Post-weaning Growth and Carcass Traits of St. Croix White and Dorper X St. Croix White Lambs Fed a Concentrate Diet in the U.S. Virgin Islands

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Summary

Growth and carcass traits of St. Croix White (STX; n = 22) and Dorper X St. Croix White (DRP; n = 18) lambs fed a concentrate ration were evaluated. Starting two weeks after weaning (63 d of age) lambs were fed a commercial diet at 4 percent BW•hd⁻¹•d⁻¹. Lambs were slaughtered at a BW of 30 kg. Carcass weight, fat thickness over the 12th rib, rib eye area (REA), percent KPH and leg circumference were measured. Days on feed was greater (P < 0.01) for STX than for DRP lambs (153.2 ± 6.8 d vs. 118.9 ± 7.4 d, respectively). Total weight gained was greater (P < 0.04) for STX than for DRP lambs (16.1 ± 0.5 kg vs. 14.6 ± 0.5 kg, respectively). The ADG of DRP lambs was higher (P < 0.01) than that of STX lambs (10.4 ± 0.4 cm² vs. 9.0 ± 0.4 cm², respectively). Fat thickness was not different (P > 0.10) between DRP and STX lambs (1.5 mm ± 0.2 mm). Percent KPH was higher (P < 0.001) in STX than in DRP lambs (3.6 ± 0.3 percent vs. 2.2 ± 0.3 percent, respectively). Leg circumference was greater (P < 0.007) for DRP than for STX lambs (37.3 ± 0.4 cm vs. 35.7 ± 0.4 cm, respectively). Cost of gain was higher (P < 0.05) for STX than DRP lambs (4.08 ± 0.02 $/kg vs. 3.73 ± 0.02 $/kg, respectively). Sales of DRP resulted in greater (P < 0.03) net revenue than sales of STX in each market. Dorper X St. Croix White crossbred lambs fed a concentrate ration are economically feasible due to lower cost of gain, higher ADG and revenue.

Key words: Hair Sheep, Lambs, Crossbreeding, Growth, Carcass.
Introduction

The Caribbean sheep industry is based on breeds of hair sheep that can be traced back to African seed stock (Shelton, 1991). The predominant breed in the U.S. Virgin Islands is the St. Croix White with a small number of Barbados Blackbelly. Carcass weight of hair sheep lambs raised under a variety of conditions in the tropics has been reported to range from 4.6 kg to 18.1 kg (Martinez et al., 1991; Wildeus and Fugle, 1991; Hammond and Wildeus, 1993; Godfrey and Collins, 1999). Attempts to produce larger carcasses from hair sheep have primarily focused on crossbreeding. McClure et al. (1991) evaluated a composite breed consisting of one-quarter to one-half hair and three-quarters to one-half wool breeds and found that the crossbred lambs had lighter carcasses than straightbred wool lambs, but they were heavier than straightbred St. Croix White lambs. In our laboratory it was found that Suffolk X St. Croix White lambs had higher ADG than St. Croix White lambs but lower feed efficiency of the crossbreds and the high cost of imported feed eliminated any economic advantage of the growth and size of the Suffolk-sired lambs (Godfrey and Collins, 1999).

The introduction of Dorper sheep into the United States has led to a high level of interest in this breed in the U.S. Virgin Islands for use in crossbreeding programs. The Dorper breed was developed in South Africa by crossing Black Head Persian with Dorset Horned sheep (Milne, 2000). The Dorper sheep was initially selected for use in arid areas of South Africa. St. Croix has a semi-arid environment with an annual rainfall of 1100 mm with the majority of the precipitation occurring during the months of September through December (Godfrey and Hansen, 1996).

There is little information in the literature describing the growth performance of Dorper X hair crossbred lambs, especially under tropical conditions. Notter et al. (2004) reported that Dorper-sired lambs had slightly greater backfat thickness and larger loin eye area than Dorset sired lambs. The dams of those lambs were wool ewes, and they were not reared under tropical conditions. Snowden and Duckett (2003) determined that lambs produced by Dorper terminal sires on wool-breed ewes were suited for U.S. lamb production due to the enhanced growth rate, feed efficiency and carcass traits of the lambs.

The Dorper was selected for use in crossbreeding with the Caribbean hair sheep in this project due to its heavy muscling and the fact that it was developed for use in arid, tropical areas and its coat is more typical of hair than wool. The objectives of this study were to evaluate the growth and carcass traits of St. Croix White and Dorper X St. Croix White lambs fed a concentrate ration during the post-weaning period.

Materials and Methods

St. Croix White (STX) ewes were bred to black headed Dorper (n = 2) and St. Croix White (n = 2) rams to produce STX and Dorper X St. Croix White (DRP) lambs. All lambs were weaned at an age of 63 ± 3 d. For two weeks after weaning, lambs were fed a commercial pelleted diet at 2 percent BW•hd⁻¹•d⁻¹ (PMI, Mulberry, FL) and had ad libitum access to guinea grass (Panicum maximum) hay, water and mineralized salt. Male lambs were surgically castrated one week after weaning. At the end of the two-week adjustment period, the lambs (n = 40) were allotted by gender and sire breed and placed into pens (3.1 X 6.1 meters). The final distribution was seven and eight DRP and STX ewe lambs and 11 and 14 DRP and STX wethers, respectively. Lambs were fed the pelleted diet at 4 percent BW•hd⁻¹•d⁻¹ and had ad libitum access to guinea grass hay, water and mineralized salt. Feed refusals from each pen were weighed daily. Lambs were weighed each week, and the amount of feed offered was adjusted accordingly.

Lambs were slaughtered at 30 kg BW, which is the preferred size for the local market. Cold carcass weight, rib eye area measured between the 12th and 13th rib (REA), fat thickness over the 12th rib, percent KPH and rear leg circumference were recorded. Dressing percent was also determined.

Total weight gain and ADG were determined for individual lambs within each pen. Cost of gain (U.S. $/kg) was calculated on a per pen basis using the total amount (kg) and cost of feed (U.S. $0.50/kg) provided to each pen and the total weight gain of each pen (kg). Even though all lambs were slaughtered and were sold in only two of the markets, net carcass value was calculated for each of the three market outlets available in the U.S. Virgin Islands. If animals had been sold live, for religious slaughter, the price would have been $2.21/kg live weight. Commercial sale of the carcasses to a local supermarket was at the rate of $3.96/kg carcass weight and sale of carcasses to individual consumers was at the rate of $4.41/kg carcass weight. Net carcass value was determined as the gross-sale price for each market described minus the cost of feed and slaughter fees (fixed at $6/ hd).

Data were analyzed using General Linear Model procedures (SAS, 1999). Body weight during the feeding period was analyzed using repeated measures procedures. The model consisted of breed, gender, days on feed and the appropriate interactions. Carcass and economic traits were analyzed using breed, gender and the interaction in the model. All data are reported as least squares means ± SEM.

Results and Discussion

There was no effect of gender or the breed x gender interaction on any traits measured (P > 0.10) so only breed comparisons are reported. At the start of the

<table>
<thead>
<tr>
<th>Breed</th>
<th>Days on feed</th>
<th>Total gain, kg</th>
<th>ADG, g/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRP</td>
<td>118.9 ± 7.4b</td>
<td>14.6 ± 0.5d</td>
<td>125.1 ± 4.7b</td>
</tr>
<tr>
<td>STX</td>
<td>153.2 ± 6.8c</td>
<td>16.04 ± 0.5e</td>
<td>108.1 ± 4.3c</td>
</tr>
</tbody>
</table>

a Lambs were provided feed (18.8% CP on DM basis) at 4% BW•hd⁻¹•d⁻¹.
b,c Means within a column with different superscripts are different (P < 0.01).
d,e Means within a column with different superscripts are different (P < 0.04).
Feeding trial the DRP lambs weighed more (P < 0.007) than the STX lambs (15.8 ± 0.5 kg vs. 13.8 ± 0.5 kg, respectively). The number of days on feed to reach market weight (P < 0.01) and total weight gained (P < 0.04) were greater for STX than for DRP lambs (Table 1). Average daily gain was higher (P < 0.01) for DRP than for STX lambs (Table 1). The DRP lambs were heavier (P < 0.04) than the STX lambs at all times during the feeding trial (Figure 1).

Previous work in our lab has shown that crossbred (Suffolk X St. Croix White) lambs yielded heavier carcasses than St. Croix White lambs after 100 d on feed (Godfrey and Collins, 1999). This is in contrast to the present study where there was no difference in carcass weight between the STX and DRP lambs. In the previous study the crossbred lambs were heavier than the St. Croix White lambs at slaughter (34 kg vs. 29 kg, respectively), while there was no difference between breed types in slaughter weight in the present study.

Table 2. Carcass traits of St. Croix White (STX) and Dorper X St. Croix White (DRP) lambs. a

<table>
<thead>
<tr>
<th>Breed</th>
<th>DRP</th>
<th>STX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot carcass wt, kg</td>
<td>12.9 ± 0.2</td>
<td>12.9 ± 0.2</td>
</tr>
<tr>
<td>Cold carcass weight, kg</td>
<td>12.6 ± 0.2</td>
<td>12.6 ± 0.2</td>
</tr>
<tr>
<td>Leg circumference, cm</td>
<td>37.3 ± 0.4 b</td>
<td>35.7 ± 0.4 c</td>
</tr>
<tr>
<td>Rib eye area, cm²</td>
<td>10.4 ± 0.4 d</td>
<td>9.0 ± 0.4 e</td>
</tr>
<tr>
<td>Kidney-pelvic fat, %</td>
<td>2.2 ± 0.3 f</td>
<td>3.6 ± 0.3 g</td>
</tr>
<tr>
<td>Backfat, mm</td>
<td>1.5 ± 0.2</td>
<td>1.4 ± 0.2</td>
</tr>
<tr>
<td>Dressing percent, %</td>
<td>41.3 ± 0.6</td>
<td>41.8 ± 0.6</td>
</tr>
</tbody>
</table>

a Lambs were slaughtered at a BW of 30 kg.
b,c Means within a row with different superscripts are different (P < 0.007).
d,e Means within a row with different superscripts are different (P < 0.02).
f,g Means within a row with different superscripts are different (P < 0.001).
Table 3. Economics of raising St. Croix White (STX) and Dorper X St. Croix White (DRP) lambs on concentrate feed.

<table>
<thead>
<tr>
<th>Breed</th>
<th>Net Price</th>
<th>Cost of gain, $/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRP</td>
<td>Live market</td>
<td>3.73 ± 0.02d</td>
</tr>
<tr>
<td>STX</td>
<td>Live market</td>
<td>4.08 ± 0.02e</td>
</tr>
<tr>
<td></td>
<td>Commercial market</td>
<td>11.77 ± 2.08f</td>
</tr>
<tr>
<td></td>
<td>Individual market</td>
<td>0.67 ± 1.90g</td>
</tr>
<tr>
<td></td>
<td>Live market</td>
<td>-4.39 ± 2.48f</td>
</tr>
<tr>
<td></td>
<td>Individual market</td>
<td>-15.95 ± 2.50o</td>
</tr>
<tr>
<td></td>
<td>Individual market</td>
<td>1.16 ± 2.53f</td>
</tr>
<tr>
<td></td>
<td>Individual market</td>
<td>-10.42 ± 2.55g</td>
</tr>
</tbody>
</table>

a Sold as live animal to ethnic consumers for $2.21/kg body weight.
b Sold as carcass to local grocery stores at $3.96/kg carcass weight.
c Sold as carcass to individual consumers at $4.41/kg carcass weight.
d,e Means with different superscripts within a row are different (P < 0.05).
f,g Means with different superscripts within a row are different (P < 0.003).

Due to the lack of fat deposition in either breed type, this pattern of fat deposition is in agreement with the results of Hammond and Wildes (1993) and McClure et al. (1991). McClure et al. (1991) reported that hair sheep lambs were trimmer than wool lambs and deposited less fat externally. Results from our laboratory (Godfrey and Collins, 1999; Godfrey et al., 1999) have indicated that St. Croix White lambs tend to store fat in the body cavity as KPH and have very little external fat. In agreement with the present study,Dodson et al. (2005) reported that DRP lambs had higher KPH than STX lambs did, but there was no difference in back fat when lambs were raised on guinea grass pastures. The trimness of hair sheep carcasses may be useful when marketing the meat to consumers who are interested in purchasing trimmed cuts of meat for perceived dietary or health reasons. Notter et al. (2004) reported an increase in muscling in Dorper-sired lambs. The larger REA and leg circumference of the DRP lambs compared to the STX lambs in the present study is indicative of more muscling on the carcass.

The STX lambs had a higher (P < 0.05) cost of gain than DRP lambs (Table 3). In all three markets the STX lambs yielded a lower net return (P < 0.003) compared to the DRP lambs. The DRP lambs yielded a greater net price (P < 0.003) than STX lambs when they were sold as live animals or when the carcass was sold to an individual consumer (Table 3). When the carcasses were sold to a retail outlet neither group had a positive net return, but the DRP lambs yielded a smaller loss than STX lambs.

The lower net value of STX lambs in comparison to the DRP lambs in each of the markets is related to the cost of gain. The DRP lambs had higher ADG and lower days on feed, implying a greater efficiency, which contributed to the lower cost of gain and higher net value. In a previous study the higher cost of gain of the Suffolk-sired lambs contributed to them having lower economic returns compared to St. Croix White lambs even though they produced a heavier carcass (Godfrey and Collins, 1999). Because there is no local concentrate feed production, it has to be imported and this further impacts the cost of livestock production in the U.S. Virgin Islands. The cost of the feed in the present study, before shipping, was $23/kg and the shipping added $27/kg to the price. The high price of imported concentrate feed is the key factor in the low level of revenue reported in the present study. If the feed price, excluding shipping, is used in calculating net return, then the Dorper X St. Croix White lambs could yield net returns of $25 to $41 and the St. Croix White lambs could yield net returns $19 to $36, dependent on the market outlet. These figures are more attractive to the producer and could be realized if there was a local source of concentrated feed. Because of the low financial return obtained from growing lambs using a concentrated ration, it may not be feasible to utilize the Dorper X St. Croix White lambs, or any breed, in this type of system in the tropics. Even with the larger size and higher ADG of the Dorper X St. Croix White lambs they did not have a financial value that would support a sustainable operation based on economic analysis of sheep production in the U.S. Virgin Islands (Godfrey and D’Souza, 2001).

**Conclusion**

Because the crossbred lambs, sired by Dorper rams, were heavier than the straightbred hair lambs the potential exists for an increase in meat production. This weight advantage of Dorper-sired lambs allowed them to be marketed at a younger age and produce a carcass with more muscling than the straightbred hair lambs. The lower cost of gain for the Dorper-sired lambs may enhance their use under some intensive, island-management systems. While the best net value of Dorper-sired lamb carcasses was $11.77, the St. Croix White carcasses had a best net value of only $6.7. This difference can be explained by the higher ADG and lower cost of gain of the Dorper-sired lambs. Further studies need to be conducted to determine if the heavier body weight of the crossbred lambs will be maintained when the lambs are raised on native pastures, instead of being fed a costly concentrated feed. In addition, further studies need to be done using a larger sampling of sires within each breed type so that inferences are not being made from a small sample size. By crossbreeding native hair sheep with the Dorper, it may be possible for sheep producers in the Caribbean to increase meat production on forage-based systems. As a precaution, Dorper rams should be limited to use as terminal sires in production systems that are raising lambs for meat and not for breeding stock. This is critical to maintain the purity of the germplasm of the indigenous hair sheep breeds in the Caribbean.

**Acknowledgements**

This study was funded by USDA-TSTAR Caribbean Grant 2003-34135-14084-S. The authors would like to thank W. Gonzales and C. Diaz for assistance with animal care and management.
Literature Cited


