GROWTH AND REPRODUCTION PERFORMANCE OF THE LOCAL GOATS AND THEIR CROSSBREDS WITH THE GERMAN (IMPROVED) FAWN GOATS.

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SUMMARY

The Local goats of Malaysia and their crossbreds with the German (Improved) Fawn goats were evaluated for growth and reproduction performance. The crossbreds were found to, generally, perform better than the Locals. The individual and maternal heterosis were, generally, negative for most of the traits while the individual additive genetic effect of the German Fawn genes were, generally, positive and significant.

INTRODUCTION

Crossbreeding as a means of improving any antagonistic property in the indigenous breed and increasing the growth and reproduction efficiency is a well established practice. However, for this method of genetic manipulation to be successful it is important that the performance of the indigenous and the crossbreds be thoroughly evaluated.

It is the objective of this study to compare the growth and reproductive performance of the Local goats of Malaysia and their crossbreds with the German (Improved) Fawn goats. The various genetic and non-genetic factors causing variability in these traits are to be evaluated and the crossbreeding parameters estimated.

MATERIAL AND METHODS

The experimental stock used in this study comprised of 1289 animals which were part of the crossbreeding programme carried out at the Research Farm of the Institut Pengajian Tinggi (IPT), University of Malaya, Kuala Lumpur, Malaysia, in cooperation with the Technical University of Berlin, West Germany (Mukherjee et al., 1983; Horst et al., 1984). This included the Local goats, and those with 25% ($BC_1$, $BC_2$), 50% (F1, F2, F3), and 75% ($BC_2$) German Fawn genes respectively.

Least square analysis of variance was used to examine the various genetic and non-genetic factors affecting the traits under investigation. Crossbreeding parameters for these traits were estimated using multiple regression analysis. The breed group effects were analysed in terms of additive genetic effect of the offspring, maternal additive genetic effect and the individual and maternal heterotic effects (Dickerson, 1974; Mather and Jinks, 1982). As the
number of breed groups available was insufficient to allow the estimation of all the crossbreeding parameters and for easy estimation of the more important crossbreeding parameters, the paternal additive genetic and heterotic effects and the epistatic effect were excluded from the model used.

\[ Y = u + k_1G + k_2M + k_3H_1 + k_4H_m \]

where:

- \( Y \) = average performance of the progenies of a cross
- \( u \) = mean
- \( k_1 \) = proportion of German Fawn genes in progenies
- \( G \) = deviation due to additive genetic effect of progenies' genes
- \( k_2 \) = proportion of German Fawn genes in dam
- \( M \) = deviation due to maternal effect
- \( k_3 \) = proportion of loci with one gene from each parental breed
- \( H_1 \) = deviation due to individual heterosis
- \( k_4 \) = proportion of loci in dam with one gene from each breed
- \( H_m \) = deviation due to maternal heterosis

**RESULTS**

Birth weight was significantly (\( P<.01 \)) affected by breed group, sex, litter type, post partum dam weight and the two-way interactions breed group x sex (\( P<.05 \)) and breed group x litter type. All the crossbreds were heavier than the Locals at birth, however, only the \( F_1 \), \( F_2 \) and \( BC_2 \) were significantly (\( P<.05 \)) heavier (Table 1). Although all the crossbreeding parameters for birth weight were positive, only individual additive genetic effect was significant (\( P<.01 \)).

The least square means proved the male kids to be significantly (\( P<.05 \)) heavier than the females at birth (1.98 vs 1.75 kg). Among the breed groups, except for \( F_1 \) and \( BC_1 \), the difference between the sexes was significant (\( P<.05 \)).

Animals of single birth (2.34 kg) were significantly (\( P<.05 \)) heavier than both twins (1.80 kg) and multiple birth (1.37 kg) kids, the advantage being 30.0% and 70.8% respectively. The difference between the twins and the kids of larger litters was also statistically significant (\( P<.01 \)). Among the seven breed groups, the mean birth weight of the twins and multiple birth kids were 71-85% and 53-66% of that of the singles respectively and were significantly (\( P<.05 \)) different from each other.

The correlations between litter size and birth weight were found to be negative and, except for the \( F_3 \) animals, significant (\( P<.05 \)). Correlations between mean birth weight of kid and post partum dam weight was observed to be positive and significant (\( P<.05 \)) for the Local, \( F_3 \), \( BC_1-R \) and \( BC_2 \) breed groups.

Two-way interaction effects were, generally, non-significant for monthly body weights and daily weight gain of the kids up to 9 months of age. Breed group effect was significant (\( P<.01 \)) for body weight at all the 9 months and daily weight gain at the early ages. The \( F_1 \), \( F_2 \), \( F_3 \), \( BC_1-R \) and \( BC_2 \) kids were generally, not significantly different
from each other in body weight (Table 1) and were, generally, significantly (P<.05) heavier than the Locals. The Locals, generally, exhibited very low daily weight gain, especially at the later ages. Individual and maternal heterosis values were slightly negative and non-significant.

The effect of sex on body weight was significant (P<.05) only at 1, 7, 8 and 9 months of age. At 1 month, the males weighed 5.14 kg and the females 4.81 kg, the difference being 6.8%. At 9 months of age this difference was 12.8% (20.51 vs 18.18 kg). Daily weight gain indicated similar influence of sex for the first month (11.32%) and sixth month onwards (22.70-32.75%)

The effect of litter size on body weight was significant (P<.01) only for the pre-weaned kids. The singles were significantly (P<.05) heavier than the twins and multiple birth kids, however, the latter two groups were not significantly different from each other. The ratios of the body weights of the singles: twins: multiple births were 100:89:90, 100:89:91 and 100:100:99 for 1, 3, and 9 months of age respectively. The litter size had a significant effect on daily weight gain during birth - 1 month (P<.01) and 3 - 4 months (P<.05) of age. In this case too, only the daily weight gain of the singles was significantly (P<.05) larger than that of the bigger litters.

Birth weight had a significant (P<.05) effect on body weight at all ages. However, its effect on daily weight gain was only significant (P<.05) for the first two months after birth.

Crossbreeding improves fertility or number of females mated that conceived. Fertility was lowest for Local does, 55:00, and highest among the BC 1-R does, 88.98% (Table 1).

There was no significant difference in the mean litter size of dams of the six breed groups, although the Locals had the highest mean value. The individual and maternal heterotic effects were both negative but only the latter effect was significant (P<.01). The individual genetic effect through non-significant was quite high and positive.

The Local dams had the lightest litters, significantly different from all other breed groups (Table 1). The BC 2, F 1, F 2 and BC 1 dams were not significantly different from each other for this trait. High individual additive genetic effect of the German Fawn genes and also individual heterosis was observed for mean litter weight (Table 2). However, both these values were not significant.

Litter weight increased with parity, however, it was only significantly (P<.05) greater for the third and subsequent parity dams. Litter weight also increased significantly (P<.05) with litter size. Litters of single progenies averaged 2.61 kg at birth, while those with two and more kids averaged 3.99 and 5.01 kg respectively. Significant (P<.05) parity x litter size interaction effect was noted for this trait.
DISCUSSION

Introduction of the German Fawn genes seems to improve the growth and reproduction traits of the Local goats although individual and maternal heterosis were found to be, generally, negative. These crossbreeding parameters were also in most cases non-significant. The individual additive genetic effect of the German Fawn genes seems to contribute most towards this improvement, especially towards birth weight and body weights.

REFERENCES


Table 1. Least square means and standard errors of growth and reproduction traits.

<table>
<thead>
<tr>
<th>Breed</th>
<th>Birth Weight (kg)</th>
<th>3-ith Height (kg)</th>
<th>6-ith Height (kg)</th>
<th>9-ith Height (kg)</th>
<th>Fertility (%)</th>
<th>Litter Size (kg)</th>
<th>Litter Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>1.66 ± 0.03</td>
<td>7.96 ± 0.42</td>
<td>10.16 ± 0.53</td>
<td>15.45 ± 0.71</td>
<td>55.00</td>
<td>1.59 ± 0.06</td>
<td>3.50 ± 0.10</td>
</tr>
<tr>
<td>F₁</td>
<td>2.07 ± 0.05</td>
<td>8.69 ± 0.39</td>
<td>13.19 ± 0.49</td>
<td>20.10 ± 0.65</td>
<td>63.73</td>
<td>1.44 ± 0.05</td>
<td>4.00 ± 0.10</td>
</tr>
<tr>
<td>F₂</td>
<td>1.87 ± 0.05</td>
<td>9.18 ± 0.32</td>
<td>14.37 ± 0.41</td>
<td>19.84 ± 0.57</td>
<td>76.09</td>
<td>1.38 ± 0.12</td>
<td>3.93 ± 0.14</td>
</tr>
<tr>
<td>F₃</td>
<td>1.74 ± 0.10</td>
<td>9.68 ± 0.84</td>
<td>13.70 ± 1.00</td>
<td>19.95 ± 1.52</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BC₁</td>
<td>1.71 ± 0.05</td>
<td>7.42 ± 0.64</td>
<td>11.32 ± 0.80</td>
<td>17.27 ± 1.11</td>
<td>70.59</td>
<td>1.48 ± 0.18</td>
<td>3.93 ± 0.21</td>
</tr>
<tr>
<td>BC₁-R</td>
<td>1.74 ± 0.06</td>
<td>9.77 ± 0.64</td>
<td>14.61 ± 0.85</td>
<td>20.97 ± 1.22</td>
<td>82.98</td>
<td>1.38 ± 0.30</td>
<td>3.76 ± 0.34</td>
</tr>
<tr>
<td>BC₂</td>
<td>2.08 ± 0.07</td>
<td>9.58 ± 0.53</td>
<td>15.59 ± 0.65</td>
<td>21.62 ± 0.97</td>
<td>74.57</td>
<td>1.56 ± 0.18</td>
<td>4.09 ± 0.18</td>
</tr>
</tbody>
</table>

Means for a particular trait that do not share any superscript are significantly (p < .05) different.

Table 2. Mean values and standard errors of crossbreeding parameters for growth and reproduction traits.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Individual Additive</th>
<th>Maternal Additive</th>
<th>Individual Heterosis</th>
<th>Maternal Heterosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth Weight (kg)</td>
<td>0.70 ± 0.16</td>
<td>0.36 ± 0.30</td>
<td>0.17 ± 0.09</td>
<td>0.21 ± 0.19</td>
</tr>
<tr>
<td>1-ith Weight (kg)</td>
<td>5.65 ± 0.64</td>
<td>1.19 ± 1.52</td>
<td>1.53 ± 0.40</td>
<td>-1.10 ± 0.76</td>
</tr>
<tr>
<td>3-ith Weight (kg)</td>
<td>9.48 ± 1.51</td>
<td>3.24 ± 3.00</td>
<td>-2.41 ± 0.85</td>
<td>-2.44 ± 1.51</td>
</tr>
<tr>
<td>6-ith Weight (kg)</td>
<td>13.41 ± 2.20</td>
<td>-1.09 ± 4.01</td>
<td>-2.36 ± 1.24</td>
<td>-0.13 ± 2.28</td>
</tr>
<tr>
<td>9-ith Weight (kg)</td>
<td>18.77 ± 3.02</td>
<td>-4.19 ± 6.82</td>
<td>-2.20 ± 1.69</td>
<td>-1.18 ± 3.42</td>
</tr>
<tr>
<td>Litter Size</td>
<td>0.24 ± 0.34</td>
<td>-</td>
<td>-0.16 ± 0.18</td>
<td>-0.26 ± 0.09</td>
</tr>
<tr>
<td>Litter Weight</td>
<td>0.55 ± 0.62</td>
<td>-</td>
<td>0.53 ± 0.32</td>
<td>-0.23 ± 0.17</td>
</tr>
</tbody>
</table>