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Maternal Performance of First-Calf Crossbred Beef Cowns in Relation to Sire Expected Progeny Differency (EPDs)

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MATERNAL PERFORMANCE OF FIRST-CALF CROSSBRED BEEF COWS IN RELATION TO SIRE EXPECTED PROGENY DIFFERENCES (EPDs)

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Summary

Cumulative milk production of crossbred daughters of sires of several breeds was estimated using weigh-suckle-weigh procedures. Pooled-across-breed analyses were conducted to determine, in retrospect, relationships of sire expected progeny difference (EPD) values for milk and total maternal value to daughter milk yield and daughter's offspring weaning weight. The pooled coefficient for regression of daughter 214-day milk yield sire milk EPD was 13.4 lb/lb (residual correlation was .14). The overall mean estimated milk yield was 2,782 lb, suggesting that a difference in sire milk EPD of 1 lb corresponded to a difference of approximately .5% in cumulative daughter milk yield. The pooled coefficient for regression of daughter's offspring 214-day weight on sire total maternal EPD was 1.18 lb/lb (residual correlation was .17). Breeders who use sire milk and total maternal EPD values as selection tools should expect such selection to be effective, on average, but should also expect that a substantial proportion of individuals or small groups may not rank as predicted.

Key Words: Cattle, Expected Progeny Difference, Maternal, Milk

Introduction

Factors affecting observed differences in beef calf weaning weights include calf genetic potential for growth and dam milking ability. The increased availability of expected progeny difference (EPD) values for "milk" and(or) maternal value has given beef producers another tool for within-breed selection. A bull's total maternal weaning weight EPD refers to expected weaning weight differences in his daughters' offspring due to the cumulative effects of genes that he passes on to his daughters for maternal effect on weaning weight (presumably due primarily to milk production) and the genes passed on to his grandprogeny for preweaning growth. A bull's "milk" EPD refers to expected weaning weight differences in his daughters' offspring due only to differences in daughter maternal effect on weaning weight, separate and apart from differences in grandprogeny genetic potential for preweaning growth. Milk and total maternal EPD values are available not only for sires used extensively through artificial insemination but also frequently available for young, unproven bulls, such as those typically purchased by commercial cow-calf producers. It is important to test the validity of such information under typical commercial production conditions. The objective of this study was to examine the relationships of sire EPD values for milk and total maternal weaning weight (defined as milk EPD plus 1/2 direct weaning weight EPD) to the cumulative milk production of their crossbred daughters and to the weaning weights of the daughters' offspring.

Materials and Methods

Milk-yield estimates were measured on a different set of 2-year-old beef females each year from 1984 through 1990. These females were

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born at the Antelope Range Livestock Station in western South Dakota and then transferred to a drylot facility near Brookings as part of a production-efficiency experiment.

Milk production was estimated by the weigh-suckle-weigh method. Calves were separated from their dams in the evening. The following morning calves were weighed, allowed to nurse for approximately 15 minutes, and then reweighed. Milk yield was evaluated at various points throughout lactation, with a total of four measurements in 1984 and 1985, five measurements in 1986, and six measurements in each of the remaining years. Cumulative milk yields were estimated from lactation curves fitted for each cow. The lactation curve of each cow was fitted to the overall average length of lactation, 214 days. Calf weaning weights were linearly adjusted to 214 days of age. Calves were allowed access to a low energy creep feed.

Cows whose milk production was evaluated in this study were produced in four two-breed rotations: Simmental x Hereford, Angus x Hereford, Salers x Hereford, and Tarentaise x Hereford. Sires of the cows were Simmental, Angus, Salers, Tarentaise, or Polled Hereford bulls. Note that Polled Hereford bulls sired daughters of four breed types, whereas bulls of the other four breeds sired daughters of one breed type each.

The only records retained for analysis were for cows whose sires' 1992 EPD values were available from the respective breed associations. Records of 32 sires and 313 daughters remained after editing. Semen of 21 of these sires was obtained through commercial outlets, while the remaining 11 sires were purchased for use as natural service "cleanup" sires. A summary characterizing sire EPD and accuracy values is presented in Table 1. No data from this herd were reported to breed associations. Therefore, the data used in these analyses were independent of those used in the calculation of sire EPD values.

Relatively few sires were available within each sire breed for this study, so individual regressions (i.e., within breeding group) would have been subject to large sampling errors. Therefore, pooled-across-breed analyses were conducted to compute the regression of daughters' milk yield or daughters' offspring weaning weight on sire EPD. Statistical analyses accounted for the effects of breeding group, year, calf sex, and calf birth weight.

Results and Discussion

The overall average for 214-day milk yield was 2,782 lb. A 1-lb change in sire milk EPD corresponded to a change in daughter 214-day milk yield of 13.4 lb (Table 2). Direct interpretation of this coefficient is difficult because sire milk EPD is expressed in units of grandprogeny weaning weight rather than daughter milk yield. The regression of calf weaning weight on 214-day milk yield was .049 lb/lb, which equates to an additional 1 lb of calf weaning weight per additional 20.4 lb of cumulative milk. Assuming that the maternal effect on weaning weight is due completely to milk production, then the theoretical expectation for regression of daughter cumulative milk yield on sire milk EPD would be 20.4 lb/lb. Therefore, differences among daughters in milk yield were positively related to differences in sire milk EPD, although the magnitude of the relationship was somewhat less than expected (i.e., 13.4 vs 20.4 lb/lb) based on genetic evaluation theory.

A 1-lb change in sire total maternal weaning weight EPD corresponded to a change of 1.18 lb for daughter's calf weaning weight (Table 2). This regression value is very close to its theoretical expectation of one.

The value for pooled regression of daughter milk yield on sire milk EPD was approximately .5% of the overall mean milk yield. This suggests that a 1-lb change in sire milk EPD corresponded to a difference of approximately .5%, on average, in cumulative daughter milk yield.

Table 1. Numbers of sires and daughters, range and mean values for expected progeny difference (EPD), and mean accuracy values

Item	No. of sires	No. of daughters	Sire milk EPD, lb		Mean milk EPD accuracy	Sire total maternal weaning wt EPD, lb	
			Range	Mean[a]		Range	Mean
Polled Hereford	12	156	-21.8 to 16.1	2.03	.68	-19.6 to 22.7	11.6
Simmental	6	55	-3.3 to 11.5	4.06	.61	5.5 to 14.1	9.24
Angus	5	47	4.0 to 14.1	6.22	.64	14.1 to 26.9	21.1
Salers	5	26	-3.7 to 4.4	1.19	.45	-10.6 to -.2	-.99
Tarentaise	4	29	-1.3 to 3.1	.20	.92	-7.9 to 6.4	.84
Overall	32	313			.67		

[a]Each sire's EPD and accuracy values were weighted by the number of daughters.

Table 2. Pooled regressions of daughter production traits on sire expected progeny difference (EPD) values

Daughter production	Sire EPD	Regression coefficient[a] ± SE
214-day milk yield, lb	Milk EPD, lb	13.4 ± 5.29*
214-day calf wt, lb	Total maternal weaning wt EPD, lb	1.18 ± .40**

[a]The average change in daughter production per 1-lb change in sire EPD.
*P<.05.
**P<.01.

Results from the residual correlation analysis are presented in Table 3. Rather low, positive correlations were observed for daughter milk yield with both sire EPD values. Correlations of weaning weight with both sire EPD values were also relatively low and positive.

To examine the effect of including data from daughters of low accuracy sires on the results of this study, additional correlation analyses were conducted in which records from daughters of low accuracy sires (i.e., cleanup sires) were deleted. Data remaining after editing included 21 sires and 217 daughters. The mean accuracy value for sire milk EPD of remaining records was .86. Results of these analyses were very similar to those obtained from using the full data set. Correlations of sire milk EPD with daughter milk yield and daughter's offspring weaning weight were .15 and .21, respectively. Correlations of sire total maternal EPD with daughter milk yield and daughter's offspring weaning weight were .11 and .18, respectively. These results suggest that average relationships between sire EPD and actual daughter maternal production were not appreciably different for high-accuracy sires compared to low-accuracy sires. Genetic prediction theory indicates that the accuracy value for a mean EPD associated with a group of animals is greater than the accuracy associated with the EPD of an individual from the group.

Table 3. Residual correlation coefficients among sire expected progeny difference (EPD) values and daughter production traits

Item	Daughter 214-day calf wt	Sire milk EPD	Sire total maternal weaning wt EPD
Daughter 214-day milk yield	.52**	.14*	.14*
Daughter 214-day calf wt		.18**	.17**
Sire milk EPD			.84**

*P<.05.
**P<.01.

In interpreting the results of this study, it is important to consider some of the assumptions made and potential shortcomings of experimental methods. The procedures used to estimate cumulative milk yield may be less than perfect. Only 2-year-old cows, presumedly not yet at peak milk-producing potential, were included. Theoretical expectations for EPDs assume that bulls' EPDs were estimated with a high degree of accuracy, on average, and that the various bulls were mated to cows of similar average genetic potential for the traits evaluated. It is uncertain if or how heterosis for milk production and(or) calf growth would affect the prediction of crossbred daughter and grandprogeny performance from purebred sire EPDs compared to prediction of purebred descendant performance.

In summary, the results of this study suggest that differences among sires in milk and total maternal expected progeny difference values, on average, were positively related to actual crossbred daughter milk production and daughter's offspring weaning weight. While the magnitudes of such relationships were relatively modest in terms of selection response, they were reasonably consistent with theoretical expectations. Industry breeders who use sire milk and total maternal expected progeny difference values as selection tools should expect such selection to be effective, on average, but should also expect that a substantial proportion of individuals or small groups will not rank as predicted.