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Full Length Research Paper

Comparison of the best breed combination in Iranian Holstein and Brown Swiss crossbred dairy cattle for production traits

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Iranian crossbred cattle performance was considered from the years 1991-2003. Holstein × native and Brown Swiss × native crossbreed cattle were surveyed for milk yield (kg), fat yield (kg), fat percent and milk-days traits. Nine genetic groups were defined according to the percentage of imported breed genes at 12.5% intervals. Data were analyzed with mixed model procedure in SAS (8.2) software. Analysis of variance showed that the Holstein breed effect was significant on fat percent, milk yield and milk- days traits, but not significant on fat yield trait. However, the effect of Brown Swiss breed was in the same trend with that of Holstein breed. But results in fat yield and fat percent traits were reversed. Total means for milk yield, fat yield, fat percent and milk- day traits were estimated to be 2722.68 ± 1541.12 kg, 122.97 ± 47.40 kg, 3.97 ± 0.73% and 260.10 ± 89.51 days for Holstein cross and 2489.19 ± 914.58 kg, 117.31 ± 49.49 kg, 3.87 ± 1.27% and 252.56 ± 81.64 days for Brown Swiss crosses. The least square means comparison with Duncan multiple range test showed that the peak of production was obtained in 50 to 87.5 shares of Holstein and Brown Swiss breeds. The result suggests that Brown Swiss is a favorable breed for crossbreeding program in Iran.

Key words: Crossbreeding, Holstein, Brown Swiss, breed combination.

INTRODUCTION

Crossbreeding system can be used in dairy cattle production for the following reasons: it provides heterosis, leads to using of different breeds, synchronizes more effectively performance traits and adaptability of producer's animal to environmental and nutritional conditions and finally breed complementarity. Other application of crossbreeding is to form new composite breeds from a multi-breed foundation. Thus, crossbreeding systems can provide a means to use both non-additive (heterosis) and additive (breed differences) effects of genes simultaneously (Gregory and Cundiff, 1980). Major differences among breeds have been demonstrated for most characters that contribute in mating system. However, one of the main goals in crossbreeding is to choose the best breed for mating with local breeds and to get to the desired level of heterosis. Besides these goals, getting to the suitable level of foreign breed's gene in crossbred animals for maximum production is essential.

Crossbreeding in Iran started with European breeds such as Holstein, Brown Swiss, Jersey, etc. few years ago. Till date, it still continues with mainly Holstein and Brown Swiss breeds. In recent years, the number of crossbred cattle in the rural farm system has increased. A limited research on this population was carried out in some provinces. The results showed that the mean of the production traits increased (Hydarpour, 1996; Naji, 1996; Rekui, 2000). Hence, further and more comprehensive study on Iranian crossbred population seems necessary and worthwhile.

This study intends to make an estimation and comparison of Holstein and Brown Swiss genetic group mean and to determine the best breed and genetic group for crossbreeding programs.

MATERIALS AND METHODS

Analysis was carried out with 12575 animal; records of Iranian

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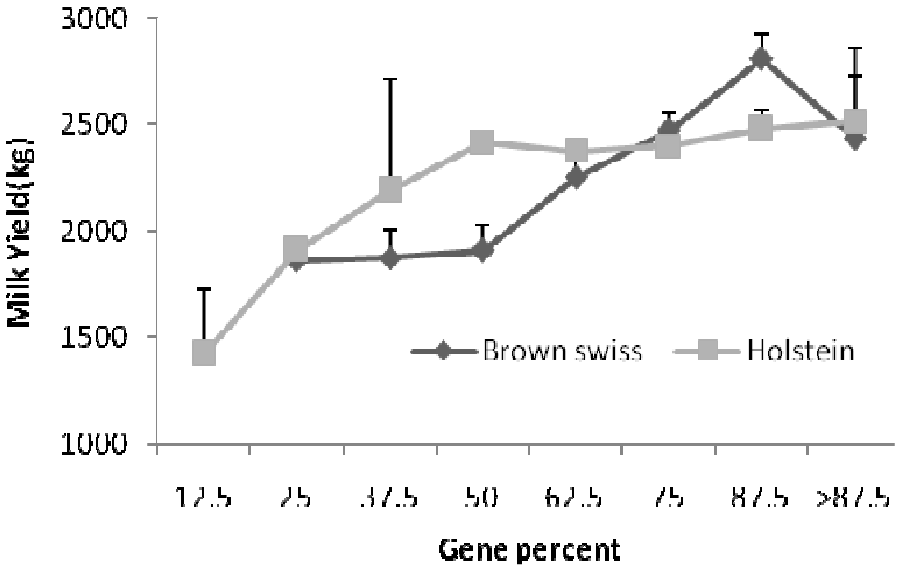

Figure 1. Milk yield mean and standard deviation in different gene percent in crossbred population

crossbred population in Animal Breeding Center of Agricultural Ministry were collected from 1991-2003. Brown Swiss and Holstein breeds were used for crossbreeding. Records include milk yield (kg), fat yield (kg) fat percent (%) and milk-days traits and also information of breed composition. Nine genetic groups were defined according to percentage of imported breed genes at intervals of 12.5%. EXCEL (2003), SPSS (9) and FOXPRO (2.6) Software were used for editing data and SAS (8.2) Software was used for analysis.

Statistical analysis

Records were analyzed with the following model proposed by Van der werf (1989).

$$y_{ijklmnop}=\mu+L_i+H_j+(YS)_k+g_l+Het+\mathrm{Rec}_n+MHet_o+a_p+e_{ijklmnoj}$$

Where, μ is the population mean; *Li* is the lactation number i = 1…8, H_j and YS_k = fixed environmental effects of herd and year season with j = 1…295 and k=1…4; g_l is the fraction of foreign gene in crossbred progeny with l = 1…8 that equals [(Ps +Pd)/2] (P_s and P_d are imported genes percent in two parent), Het_m = heterosis percent in progeny is equal to degree of heterozygosity of animal; Rec_n is the interactions between presences of imported gene in two parents; $Mhet_o$ is the maternal heterosis; a_p is the additive genetic effect of cow making record; $e_{ijklmnop}$ is the a residual effect.
Mean of genetic group was compared with Duncan multiple range test.

RESULTS AND DISCUSSION

Analysis of variance showed that the Holstein breed effect was significant on fat percent trait and also has individual and maternal heterosis and recombination effects on the milk yield and milk day's traits. It has no significant effect on fat yield trait. However, the effect of Brown Swiss breed was in the same trend with that of Holstein breed, but results in fat yield and fat percent traits were reversed. Total means for milk yield, fat yield, fat percent and milk-days traits were estimated to be 2722.68±1541.12 kg, 122.97 ± 47.40 kg, 3.97 ± 0.73% and 260.10 ± 89.51 days for Holstein cross and 2489.19 ± 914.58 kg, 117.31 ± 49.49 kg, 3.87 ± 1.27% and 252.56 ± 81.64 days for Brown Swiss crosses. Least squares mean with standard error for mentioned trait in different group of Holstein and Brown Swiss breeds are given in Figures 1, 2, 3 and 4.

The milk least squares mean in milk yield increased with Holstein breed share (HBS) in crossbred animals and peak of performance obtained is higher than 87.5% of the HBS. But between 50% of HBS and above, there was no significant difference. However, in another population, the peak of the milk yield obtained is 87.5% share of the Brown Swiss breed share (BBS), and unlike previous populations there were significant differences between groups and also the production decreased after 85.7% of the BBS; but maximum milk production in Brown Swiss was higher than others. Furthermore, the curve slop and total mean in Holstein were higher than Brown Swiss. Other researcher has reported the same results with few contrasts (due to different native breeds) in studied crossbred population (Caimane, 1973; Katpatal, 1977; Bhat and Taneja, 1978; Jeannin et al., 1988; Hydarpour, 1996; Nji, 1996; Rekui, 2000; Miraei-Ashtiani et al., 2001)

In fat yield trait, same trend with milk yield can be seen but the maximum value belonged to Holstein crossbreeds with 87.5 of HBS. Although, the peak of the fat yield in Brown Swiss crossbreeds was shown in 75 of BSB but there was not any significant difference between 62.5 and

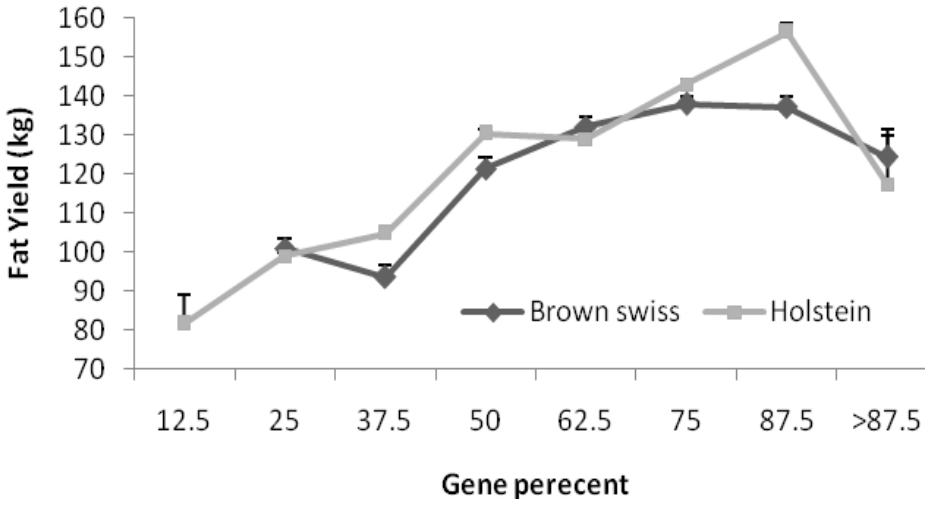

Figure 2. Fat yield mean and standard deviation in different gene percent in crossbred population.

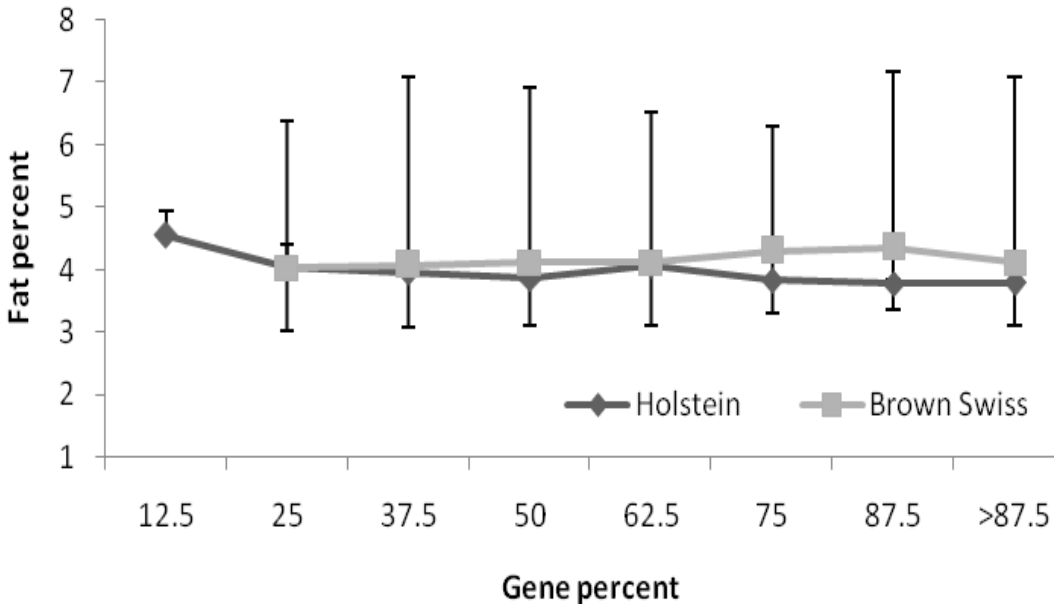

Figure 3. Fat percent mean and standard deviation in different gene percent in crossbred population.

above. It was same to milk yield in this breed. Also the curve slop in the Holstein and total mean in Holstein was higher than Brown Swiss. Nearly all the results of the studies indicated that the entry of foreign gene increased the production potential of native herds (McDowell and McDaniel, 1968; Naji, 1996; Rekui, 2000). In these studies, maximum production was derived in different percentages of European breeds but the important issue is that in majority of the studies the peak of fat yield was obtained in percentages of 50 to 87.5. This could be due to different environmental conditions and local breeds.

The comparison of least squares means in fat percent showed that introduction of Holstein genes affected and decreased fat percent but after 50 %, HBS did not have any significant difference. In Brown Swiss population, despite the significant effect of breed on fat percent traits, there was not any significant difference between genetic groups. But the reason for these different results could be due to the lower fat percent in Holstein breed than Brown Swiss breed. So the fat percent decrease in Holstein crossbred and less effect of Brown Swiss were predictable. Rekui et al. (2000), in their study on Esfahan provenance crossbreed population, showed that the fat percent least squares mean for 12.5, 25, 50, 75 and 87.5

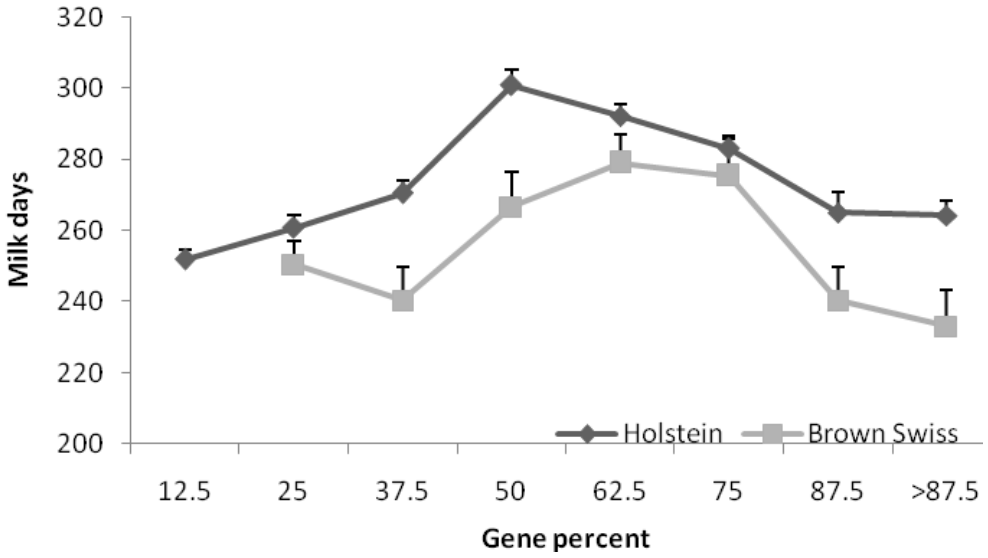

Figure 4. Milk day mean and standard deviation in different gene percent in crossbred population.

gene percent were 4.31, 5.54, 4.14, 4.32 and 4.68 in Holstein and 4.34, 4.21, 4.4, 4.22 and 4.23 in Brown Swiss, respectively. Fat percent means in Thailand Holstein crossbred was obtained as 3.7% (Elzo et al., 2002). This result is similar to that of this study. Bhat and Taneja, (1978), in their research on Indian crossbred cattle, reported that the F1 cross fat percent was higher than other groups. This is also similar with the result of this study.

Comparison of milk days means showed that the entry of foreign genes is effective, and maximum milk days were obtained between 50 and 75% genetic group; but the mean in Holstein crosses is higher than the others.

Crossbreeding, as a mating method, has been used in different countries for years. This method has increased the performance of the local production systems. Crossbred animal performance is a combination of additive and non-additive genetic factors. Therefore, determining the portion of each factor can be helpful to breeders in increasing the performance of crossbred population.

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