NEW DEVELOPMENTS IN SIMULTANEOUS ACROSS AND WITHIN BREED COMPARISONS FOR CENTRAL TESTED BEEF BULLS

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SUMMARY

Post-weaning gain measurements were taken on 24,00 bulls tested in Ontario, Canada from 1980 to January 1990. Expected Progeny Differences (EPD's), which incorporate information on related animals, were used to give accurate genetic evaluations for bulls within breed. Ranges of EPD's for six major breeds varied by breed with Shorthorn having the smallest range (-21 kg to +13 kg) and Charolais having the largest range (-37 kg to +30 kg). Mean Across Breed Comparisons (ABC's), which also incorporate information on relatives, were highest for Charolais and lowest for Hereford. Accuracies associated with the genetic evaluations were typically between 0.38 and 0.61. Positive genetic trends over the time period were significant ($P < 0.05$) for Angus, Hereford, Limousin and Shorthorn.

INTRODUCTION

Central performance testing of beef bulls in Canada has been designed to promote the selection of genetically superior bulls as potential herd sires. The recent introduction of Expected Progeny Differences (EPD's) to the Ontario Bull Test Program is designed to greatly enhance the selection of bulls. Currently in Ontario, herds are too small and too poorly linked genetically to effectively compare bulls from on-farm testing (Wilton et al., 1989). Thus, central performance testing on bulls is important for genetic improvement of beef breeds. Compared to gain index or adjusted performance records, the implementation of EPD's allows information on relatives to be used and simultaneously considers group effects in which average genetic quality differs. Although EPD's are effectively used for selection within breed, there is no complementary program which has been widely used to compare purebred animals between breeds. Across Breed Comparisons (ABC's) were introduced to the Ontario Bull Test Program in July, 1989. The implementation of ABC's enables commercial producers to select bulls across breeds. The objectives of this study were 1) to develop and implement the use of EPD's and ABC's as a means to accurately identify genetically superior bulls to be used as herd sires and 2) to study genetic trends of six major beef breeds in Ontario over the past nine years.

MATERIALS AND METHODS

The Ontario Bull Test Program is a government supervised program, where strict criteria must be met for entry of bulls into test stations. A thirty day pre-test adjustment period is allocated for bulls to adapt to feeding and grouping procedures. Twenty eight beef breeds are represented,

the majority of bulls being Aberdeen Angus (AN), Charolais (CH), Hereford (HE), Limousin (LM), Simmental (SM) and Shorthorn (SS). Bulls in this study averaged 240-d at start of test period, with animals within any one test group not exceeding a 90-d age range. The minimum number of bulls in any one test station was 18, with an average number of 52 bulls across all stations. Weight was measured at 28-d intervals during test. Daily gain on test was calculated using a regression of repeated weights and post-weaning gain by multiplying daily gain by 140.

Post-weaning gain (140-d) for 24,000 bulls at 453 test stations in Ontario from 1980 to January 1990 were analyzed with an animal model that included the effects of fixed test station group and random animal additive genetic effects. Relationships among bulls were included based on sire and maternal grandsire pedigree data. The phantom grouping procedure of Westell and Van Vleck (1987) was used to assign unknown parents to breed and year of birth groups within breeds. Different residual and additive genetic variances were used for each breed, but all breeds were analyzed simultaneously as test groups commonly had bulls of several breeds. The assumed heritabilities were 0.46, 0.56, 0.54, 0.42, 0.38 and 0.38 for AN, CH, HE, LM, SM and SS, respectively. All crossbreds were assigned to one group and the HE parameters were used for this group. All other less numerous breeds were assigned parameters from one of the six major breeds on the basis of body size and milking ability. All bulls which were 7/8 purebred and greater were treated as purebreds. Pedigree information between 1975 and 1990 was used in the analysis.

ABC's and EPD's were derived from estimated animal solutions (which included grouping effects) from the animal model. ABC's were derived by dividing animal solutions by 2 and adjusting for a three year rolling base. ABC's were then reported as a deviation of total gain in kg from the average of all bulls across breeds. EPD's were derived by subtracting the within breed current three year average ABC from the bull's ABC. Accuracies were associated with genetic evaluations for each bull and were calculated following a modified procedure of Meyer (1989). Average EPD's by year were used to estimate genetic trends within breed.

RESULTS

Ranges for EPD's were largest for CH and smallest for SS over the past nine years (Table 1). Mean EPD's for all six beef breeds from the last three years were not different from zero.

Mean ABC's were highest for CH at 8.3 kg, followed by SM at 7.4 kg (Table 2). LM and SS mean ABC's were similar to each other at -4.6 kg and -4.4 kg, respectively. AN and HE had the lowest ABC's for 140-d post-weaning gain.

The range of accuracies associated with EPD's and ABC's were typically between 0.38 and 0.61. Mean accuracies for each breed were very close to heritability (Table 1).

Positive genetic trends were significant ($P < 0.05$) for LM and the three British breeds AN, HE and SS over the nine year interval (Table 3).

DISCUSSION

As illustrated by the results in Table 1, there is a tremendous variation in the trait post-weaning gain, both within and across breed. Utilizing the Ontario genetic evaluations and applying acceptable levels of

Table 1. Means and Ranges of EPD's over the last nine years for six major beef breeds (total kg gain for 140-d)

Breed	Number of Bulls	Mean*	Minimum EPD	Maximum EPD	Accuracy
Angus	2106	-3.0	-32.2	22.9	0.48
Charolais	3725	0.1	-37.0	29.9	0.59
Hereford	5904	-0.4	-30.2	25.9	0.57
Limousin	4644	-0.1	-26.2	20.2	0.49
Simmental	4651	-0.2	-22.0	23.8	0.44
Shorthorn	805	-1.5	-21.2	13.5	0.40

* All EPD's have been calculated to a 1990 base

Table 2. Means and Ranges of ABC's over the last nine years for six major beef breeds (total kg gain for 140-d)

Breed	Mean	Minimum ABC	Maximum ABC
Angus	-5.4	-34.6	18.7
Charolais	8.3	-28.8	38.1
Hereford	-7.1	-36.9	19.3
Limousin	-4.6	-29.9	16.5
Simmental	7.4	-14.5	31.3
Shorthorn	-4.4	-24.1	10.6

Table 3. Genetic Trends for Post-weaning Gain EPD's from 1980 to 1988 (total kg gain for 140-d)

Year	Breed					
	Angus	Charolais	Hereford	Limousin	Simmental	Shorthorn
1980	-6.1	-0.2	-2.1	-2.1	-1.3	-2.4
1981	-6.6	0.3	-1.4	-2.9	-1.0	-2.0
1982	-4.5	1.0	-2.5	-2.4	0.6	-4.9
1983	-4.4	0.0	-0.4	-2.3	-0.6	-2.9
1984	-4.9	-0.4	-0.7	-2.6	-0.3	-1.9
1985	-4.6	-0.4	-0.3	-1.5	0.2	-1.7
1986	0.2	-0.6	-0.7	-0.3	0.0	-1.5
1987	-0.9	0.4	0.5	0.0	0.0	0.2
1988	1.0	0.4	0.8	0.3	-0.1	1.4

selection intensity should result in positive genetic progress. Ultimately this should result in increased income for the beef cattle breeders. Because bulls of different breeds are tested in similar environments, comparisons can be made across breed utilizing ABC's. This information will be useful to a commercial breeder wanting to increase post-weaning gain, regardless of breed.

Currently, EPD's and ABC's for young bulls on the Ontario Bull Test Program are only available for 140-d post-weaning gain. While this is the only trait presently evaluated, it must be stressed that this is not the only important trait. With the introduction of a multi-trait model, evaluations on carcass traits and other economically important traits will be made available.

Although breeding objectives for each breed have not yet been clearly defined, there has been a significant increase in post-weaning gain for AN, HE, LM and SS breeds in the last nine years. Similar trends were reported by de Rose et al. (1988). The average EPD's for both CH and SM breeds were close to zero. One may extrapolate from these nonsignificant genetic trends that CH and SM breeders have placed less emphasis on post-weaning growth traits and more emphasis on other traits.

While ABC's can be produced for crossbred animals, heterosis effects have not been separated out. The need for a more comprehensive evaluation for crossbred animals must still be addressed.

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