Evaluation of young crossbred bulls under field conditions

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Holstein-Friesian crosses have gained most popularity among all crossbreds due to their highest milk production (Singh *et al.* 2000, Upadhyay *et al.* 2002, Akhter *et al.* 2003). Crossbred animals, however, declined in milk production in subsequent generations when interbred due to segregation loss and lack of selection pressure in the herds. The loss in production performance could be minimized by intense selection in males and females. Evaluation of bulls under field conditions removes possibility of genotype × environment interaction and results in production of quality bulls suitable to field conditions. This study aimed to evaluate the breeding value of crossbred bulls and to rank them for first lactation 305 days milk yield so that top ranked bulls could be used under nominated mating for production of quality male calves.

Project Directorate on Cattle executed the field progeny testing scheme at Punjab Agricultural University, Ludhiana (Punjab) in April 1995 (set 1) for testing of the young crossbred bulls under field conditions and to improve the genetic makeup of field animals. Subsequently second and third batches were started in January 1997 and January 1999 under this scheme. The insemination work was undertaken through 21 Artificial Insemination Centres around Punjab agricultural University, Ludhiana, Punjab. -

The centres are operated by the Punjab State Department of Animal Husbandry and some trained inseminators. The bulls used under the sets had 50–75% exotic inheritance (Holstein-Friesian) with minimum 45000 kg dam's mature yield. The data were recorded on farmers, cows and their daughters. The milk was recorded in first lactation at monthly interval on contract basis under trained supervisors. The test day yields were used to estimate the 305 days yield.

The first lactation records of 471 cows, daughters of 34 bulls and calved during 4 years from 1999 to 2002 were used in the present analysis. Each year of calving was divided into 3 seasons i.e. winter (November to February), summer (March to June) and rainy season (July to October) based on

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climatological conditions. Sires with less than five daughters were excluded from the study. The trait considered for analysis was 305 days milk yield. Bulls' breeding values were estimated through best linear unbiased prediction (BLUP) procedure using suitable option in least squares and maximum likelihood computer package (Harvey 1990). The heritability estimate of 305 days milk yield used in BLUP analysis was taken as 0.25. The ranks of bulls were also estimated. The following model was used for analysis:

$$Y_{ijklm} = \mu + ST_i + SR_{ij} + YR_k + SN_l + b\,(A_{ijklm} - \bar{A}_{ijklm}) + e_{ijklm}$$

Where, Y_{ijklm} = observation on mth daughter of jth sire within ith set, μ = overall mean, ST_i = fixed effect of ith set, SR_{ij} = random effect of jth sire within ith set, YR_k = fixed effect of kth year of calving, SN_l = fixed effect of lth season of calving, b = regression of 305 days 1st location milk yield on age at first calving, A_{ijklm} = observation on age at first calving, $\bar{A}_{ijklm}$ = average age at first calving and e_{ijklm} = random residual error.

The genetic and phenotypic trends were estimated using standard procedures i.e. regressing breeding value/performance on time. The accuracy of sire evaluation was estimated as per Jain (1982).

First lactation 305 days milk yield in crossbred cows averaged 2813±21.19 kg in field conditions. This was higher than that reported by earlier workers in Friesian crosses (Singh *et al.* 2003) and similar to that reported by Bhattacharya *et al.* (2002). Effects of set, year and season of calving and age at first calving had nonsignificant effect on 305 days milk yield. Upadhyay *et al.* (2002) also observed non-significant effect of season of calving on first lactation milk yield in Holstein-Friesian crossbred cows. The cows born in set 1 (2 860 kg) had the highest 305 days milk yield followed by those born in set 3 (2 833 kg). Milk yield increased from the year 1999 to 2000 (2 874 kg) and declined marginally thereafter. The cows calved during winter (2 829 kg) produced the highest yield followed by those calved in summer season (2826 kg) in first lactation.

Altogether 34 bulls were tested in 3 sets (17+09+08). The bulls inducted in each set were not uniform due to variation in availability of bulls. The daughters' average 305 days milk

yield first lactation varied from 2 396 (Deven/Code 12) to 3157 (Hameed/Code 20) kg for different bulls. The product moment correlation (0.36±0.12) and rank correlation (0.71±0.23) of daughter's average was low and medium with the breeding value of the bulls. This reflected that evaluation of young bulls based on their daughters' average cannot be considered as a perfect criteria. BLUP estimates of the sires ranged from 2 742 to 2 861 kg. The highest breeding value was observed for sire no. HRS 548 followed by Hameed and WAM 457. Sire no. 1F748 has the lowest breeding value.

The bulls inducted in set first and third had higher breeding value than those inducted in set second. The breeding value of certain bulls was higher than corresponding daughters average (phenotypic value) in all sets. This reflected that genetic potential of the bulls could not be exploited fully in the given environment. The breeding values of the bulls in the present investigation were higher than that reported by Gaur (2003) in Holstein-Friesian × Sahiwal cross who observed the breeding value of young crossbred bulls ranging from 2 481 to 2 768 kg for first lactation milk yield.

Bulls within the set had minimum variation in first lactation milk yield while those between the sets had maximum variation. Number of daughters per bull varied from 5 to 43. It had no specific trend over the performance (breeding value) of the bulls. Some bulls having more number of daughters had their low breeding value as compared to those with less number of daughters. The accuracy was however, more for the bulls evaluated based on more number of daughters. The accuracy of the breeding values ranged from 0.50 to 0.86.

Bulls (25) of first and third set had their breeding values exceeding overall mean (μ) of 2812.70 kg while bulls inducted in second set were below average. HRS 548 (49.07 kg) had the highest superiority over herd average followed by followed by Hameed (48.70 kg) and WAM 457 (48.68 kg). The phenotypic trend in the present study was estimated by regressing daughter's performance on year of calving. The genetic trend was calculated as regression of bull's breeding value for first lactation milk yield on year when it was inducted in AI program. The phenotypic (-55.48±21.43 kg/year) and genetic (-16.66±10.07 kg/year) trends, were negative due to the lower performance of bulls inducted in second set. The improved breeding value of the bulls in 3rd set however, reflected that the program has moved in desired direction and positive trends may be expected in near future when more number of sets will complete in the program.

SUMMARY

This study aimed to evaluate the breeding value of crossbred bulls being used in Field Progeny Testing Programme at the Punjab Agricultural University (PAU), Ludiana, Punjab, in different sets and to rank them for first lactation 305 days milk yield. First lactation 305 days milk yield in crossbred cows averaged 2813±21.19 kg in field conditions. Effect of set, year and season of calving and age at first calving had non-significant effect on 305 days milk yield. The daughters' average 305 days milk yield varied from 2396 to 3 157 kg for different bulls. Best Linear Unbiased Prediction estimates of the sires ranged from 2 742 to 2 861 kg. The bulls inducted in set first and third had higher breeding value than those inducted in set second. Bulls within the set had minimum variation in first lactation milk yield while those between the sets had maximum variation. The accuracy of the breeding values ranged from 0.50 to 0.86. Bulls (25) of first and third set had their breeding values exceeding overall mean (μ) of 2812.70 kg while bulls inducted in second set were below average. Top 3 ranked bulls had superiority over herd average by 49.07, 48.70 and 48.68 kg and are being used under nominated mating.

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