

Growth and pelvic dimensions were adjusted for the significant environmental effects before calculation of correlations (i.e. correlations between residuals). These correlations correspond to correlations among bulls of the same age and kept in the same environment. Pelvic dimensions were correlated to end-of-test weight and to test gain (P < .05), (Table 1). These correlations, though not high, confirm that pelvic area was associated to body size and growth capacity of the bulls.

Table 1. Means, standard deviations and correlations for test station performance traits

			Correlations[a]			
Trait	Mean[b]	s[c]	EWT	PW	PH	PA
Test gain, kg (TG)	236	30	.65	.16	.13	.18
End-of-test weight, kg (EWT)	594	63		.28	.22	.31
Pelvic width, cm (PW)	12.9	1.0			.30	.80
Pelvic height, cm (PH)	14.1	1.1				.81
Pelvic area, cm^2 (PA)	182.3	22.5				

[a]Correlations between residuals, pooled over years, stations and breeds. All correlations were significantly different from zero (P < .05)
[b]3291 bulls
[c]Standard deviation pooled over years, stations and breeds

EPD's and correlations with pelvic dimensions. Mean EPD's are shown in Table 2. The mean EPD's for calving ease and maternal weaning gain were near zero but the mean EPD's for direct weaning gain and yearling gain suggested that these bulls were preselected for growth capacity to some extent. The standard deviations indicated that there was, however, reasonable variation among animals in these data. Correlations of pelvic dimensions to calving ease EPD's (direct and maternal) were not significantly different from zero ($P > .05$), (Table 2). All the pelvic dimensions were positively correlated ($P < .05$) to the weaning and yearling gain EPD's, confirming the association with size noted in Table 1. The correlations of the pelvic dimensions to the maternal weaning gain EPD were all negative. This is likely an indirect result of the negative genetic correlation between direct and maternal weaning gain (Agriculture Canada 1993). Since pelvic dimensions are associated with body growth and size this negative correlation is expected. All three of the pelvic measurements appeared to behave similarly in terms of correlations. The correlations were homogeneous across breed groups in these data so it was considered appropriate to pool them.

Table 2. Means and standard deviations of EPD's, and correlations with pelvic width (PW), pelvic height (PH) and pelvic area (PA)

			Correlations[a]		
EPD	Mean[b]	s[c]	PW	PH	PA
Direct calving ease, score pts.[d]	+.04	.97	.07	-.01	.03
Maternal calving ease, score pts.[d]	-.01	.73	.05	.04	.05
Direct weaning gain, kg	+4.63	7.06	.09*	.11*	.12*
Maternal weaning gain, kg	+.55	4.39	-.09*	-.06*	-.09*
Yearling gain, kg	+8.22	12.32	.09*	.12*	.13*

[a]Correlations between residuals, pooled over years, stations and breeds. Correlations with * are significantly different from zero ($P < .05$)
[b]907 bulls
[c]Standard deviation pooled over years, stations and breeds
[d]Positive calving ease scores indicate easier calving

DISCUSSION

Specific guidelines for the use of pelvic dimensions as a culling tool for young beef heifers were formulated by Deutscher (1988). Other researchers (Basarab et al. 1993; Naazie et al. 1989) have found that pelvic dimensions had limited use in predicting calving ease outcomes for beef heifers. Results from the present study suggest that pelvic area of yearling bulls would not be a useful indicator trait for selecting yearling beef bulls to improve maternal calving ease. In addition pelvic dimensions of the yearling bulls were not associated with more difficult calvings of offspring since the correlations with direct calving ease was not significantly different from zero ($P > .05$). Knowledge of the genetic correlation between pelvic dimensions and direct and maternal calving ease would be needed in order to assess this completely. We did not estimate genetic correlations in this study but the correlations of pelvic dimensions and calving ease EPD's would be proportional to the genetic correlation. Accuracies of the calving ease EPD's were low and this may played a role in the small correlations observed in this study. The bulls used in this study would have been active as breeding bulls for few years so that the number of calves and daughters with calves would be relatively small. The EPD's of bulls born and tested in 1991, for example, would be composed of information from

ancestors and collateral relatives. Further study, as these bulls acquire more descendents and more accurate EPD's would be useful.

Placed alongside the results found by Basarab et al. (1993) and Naazie et al. (1989) it seems unlikely that pelvic dimensions will aquire significance as indicator traits for calving ease. The pathway connecting the observations on pelvic dimensions of yearling bulls and the eventual outcome in the expressed calving ease of daughters is likely too long for the information to have predictive value.

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