Farming Systems & Farm Management

Caribbean Sheep Production & Marketing Project
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THE EFFECT OF INDIVIDUAL PENNING OF EWES WITH THEIR LAMBS AT PARTURITION ON LAMB MORTALITY AND MORBIDITY

by Aman Hosein, Animal Scientist
The effect of individual penning of ewes with their lambs at parturition on lamb mortality and morbidity

Aman Hosein, Animal Scientist

ABSTRACT
Ewes expected to lamb on three farms were each divided into two groups. Within four days of expected lambing, the ewes of one group were penned individually using a simple, inexpensive means of separation. The ewes and their lambs were kept in these pens for a period of between 7 and 10 days post-partum (T = treatment group). The ewes of the other group were allowed to lamb unpenned with the general flock (C = control group). All ewes on each farm otherwise received the same feeding regime and general management. A total of 56 lambs were born to 43 ewes on the three farms.

Twelve lambs of the treatment (T) died, while three unpenned lambs died. There was no significant difference in the mortality of lambs (P > 0.05) due to treatment. While there was no significant difference in the birth weight and weaning weight of lambs, there were significant differences between the number of days to weaning and the growth rate (P < 0.01) which were 99.43 (SEM = 2.86) and 127.57 (SEM = 2.73) days; and 96.94 (SEM = 3.52) and 70.68 (SEM = 3.52) g/d respectively. The farmers who used the technology thought it was a good practice. The use of the technology required additional capital expenditure in the construction of separations within the existing housing structures. Farmers generally thought lamb rejection was not a major factor in the problem of lamb mortality, but the technology may have application on large-scale commercial breeder operations.

INTRODUCTION
Neonatal mortality in sheep production is a problem. Though it is recognized that the major factor contributing to the problem is the nutrition of the ewe and the lamb, it is believed that lamb rejection is also a factor. It has been observed that there can be a reduced level of bonding of ewe and lamb and subsequent rejection of the lambs when parturition takes place in the whole-flock scenario. The level of rejection can be expected to increase as litter sizes increase. Although lamb rejection may not increase lamb mortality per se, by reducing the level of contact between the ewe and her lamb(s), there may be appreciably higher levels of morbidity in these litters. The higher morbidity can be expected to manifest itself in lower growth rates of lambs and general unthriftiness.
Therefore, an on-farm trial was conducted to determine the effect of confining individual ewes and their young for a period of 7 - 10 days post-partum on the mortality and morbidity of the lambs.

METHODOLOGY

Three farms (X, Y, Z) were selected for the testing of the system. These included one large state farm and two small private farms in Tobago. These farms had experienced lamb mortality and morbidity problems within the last 2 - 3 years of operation. On each farm the ewes which were expected to lamb within one month were randomly assigned to two groups. One group of ewes was placed into individual pens at lambing and each ewe was kept with her lamb(s) for 7 - 10 days post partum (T = treatment). The other group was allowed to lamb and be with their young in the general flock (C = control). All feeding and other management practices of the ewes and lamb were similar on each farm. The performance of the lambs were evaluated in terms of litter size, birth weight, deaths post-partum, weaning weights, growth rate and days to weaning. The farmers' evaluation of the system and the cost of the implementation of the technological innovation were monitored.

Statistical analysis of data for mortality was done using Fisher's exact test and an ANOVA was performed on data related to birth weight, weaning weight, days to weaning and growth rate. Birth weight was used as the covariant in the analysis of weaning weight, days to weaning and growth rate.

RESULTS AND DISCUSSIONS

A total of 56 lambs were born to 43 ewes (Table 1). There was no significant difference in the mortality of lambs between treatments, though 12 out of 32 lambs, and 3 out of 24 lambs died from the T and C groups respectively. There was a high mortality rate of lambs on farm X, especially in the T group. This level of mortality was mainly due to a large number of lambs born as twins and triplets. On this farm there were eight twin lambs and six triplet lambs born in the T group, out of which three and six died respectively. The C group showed only one death out of the four twins. No triplets were born. Other investigations in the Caribbean Sheep Production and Marketing (CSPM) project have associated higher levels of lamb mortality with multiple births, particularly where there is inadequate levels of nutrition for the ewe pre- and post-partum.
Table 1 Birth and death of lambs from ewes individually penned (T) or in the general flock (C) on three farms (X,Y and Z) by birth type

<table>
<thead>
<tr>
<th>No. of births and deaths</th>
<th>Treatment (T)</th>
<th>Treatment (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td>No. of ewes</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Total lambs born</td>
<td>20</td>
<td>8</td>
</tr>
<tr>
<td>Lamb deaths</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>Single lambs</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Deaths</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>Twin Lambs</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Deaths</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>38</td>
<td>0</td>
</tr>
<tr>
<td>Triplet lambs</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Deaths</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

The birth weights of lambs were not significantly different between treatments (P<0.05), though the T lambs tended to be lighter (Table 2). There was also no significant difference (P<0.05), in the weaning weights, though the weaning weight of the T lambs tended to be higher than the C lambs.

As shown in Table 2, there was a significant treatment effect on the number of days to weaning and the growth rate of the lambs. The lambs of the T ewes grew faster and took less days to wean.
Table 2  The growth performance of lambs ewes individually penned (T) at birth and ewes lambing in the general flock (C)

<table>
<thead>
<tr>
<th>Growth performance</th>
<th>Treatment (T)</th>
<th>Control (C)</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of lambs</td>
<td>32</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Birth weight (kg)</td>
<td>2.75</td>
<td>3.00</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Weaning weight (kg)</td>
<td>12.43</td>
<td>11.68</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Days to weaning</td>
<td>99.42(SEM=2.86)</td>
<td>127.57(SEM=2.73)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Growth rate (g/day)</td>
<td>96.94(SEM=3.69)</td>
<td>70.68(SEM=3.52)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

The biological performance of the lambs indicated that lamb mortality may not necessarily be reduced by the individual penning of ewes and their lambs during parturition and post-partum. Lamb mortality may be more greatly influenced by nutrition of the ewe and subsequently the lambs through the mother's milk. The data indicated that lambs individually penned grew better than lambs born into the general flock. This was due to factors associated with the intimacy of the relationship between lamb and ewe in the neonatal period. The more intimate the relationship, the higher the rate of feeding of the lambs by suckling.

Both private farmers who tested the system thought it was useful, and one had carried out the practice previously. They did not see rejection *per se* as a problem and were not prepared to implement the system due to additional costs. This practice may be more relevant to specialized breeding farms or large breeding flocks where the problem of rejection and trampling is great.

The cost of the system can be reduced if second-hand lumber and wire are used to make pens. It may also be possible to adapt the system to pen groups of three to four ewes at a time, instead of individually. That system can have the same effect of having fairly close contact between the ewes and lambs.

**CONCLUSION**

The individual penning of ewes and their neonatal lambs had no effect on birth and weaning weight. A significantly better growth performance was observed with individually penned lambs. The practice may be more applicable for use on larger flocks and specified breeding flocks where rejection of lambs by ewes is a problem.
THE EFFECT OF AZADIRACHTA INDICA (NEEM) AS A SHEEP DEWORMER

by Vernon Mc Pherson, Animal Scientist
Kathleen Collins, Veterinary Officer
INTRODUCTION

Gastro-intestinal parasitism is a major constraint to sheep productivity, particularly among juvenile classes, in the Mahaica/Berbice region of Guyana. Although this impediment can be readily controlled with commercial anthelmintics, the cost of such control, especially when administered by para-veterinary and veterinary personnel, is often unaffordable by farmers with limited financial resources (CARDI 1991). The use of a traditional herbal remedy seems to hold promise in this regard.

Neem is a perennial tree that is native to India and Burma; it is also fairly widespread across the Caribbean Sheep Production and Marketing Project Area (Guyana, Trinidad and Tobago, and Barbados). While its insecticidal properties have been reported and continue to be researched, there is a dearth of information on its medicinal properties (National Research Council, 1992). Some local farmers already use aqueous extracts of neem leaves as an animal and human 'cure-for-all'.

This study was done at the Sheep Production Unit, Burma (East Coast Demerara), primarily to validate the anecdotal claims of neem's effectiveness as a dewormer for sheep, and possibly lay the groundwork for developing procedures for the control of gastro-intestinal parasitism with a low-cost herbal remedy.

METHODOLOGY

Trial 1:

Nine young rams (approx. 10-12 months old and weighing 13-26.5 kg) were randomly assigned in equal numbers to three stalls in June 1994. Each stall served as a treatment. Stall no. 1 being the control received no neem; each of the lambs in stall no. 2 were force fed 10 g fresh neem leaves dipped in molasses; while each of those in stall no. 3 were drenched with 50 ml of an aqueous extract of neem, prepared the previous evening by boiling 30 g fresh neem leaves in 300 ml water to give 150 ml extract. The treatments were administered in the morning following an overnight fast.

The nutritional regime for all treatments was ad lib feeding of freshly harvested Antelope grass, a proprietary mineral supplement and water.

Rectal faecal samples were taken at approximately 7 a.m. on the day before treatment and on days 1, 2, 3, 5, 7, 14 and 21 post-treatment. The McMaster technique was used to quantify strongyle eggs on the day of sampling.
Trial 2

Extract preparation
A total of 1000 g freshly harvested neem leaves from a flowering tree were homogenized in 2500 ml water at room temperature using a domestic blender. The homogenized mass was then filtered through a piece of clean cotton cloth; the aqueous extract measured 2050 ml.

Animals
Sixteen 4-month-old lambs which were continuously housed together and subjected to similar husbandry routines along the lines outlined for Trial 1, were monitored in June 1995. Immediately after preparation of the extract (in the evening), 100 ml was given to each lamb. Faecal samples (grab, per rectum) were taken from each lamb one week before treatment, on the day of treatment and at daily intervals thereafter for 13 days. These samples were refrigerated until analysis for roundworms, tapeworms and coccidia using the McMaster technique.

RESULTS AND DISCUSSION

Trial 1
In Table 1, the mean strongyle egg counts for the two methods of administration of the neem are compared with those of animals which were not dosed. The mean worm burdens of the control group appear to be significantly less than the treated groups throughout the observation period. Also, there is apparently no consistent significant change in the worm loads for the treated groups.

These anomalies may have been due in part to human error. More than one person was involved in the preparation of the flotation mass and the microscopic examinations. Although there was the possibility of heat damage in preparation of the extract, the validity of this is debatable since this is the traditional farmer-method which is reported to be effective. In this case however, the boiling might have been excessive.

Trial 2
The mean worm loads monitored over the observation period are presented in Table 2. The neem extract had a significant effect on the reduction in the load of all three parasite species. The effect was not only immediate but prolonged. It might be inferred that not only the adult stages, but also the larval stages of the parasites were affected, thus leading to the reduced shedding of ova. Since a worm-free state is uncommon in farm situations where regular use of commercial anthelmintic is practiced, the results are encouraging.

One disconcerting aspect of this trial was the tedium involved in preparing the homogenate and resultant extract used. As suggested later, alternatives warrant investigation.
### TABLE 1: MEAN STRONGYLE EGG COUNTS (EGGS PER GRAM FAECES) OF RAMS ON NEEM TRIAL

<table>
<thead>
<tr>
<th>Treatment</th>
<th>1 (Control)</th>
<th>2 (Leaves)</th>
<th>3 (Extract)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal No.</td>
<td>96</td>
<td>133</td>
<td>58</td>
</tr>
<tr>
<td>Pre-treatment</td>
<td>6300</td>
<td>4733</td>
<td>300</td>
</tr>
<tr>
<td>Day 0</td>
<td>1833</td>
<td>11267</td>
<td>0</td>
</tr>
<tr>
<td>Post-treatment</td>
<td>1166</td>
<td>8100</td>
<td>33</td>
</tr>
<tr>
<td>Day 1</td>
<td>1333</td>
<td>5900</td>
<td>300</td>
</tr>
<tr>
<td>Day 2</td>
<td>4633</td>
<td>14233</td>
<td>767</td>
</tr>
<tr>
<td>Day 3</td>
<td>3933</td>
<td>14233</td>
<td>167</td>
</tr>
<tr>
<td>Day 4</td>
<td>4300</td>
<td>2567</td>
<td>2067</td>
</tr>
<tr>
<td>Day 5</td>
<td>4100</td>
<td>7200</td>
<td>6000</td>
</tr>
<tr>
<td>Parasite species</td>
<td>Pre-treatment</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Strongyle</td>
<td>11,201</td>
<td>250</td>
<td>237</td>
</tr>
<tr>
<td>Moniezia</td>
<td>1,187</td>
<td>962</td>
<td>200</td>
</tr>
<tr>
<td>Coccidia</td>
<td>1,406</td>
<td>762</td>
<td>1,675</td>
</tr>
</tbody>
</table>
The National Research Council (1992) reported that water extracts of ground neem leaves are very useful and Schmutterer (1992) found that neem preparations had to have relatively high concentrations of azadirachtin to be effective against intestinal nematodes in animals. The active ingredients in neem are three or four related compounds. The limonoids is the main group of which azadirachtin appears to be responsible for more than 90% of the effect on most pests (National Research Council 1992).

CONCLUSION
This work corroborates the traditional farmer's claim and is testimony to the fact that researchers can learn from farmers.

There is apparently a niche for neem in accelerating animal productivity especially for low resource farmers. The reported nutritional properties of its leaves and fruit coupled with its anthelmintic properties would be a boon.

There is need for extending this work with respect to plant parts—the seed, fruits and bark which are also supposed to have pharmacological properties (National Research Council 1992). Other methods of preparation and administration, dosage levels and frequency of use also need to be investigated. Since extracts from neighbouring trees may differ in their composition, it would be necessary to establish that similar cultivars are being researched. Finally, while the NRC also suggested that neem products should be tested as treatments for roundworms and tapeworms, we have established that there is an effect on both of these intestinal parasites in sheep.

REFERENCES

ACKNOWLEDGEMENTS
The authors wish to thank Ms Sharon Allicock, Regional Educational Programme for Animal Health Assistants (REPAHA), for her analysis of all faecal samples of Trial 2.
The senior author is also grateful to CSPM project leader, Mr. H. Patterson, for encouraging the continuation of this work after the initial anomalous results.
A PILOT STUDY
ON SOME SHEEP PRODUCTION PARAMETERS
IN REGION 5 — GUYANA

by Nigel Cumberbatch, Forage Agronomist
Vernon Mc Pherson, Animal Scientist
Abdul Annief, Technician
Gertrude Scott, Social Gender Associate
A pilot study on some sheep production parameters in Region 5
Guyana

Nigel Cumberbatch, Forage Agronomist
Vernon McPherson, Animal Scientist
Abdul Annief, Technician
Gertrude Scott, Social Gender Associate

INTRODUCTION
Sheep production, particularly among hair sheep populations, usually does not realize its full potential because little effort is made to improve the production environment. (Bradford and Fitzhugh 1983).

In an effort to improve the production environment of sheep in the West Coast Berbice region (Region 5) of Guyana, the Caribbean Sheep Production and Marketing (CSPM) Project, a CIDA funded project executed by CARDI, embarked on activities geared towards characterizing the sheep resources of farmers in the project area. These activities included obtaining a clear understanding of the constraints to production within the traditional systems. Feed supplies, health status, marketing arrangements, housing conditions and other economic aspects of sheep production were monitored.

These parameters are inter-related and the improvement in sheep production is somewhat dependent on all factors functioning together properly.

The objective of this study was to acquire data on the production parameters of sheep and the effect of housing types on production output.

EXPERIMENTAL PROTOCOL
The flocks of sheep used to produce the data for this study were mainly cross-bred hair sheep originating from an array of crosses, comprising the Barbados Blackbelly, the Wiltshire Horn, possibly the Black Head Persian and other breeds. These animals can therefore best be described as Creole types.

Data for this study were collected from March 1993 to March 1994. However, because some farms had records prior to the commencement of this study, and some selected farms were monitored after March 1994, the data collection period was in excess of one year.

Approximately 1000 animals from 22 farms were ear-tagged, weighed, and an estimate of age was done by the number of permanent incisor teeth found. Lamb ages were acquired from records or estimated. The 22 farms were located in region between Prospect, Mahaicony in East Coast Demerara, and Cotton Tree in West Coast Berbice.
This area along the coastal strip is flat and is subdivided by two rivers and a number of drainage and irrigation canals. The native vegetation or the vegetation that is consumed by the animals, varies from the salt marsh and mangrove swamps on the north, to the native grasses on the acid soils which are located south of the main road. These native grasses are mainly *Hymenachne, Amplexicaulis, Leersia hexandra* and *Cynodon dactylon*.

Grazing was not restricted to any one area, so that in some instances, animals had access to pastures on both the acid and saline soils. They were also supplemented with cut grass and agricultural by-products, where available.

Sheep housing on most farms monitored were provided by the project. The features of the type of housing provided are shown below:

<table>
<thead>
<tr>
<th>Roof</th>
<th>Floor</th>
<th>No of structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thatched (long grass)</td>
<td>earthen</td>
<td>7</td>
</tr>
<tr>
<td>Thatched (long grass)</td>
<td>concrete with bedding</td>
<td>1</td>
</tr>
<tr>
<td>Thatched (ete palm)</td>
<td>earthen</td>
<td>5</td>
</tr>
<tr>
<td>Thatched (coconut frond)</td>
<td>earthen</td>
<td>1</td>
</tr>
<tr>
<td>Thatched</td>
<td>slats (lumber)</td>
<td>2</td>
</tr>
<tr>
<td>Thatched</td>
<td>slats (round wood)</td>
<td>1</td>
</tr>
<tr>
<td>Galvanized zinc</td>
<td>slats (lumber)</td>
<td>1</td>
</tr>
<tr>
<td>Galvanized zinc</td>
<td>earthen</td>
<td>3</td>
</tr>
</tbody>
</table>

The farm data were analyzed using the statistical measurement ANOVA to establish differences in animal performance on-farm under different roof and floor types and combinations.

Data were compiled on record sheets. This included information on lamb birth weights or in most instances the first weight of the lamb; adjusted weights at 3, 6, 9, and 12 months; sex, as well as the weight and age of the ewe.

The record sheets also provided data on lambing intervals, average daily gains, total births and total number of lambs born. Weekly farm visits were made to collect data and to weigh animals. Lamb birth weights were recorded by those farmers with scales. All other lamb birth weights were recorded when the farms were visited. The weights of the other animals were also taken during the farm visits.

**RESULTS AND DISCUSSION**

Tests for statistical significance for the different parameters such as birth weights, lambing intervals, adjusted weights at 90, 180, 270 and 360 days, total births and proportion of single
births were conducted for all farms together, and for the farms grouped according to roof types, floor types and a combination of roof and floor types.

The average birth weights will not be discussed in this study because they are not a true reflection of the birth weights of lambs, but are the first weights obtained or recorded.

Lambing Intervals
Lambing intervals can only be measured from animals that have two or more lamb crops. It was therefore possible to collect data on lambing intervals because monitoring of some farms continued after the designated cut-off date, and data was available from records farmers had prior to the beginning of the study. The lambing intervals of the farms in this study were between 219 and 332 days, with a mean lambing interval similar to those reported by Levine and Spurlock (1983) and Bradford et al. (1983). These authors reported intervals of between 212 and 243 days.

The usual management practice in Region 5, is to allow the ewes to run with the ram unrestricted. Bourzat et al. (1992), reported that generation intervals usually have great variations from flock to flock, area to area, and time to time, and may be attributed to deficiencies in feeding and management.

Birth Type (Singles, twins etc.)
There were no differences for birth type among the farms monitored. The majority of litters were single births (92%). Rastogi et al. (1991) and Wildeus et al. (1991), indicated that the litter percentages for single lamb births in the Caribbean for the various breeds was approximately 40% and Rastogi et al. (1991) also indicated that the two-way crosses and the purebred animals had a litter percentage for single births of 60%.

The animals on the farms were a combination of crosses and this was probably the reason that the percentage of single lambs was so high. However, a high percentage of single births has a positive benefit. Fitzhugh and Bradford (1983), suggested that ewes rearing single lambs have a shorter lambing interval, suggesting that milk yield and suckling affects the length of post-partum anestrus.

The gestation length on the farms, although similar to those from other areas of the world as reported by various authors, highlighted the need to improve some management practices relating to the time of weaning, since milk production influences post-partum anestrus.

Further improvements to management practices should include the availability of a good ram and improved nutrition pre and post-partum and at weaning for both lamb and ewe.
Total Births

Total births represents the number of births in the flocks over the monitoring period. The total number of births for the 22 farms monitored was 640 (average, 29 lambings per farm). Pen types, viz., roof and floor did not have a significant effect on the number of ewes lambing or the number of lambs produced.

Lamb Weight Gains

Weight gains of animals up to weaning are a function of the amount of milk available to the lamb. Lambs therefore make the fastest gains between birth and weaning.

Seasonal effects also play an important role in lamb growth rates. The two lambing seasons coincided with the dry periods, when the stress factors common to the rainy season are reduced. However, because of the open range management system employed by livestock farmers in Region 5, the availability of forages is quickly depleted.

There were no differences in weight gains for the animals at the various stages - 90, 180, 270 and 360 days - for roof types, floor design and the combination of roof and floor types. (See Figs. 1, 2 & 3).

However the mean weights at the various ages compare favourably with sheep grazing under similar conditions elsewhere.

From Venezuela, Stagnaro (1983) reported weights of 21.6 kg for African and African crossbred sheep of between 8-14 months grazing for a total of 6-8 hours on poor soils and fed occasionally with concentrate.

Fig. 1 Adjusted weight at 90, 180, 270 & 360 days on roof structures

![Graph showing weight gain over days for different roof structures.](image-url)
Fig. 2 Adjusted weight at 90, 180, 270 & 360 days on Floor structure

Fig. 3 Adjusted weight at 90, 180, 270 & 360 days on roof/floor structures
Pre- and Post-weaning Data

Average daily gains were 88 g pre-weaning, assuming that weaning was at 90 days. These gains compared favourably to gains at Ebini, where Nurse et al. (1983) reported gains of 90 g/d for lambs grazing improved and unimproved pastures.

The average daily gains of lambs declined considerably after the 90 day period. The growth rate during the 180 day period was 69% of that attained during the pre-weaning period and during the 270 and 360 day periods, the growth rates were 40 and 33% of the pre-weaning growth.

Adult Weights

Hassan and Ciroma (1992), working with goats in Nigeria, indicated that animals between 1-2 years, were lighter than those of 3, 4 and 5 years and above; suggesting that weight gains increases with maturity.

The difference between weights of animals at between 1-2 years and those greater than 4 years was 9 kg, while the differences in weight between animals 2-3 years and 3-4 years was negligible at 28.4 kg and 29.7 kg respectively.

CONCLUSION

The data presented give some insight into the production parameters of hair sheep production on the coastal plains of Guyana and are comparable with those acquired from other locations. There is the potential for improved sheep production of hair sheep on the coast.
STUDY ON THE STRUCTURE, CONDUCT AND PERFORMANCE OF THE SHEEP AND GOAT INDUSTRY IN GUYANA AND TRINIDAD & TOBAGO

by Randolph Hickson, Marketing Specialist
Study on the structure, conduct and performance of the sheep and goat industry in Guyana and Trinidad and Tobago

Randolph Hickson, Marketing Specialist

INTRODUCTION

The production of sheep and goat plays a critical role in Caribbean agriculture which is usually understated. The industry is characterized by mainly small producers, with small ruminants constituting a vital component of the agricultural systems. The majority of sheep and goat producers rear these animals mainly for the production of meat (lamb, mutton and chevron).

Specifically, the industry in Trinidad and Tobago and Guyana can be characterized as follows:

- Many small producers in which sheep rearing is supplementary to other economic activities.
- A market in Trinidad and Tobago dominated by the consumption of imported frozen lamb/mutton sourced principally from New Zealand. Local production contributes 2 to 6% of total consumption.
- Consumers in Guyana are predisposed to consuming fresh mutton.
- Inadequate or inefficient marketing infrastructure and support services.
- Fragmented structure of the industry.
- Low levels of productivity.
- The trend in Trinidad and Tobago in recent years tending towards
  - Intensive and semi-intensive production systems
  - Increased consumption of blended feeds
  - More specialized and larger farms

In an attempt to rectify the aforementioned deficiencies, the CSPM project sought to develop the sheep production and marketing capabilities of targeted farm families in Guyana and Trinidad and Tobago in ways which would enhance the development of the industry in the CARICOM region.

Specifically the project's marketing component contributed to the attainment of the project's purpose by improving market opportunities for local sheep products.
OBJECTIVES OF THE STUDY

This study therefore analyses the structure, conduct and performance of the sheep industry as it relates to marketing activities.

METHODOLOGY

A comprehensive review of literature on the industry in Guyana and Trinidad and Tobago was undertaken. The trafficker trade between Tobago and Trinidad, and in Guyana from the project's catchment area to Georgetown and its environs was monitored, and information on price, volume of animals, etc. collected. Market research, undertaken during the implementation of the project, also generated useful information on the industry and was used in the analysis.

ANALYSIS OF THE SHEEP INDUSTRY IN TRINIDAD AND TOBAGO

Structure of the industry

Production and imports

Domestic production of sheep and goat meat averaged 63 t between 1981 and 1992. As with overall production figures, the trend has been declining down from 67 t in the 1981–83 period to 56–57 t in 1990–92. (Table I). Domestic production therefore accounted for 2–6% of total supply for the period 1981–1992 (Table I). According to the Ministry of Agriculture, CSO production data account for approximately 20% of actual production because of the large number of sheep and goats which are slaughtered outside of the public abattoirs and consequently not captured in CSO surveys.

Imports on the other hand increased from 1.4 t in 1981 to 3 t in 1984. In 1992, 1.5 t was imported (Table I). During the period 1981 to 1992, imports as a percentage of total supply varied between 93.5% to 98.1%. The consumption of sheep and goats therefore, is dominated by imports mainly from New Zealand.
Table 1: Imports, domestic production and total supply of mutton and goat meat in Trinidad and Tobago (1981–1992) (000/kg)

<table>
<thead>
<tr>
<th>Year</th>
<th>Goat/sheep meat production quantity</th>
<th>Total imports goat and sheep</th>
<th>Total supply</th>
<th>Imports as a % of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>76</td>
<td>1355</td>
<td>1431</td>
<td>94.1</td>
</tr>
<tr>
<td>1982</td>
<td>67</td>
<td>2220</td>
<td>2287</td>
<td>97.1</td>
</tr>
<tr>
<td>1983</td>
<td>67</td>
<td>2367</td>
<td>2434</td>
<td>97.2</td>
</tr>
<tr>
<td>1984</td>
<td>59</td>
<td>2977</td>
<td>3036</td>
<td>98.1</td>
</tr>
<tr>
<td>1985</td>
<td>51</td>
<td>2379</td>
<td>2430</td>
<td>97.9</td>
</tr>
<tr>
<td>1986</td>
<td>67</td>
<td>1860</td>
<td>1927</td>
<td>96.5</td>
</tr>
<tr>
<td>1987</td>
<td>64</td>
<td>1873</td>
<td>1937</td>
<td>96.7</td>
</tr>
<tr>
<td>1988</td>
<td>85</td>
<td>1218</td>
<td>1303</td>
<td>93.5</td>
</tr>
<tr>
<td>1989</td>
<td>53</td>
<td>1099</td>
<td>1152</td>
<td>95.4</td>
</tr>
<tr>
<td>1990</td>
<td>57</td>
<td>1191</td>
<td>1248</td>
<td>95.4</td>
</tr>
<tr>
<td>1991</td>
<td>58</td>
<td>1923</td>
<td>1981</td>
<td>97.1</td>
</tr>
<tr>
<td>1992</td>
<td>55</td>
<td>1493</td>
<td>1552</td>
<td>96.2</td>
</tr>
</tbody>
</table>

The population of sheep and goat in Trinidad and Tobago over the period 1988–1990 remained relatively constant.

Table 2: Population of sheep and goat in Trinidad and Tobago and Guyana 1979–81 and 1988–1990 (000 head)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sheep</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>10</td>
<td>13</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Guyana</td>
<td>114</td>
<td>120</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td><strong>Goat</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>46</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Guyana</td>
<td>70</td>
<td>77</td>
<td>77</td>
<td>77</td>
</tr>
</tbody>
</table>

Source: FAO Production Yearbook, 1990
Consumption

Research into the consumption patterns of the population revealed that chicken is the most dominant meat type, and that mutton was the least preferred or affordable.

Local mutton is consumed primarily by Indo-Trinidadians of the Muslims and Hindu religious persuasions. Therefore, the demand for mutton is linked to the celebration of religious holidays in the Hindu and Muslim calendar and non-religious festivities for the Hindus. The omnibus survey of 1992, also found that user households of local lamb/mutton are upper and middle class households located in urban areas. Local sheep meat is stewed or curried. Imported sheep meat is consumed by Trinidadians of all ethnic and income groups.

Prices

A number of prices exist in the industry, viz.:

- Wholesale farmgate price i.e. price paid to farmers for local animals, normally transacted with butchers. This price ranged from TT$8.11/kg to TT$8.80/kg in 1995.
- Retail price of fresh mutton averaged TT$22.00/kg in 1995.
- Wholesale price of frozen mutton averaged TT$17.60/kg in 1995.
- Retail price of frozen mutton averaged TT$22.00/kg in 1995.

It should be noted that foreign mutton is sold mainly by type of cut. Recent trends however, have indicated that the upscale supermarket trade is offering fresh, chilled, local lamb in the differentiated market. The following example (Table 3) will illustrate the price differential according to the type of cuts.

Table 3: Upscale supermarket prices for local and foreign lamb (TT$/kg)

<table>
<thead>
<tr>
<th>Type of cut</th>
<th>Local</th>
<th>Foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder chops</td>
<td>26.99</td>
<td>26.43</td>
</tr>
<tr>
<td>Leg</td>
<td>39.99</td>
<td>36.99</td>
</tr>
<tr>
<td>Lamb stew</td>
<td>17.71</td>
<td>16.99</td>
</tr>
<tr>
<td>Loin chops</td>
<td>34.06</td>
<td>34.06</td>
</tr>
</tbody>
</table>

The undifferentiated market for fresh, local mutton is serviced by the municipal and roadside markets.
Producers in the industry

The sheep and goat industry is characterized by a large number of small producers located throughout Trinidad and Tobago. Large producers such as Latours and Lowlands Estate in Tobago are withdrawing from the industry.

In Trinidad, one large producer — J N Harriman and Company Limited — has taken a strategic decision to scale down its agricultural operations and focus instead on the tourism industry. Caroni Limited is also a large producer.

Generally, the producers in Trinidad are more business oriented and given the existence of markets, some have already commenced expanding their operations to meet the identified needs.

Policies in the industry

Trade policy

Several elements of the trade liberalization programme, particularly the proposed tariff regime for agricultural commodities, have been implemented by the Government of Trinidad and Tobago. This approach emanated from the structural agricultural programme with the World Bank and negotiations with the Inter-American Development Bank (IDB) with respect to the investment and agricultural sector loans. The government, in its quest to create more open and less distorted agricultural markets, agreed in principle to effect trade and pricing reform. The major undertaking in this regard is the decision to replace the protection offered by the negative list with levels of tariff, including surcharges on all agricultural commodities. This became effective in January 1995. A comprehensive package of trade reform measures was developed in an attempt to revitalize the agricultural sector and make it more competitive.

Other elements of the package include legislative and institutional reform and appropriate incentives to foster increased investment in the sector. As a consequence, effective 1 January 1995, the government of Trinidad and Tobago removed mutton, chevron and livestock feed ingredients from the negative list but continued to offer protection to the sector through the Common External Tariff (CET).

In addition, an import surcharge was also placed on those items. Previously, mutton and chevron were on the negative list, which required specific import licenses. These licenses were granted by the Ministry of Industry and Enterprise on the advice of the Ministry of Agriculture, Land and Marine Resources. These items were then subject to the payment of various internal taxes and charges.

The above measures are also consistent with the 1994 General Agreement on Tariff and Trade (GATT).
Import policy relating to the sheep industry

Tax exemptions

Provisions have been made by the government for the granting of import tax exemptions for some inputs which are intended to be used exclusively for agriculture, forestry and fisheries. The following is a list of items that can be imported 'duty free' for the small ruminant industry as listed in the Third Schedule, Chapter 78.01 of the Laws of Trinidad and Tobago.

(a) Agricultural machinery, equipment, implements and tools
(b) Medicines and mineral supplement for livestock
(c) Vats, tanks and parts for water storage
(d) Semen for artificial insemination imported in accordance with a permit issued by the proper authorities
(e) Such other goods that are intended solely for use in approved agriculture
(f) Pipes having an internal diameter exceeding 2", and pipe fittings, except plastic pipes

The negative list, tariffication and the CET

Prior to January 1995 mutton was on the negative list. The CET applicable was 5%. As of January 1995, the product is now subject to a CET of 15% together with an import surcharge of 20%. This will be reduced as follows:

<table>
<thead>
<tr>
<th>Date</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>20</td>
</tr>
<tr>
<td>1996</td>
<td>10</td>
</tr>
<tr>
<td>1997</td>
<td>5</td>
</tr>
<tr>
<td>1998</td>
<td>0</td>
</tr>
</tbody>
</table>
Value added tax

Unprocessed food for human consumption is zero rated with respect to the value added tax (VAT) which is 15%. Likewise, no VAT is charged on animal feeds. It should be noted that whenever the CET, Stamp Duty and Import Surcharge are applicable, they are levied on a CIF basis. VAT is levied on the landed price.

Role of traffickers

Since 1993, the trafficking market has been expanding rapidly. Craig (1992) estimates that 90% of animals sold by producers in Tobago enter this market. In 1993, a total of 972 animals were transported from Tobago to Trinidad, an average of 81 per month. In 1994, this number increased by 91% to 1772 or an average of 148 animals per month. The data collected for 1995 indicates a significant increase in the average monthly supply to 306 animals with the total number of animals transported to Trinidad being 3670. The price paid by traffickers remained stable at TT$8.80/kg live weight. Some farmers however, have been getting higher prices of up to TT$9.90/kg live weight.

The traffickers purchase the sheep by sight. The general consensus is that Tobago's sheep is marketed at the San Juan market in Trinidad on Saturdays and Sundays.

Traditionally, the Tobago producer placed almost total reliance on the traffickers, hence the latter had disproportional bargaining power over the producer. The development and testing of alternative marketing strategies in terms of the sale of local lamb to Hi-Lo Food Stores, an upscale supermarket chain in Trinidad, and the hotel sector in Tobago should even the negotiating position in the not too distant future.

The trafficker however plays a vital role in the industry since they:

- Provide customers with fresh meat on immediate demand
- Source animals from the producing areas and market the product in the consuming areas
- Service allied industries such as leather manufacturers/craftsmen
ANALYSIS OF THE SHEEP INDUSTRY IN GUYANA

Structure of the industry

Production and imports

The domestic production of mutton in Guyana, as estimated in the FAO yearbook (1993), remained fairly constant at about 1.24 m kg per annum during the period 1988–91 (Table 4). This production level was supported by a population of 120,000 head over the review period.

Table 4: Production of mutton in Guyana ('000 kg)

<table>
<thead>
<tr>
<th>Year</th>
<th>Mutton</th>
<th>% of total meat production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>1240</td>
<td>2.5</td>
</tr>
<tr>
<td>1988</td>
<td>1240</td>
<td>3.0</td>
</tr>
<tr>
<td>1989</td>
<td>1240</td>
<td>3.1</td>
</tr>
<tr>
<td>1990</td>
<td>1240</td>
<td>3.1</td>
</tr>
<tr>
<td>1991</td>
<td>1240</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture, Guyana - FAO estimated

Based on Table 4, it can be deduced that mutton plays a relatively minor role in the consumption of meat in Guyana.

Traditionally, the importation of meat and meat products has been minimal in domestic meat supply in Guyana. However, within recent years meat imports have been gaining popularity among importers, and it is estimated that over 4,500 kg of lamb shoulders and baby legs were imported in 1995.

Consumption

Fish, beef, chicken and pork are the main meat types consumed in Guyana. Mutton is the least preferred or affordable meat. Trade research conducted in Georgetown and the East Coast Demerara revealed that Indo-Guyanese of the Hindu and Muslim religions are the traditional consumers. As in Trinidad, the demand for mutton increases during religious holidays (Muslim) and at Christmas. It is also the meat used at Indo-Guyanese religious functions. Consumers have a predilection for curried mutton and to a lesser extent, stewed mutton.
In general, the demand for mutton and hence its consumption, is a factor of the price of mutton. Further, the price for mutton is controlled in the main by uneconomic variables and to a lesser extent by demand and cost changes.

Prices

The prices of local and imported frozen mutton as at February 1996 were as follows:

- Wholesale prices of local mutton (carcass) $G169 –269/lb
- Retail prices of local mixed mutton $G200 –322/lb
- Retail price of local leg mutton $G75 –400/lb
- Wholesale price for imported frozen mutton $G100 –109/lb
- Retail price for imported frozen mutton $G120 –125/lb

Producers in the industry

The common thread in the industry in Guyana and Trinidad and Tobago is the domination by large numbers of small scale producers(<10 ewes).

In Regions 4 (coastal area) and 5 there are over 10 large (>50 ewes) and 300 small-scale producers. Most of the large producers use sheep as an asset base, rather than a business unit within the farming system.

During the 1990s, large producers such as Guysuco (>500 head), Bounty Farm ( >200 head) and Letter T Estate (>100 head) all withdrew from the industry citing economic reasons. A number of medium-sized producers also exited the industry, opting instead for poultry rearing which they considered to be more profitable.

No new large producers have entered the market over the past 5 years. However, as a result of the expansion of rice production in the regions, sheep grazing activity has been relegated to marginal soils.

The majority of producers dispose of their animals to middlemen/traffickers.
Policies in the industry

Trade policy

Guyana has been operating under an import restriction regime for over a decade. In 1990 however, the government implemented its Economic Recovery Programme of which trade liberalization was an integral component.

With respect to mutton, Guyana's total tariff on imports is the CET rate of 30%. There are no additional charges or duties applied to the CET rate.

Role of the traffickers

The main players that comprise the distribution system are sheep rearers, butchers or traffickers, and intermediaries (mainly roadside sellers).

The sub-distribution channel involves meat shops and supermarkets which sell to hotels, restaurants, bottom-house shop owners, large firms and retailers and wholesalers.

Market research conducted in 1995 and 1996 established that Region 4 command 70% of the market share in terms of volumes/quantity of mutton purchased. The butcher/trafficker is the main source of supply to the sub-distribution channel in Region 4. It will be useful at this juncture to mention the services performed by the traffickers, who:

- Identify producers
- Assist in evening out the distribution flow, i.e. moving the product from the producing to the consuming area
- Make up-front cash investments by purchasing the animals
- Provide transportation and slaughter services
- Deliver meat to the distribution channel members

Performance of the industry

The CSPM project had a life span of 5 1/2 years. During the period various production technologies and marketing systems were designed and tested. Some of the technologies and systems need to be applied and validated in order to demonstrate commercial viability. Given this scenario and the relatively short existence for a project of this nature, its impact on the macro-environment in the target countries at this point in time will be 'minimal'.

As such, this section on performance of the industry will focus on the emerging trends as a result of the marketing intervention and production technology developed,
given the continued momentum in follow-up activities, which is a prime requisite for sustainability. This is being addressed in CARDI’s Medium Term plan and reflected in the individual country programmes.

**Price stability and income distribution**

The upscale supermarket segment in Trinidad has the potential to consume about 36 – 43 t of fresh chilled local lamb annually. Currently about 18–23% of this demand is being supplied. Most of this demand, which is being serviced through the Hi-Lo marketing initiative developed under the CSPM project, has stimulated existing producers' interest in sheep production resulting in an increased investment in the sector.

Craig (1992) observed that although the retail price for sheep meat remained stable at TT$22.00/kg, farmgate prices for live animals decreased from TT$12.00–15.00/kg to TT$6.60 – 7.70 /kg in Tobago between 1990 and 1992.

As has been previously stated, the rapid expansion of the trafficking market since 1993 resulted in the stabilization of prices at TT$8.80/kg live weight.

In the case of carcass sales by project farmers to the Hi-Lo supermarket chain, price increased from TT$19.84/kg in 1994 to TT$21.82/kg in 1995.

In the Guyana scenario, market research had estimated the current annual demand for mutton in Regions 4 and 5 to be in the vicinity of 77,520 kg. There exists however, a lucrative captive market of traditional users in both regions. This potential demand is conservatively estimated at 259 t per annum. Approximately 30% of this demand is presently being met. Opportunities for further investment exist in the sector.

The price of mutton has generally been inching upward over the review period (Table 5).

<table>
<thead>
<tr>
<th>Table 5: Live weight prices of sheep 1992/1995 in G$/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>Lambs</td>
</tr>
<tr>
<td>Mature males</td>
</tr>
<tr>
<td>Mature females</td>
</tr>
</tbody>
</table>

Source: Project records

The seasonal variation in prices is reflected in the fourth quarter highs of the years 1992, 1993 and 1994. Mature males and lambs obtain premium prices.
Based on the evidence presented in Table 5, it is reasonable to conclude that the price at which retailers have been purchasing and selling mutton has been increasing steadily over the review period.

Market research conducted in March 1996 also showed that the demand for mutton cannot be sustained at the prevailing prices. Because of their consumption pattern, the high-income earning group cannot be depended upon to support the industry. Survival of the industry is contingent on the persistent demand for the product by the traditional consumers.

For reasons advanced earlier, it is difficult at this juncture to access the impact of commodity prices on income distribution. In Trinidad for instance, a few large and medium-sized farms are investing in the industry to capitalize on the opportunity for the sale of meat at the Hi-Lo and other upscale supermarkets. The business acumen displayed by these producers will auger well for their continued involvement in the sector.

In Tobago, however, members of the Tobago Sheep Farmers Association are deliberating on which market segment (hotel or upscale supermarkets) they should be targeting. The use of appropriate production systems such as feedlots are also being considered.

In Guyana, the positive increase in income which accrued to project farmers as a result of the testing of a direct marketing system, has stimulated the Sheep Farmers Association's interest in consolidating their position to exploit the existing and potential market opportunities.

**Technological progress**

Feeds and feeding systems were identified as some of the main inhibiting elements in the operation of a viable sheep business unit. Trials done with project farmers in Guyana and Tobago on the development of low-cost feeds have yielded encouraging results. However, additional work needs to be done in this regard as it relates to validation of technologies. As a consequence, its impact on the marketing of sheep products cannot be effectively evaluated at this point in time.

**CONCLUSION**

The sheep and goat industry in the Caribbean is dominated by a large number of small producers in which sheep rearing is supplementary to other economic activities. The fragmented structure of the industry, coupled with inadequate or inefficient marketing infrastructure and support services, has to a great extent inhibited the producers from
optimizing exploitation of market opportunities in captive market situations. Imports account for over 95% of the consumption in Trinidad & Tobago.

The liberalized trading environment existing in the region has necessitated producers to focus on 'niche' markets. The adoption of efficient production technologies, resulting in reduced production costs and improved quality of animals, is mandatory for survival in the industry.

The CSPM project has been in existence for just over 5 years and consequently it would be extremely difficult at this juncture to measure its impact on the performance of the industry as it relates to the marketing intervention. Some of the technologies and systems developed during the project's life need to be applied and validated in order to demonstrate commercial viability and sustainability.

Utilizing the emerging trends as a point of reference to gauge potential impact, one can conclude that the signs are encouraging. The investments being made by producers in the industry in Trinidad and Guyana will definitely auger well for the industry's growth and development.

REFERENCES:


MONITORING THE FARM SITUATION
ON CSPM FARMS IN TOBAGO

by Aman Hosein, Animal Scientist
Monitoring the farm situation on CSPM farm in Tobago

Aman Hosein, Animal Scientist

The goal of the CSPM projects was to improve the welfare of low resource farm families in the Caribbean. The project used the medium of sheep enterprises in order to stimulate the change process. The farming systems research and development approach was used and the involvement of economists, sociologists and productionists combined holistically to achieve the aims of the project.

The project involved the development and testing of technological interventions on farms. Regular monitoring was part of the dynamic diagnosis of these farms in order to determine how and to what extent the interventions influenced the biological, economic and social factors on the farm and the life of farm family members. This report focuses on the biological change that occurred in the farms.

METHODOLOGY

The project was started in October 1990 and monitoring of 12 farms commenced in March 1991. The monitoring was done quarterly until the third quarter of 1995. During which time the number of farms under consideration increased to 16 in 1993/94 and then decreased to nine by the end of the project.

A monitoring instrument was designed, tested and used by the technicians to record the farm situation the end of each quarter (Appendix 1). The areas or production parameters that were observed were related to stock levels including births and deaths; sales and purchases, fed consumption and cost of production and; time involved in productive output.

RESULTS AND DISCUSSION

Stock

Flock sizes decreased over the period of the project. The average number of mature breeding stock on farms decreased from approximately 25.9 in 1992 to 16.6, 12.4 and 12.6 in 1993, 1994 and 1995 respectively. The size of the breeding herds did tend to stabilize in the last 2 years of the project. Average total flock sizes decreased similarly from over 40 to 30, 24.5 and 25.3 in 1992, 1993, 1994 and 1995 respectively. Figure 1 shows the flock growth rate between 1992 and 1995. The flock growth rate is an index of the change in the opening and closing stock as a percent of the opening stock. These appeared to be no particular pattern in the rate of growth of the flock but growth rate was generally negative as farmers disposed of stock on a regular basis.
The sales were between 20-50 animals per quarter but decreased in 1994, then increased to a fairly constant level of over 40 animals in 1995 (Figure 2). Figure 3 shows the lamb off-take in Tobago between 1992 and 1995. The off-take is the difference between sales and purchases in a quarter as a percentage of the opening stock. Generally there was increasing off-take between 1992 and 1995. The flock productivity, which was the sum of the off-take and growth rate was inconsistent (Figure 4).

**Lamb mortality**
The baseline study indicated the existence of lamb mortality figures in excess of 25% in 1990 and 1991. During the project's life lamb mortality levels of less than 15% was generally maintained as farmers were given early exposure to the technology involved in reducing lamb mortality (Figure 5).

**Feed consumption**
Indications were that feed consumption fell between 1992 and 1995 (figure 6). This was not primarily a response to the decreasing flock sizes since the cost of inputs tended to increase during the same period (Figure 7). Feed represented the major cost items on farms, and as management on farms increased or improved there tended to be more judicious use of feed. The increasing price of inputs also influenced farmers to decrease flock sizes as alluded to earlier.

**OUTPUT**
The farmers saw no increase in the price of outputs of the farm. In fact, while the average cost/farm may have been approximately TT$6000.00 per quarter; there were significant lows in the value of outputs during most of 1994 (Figure 8).

The average value of outputs in 1995 was generally above $7000.00. This was due to the fact that there was a higher off-take, possibly at lower prices.

**WORK ON FARM**
After increasing between 1992 and 1993, the number of hours per day worked by the farm family increased and then decreased to fairly stable rate of about 1 hours per day in the last 6 quarters of the project (Figure 9). The number of hours worked by the farmer on the farm also stabilized to about 2 hours per day at the end of the project.

It would appear that the animal performance on the farms began to stabilize by the end of the project. The size of the flocks, sales, mortality, feed use, outputs and time worked on the farm all showed a tendency to stabilize after initial decreases in flock size.
size and in the face of increasing prices of inputs, sales and stability in farm income. The farm families were apparently becoming very comfortable with the introduced technologies.

CONCLUSION
The project needed another phase in order to prove that the technologies were impacting on the welfare of the farm families. Biological performance indicators tended to show some stabilizing effects. The project needed to go beyond measuring only biological performance to measuring changes in welfare, and this required a more long-term monitoring.
Fig. 1  Flock Growth Rate (Tobago 1992-1995)

Fig. 2  Tobago Animal Sales (Tobago 1992-1995)
Fig. 3 Lamb off-take (Tobago 1992 - 1995)

Fig. 4 Flock productivity (Tobago 1992 - 1995)
Fig. 5  Lamb Mortality (Tobago 1992 - 1995)

Fig. 6  Feed Consumption (Tobago 1992 - 1995)
Fig. 7 Cost of inputs (Tobago 1992 - 1995)

Fig. 8 Cost of outputs (Tobago 1992 - 1995)
Fig. 9 Hours/day by farm family (Tobago 1992 - 1995)

Fig. 10 Hours/day by farmer (Tobago 1992 - 1995)
THE BARBADOS MODEL FOR THE PRODUCTION OF LAMB MEAT FROM BARBADOS BLACKBELLY SHEEP

by Gerry Thomas, Animal Scientist
The Barbados model for the production of lamb meat from Barbados Blackbelly Sheep

by Gerry Thomas, Technician

Development of rations based on locally available feed resources

One of the Caribbean Agricultural Research and Development Institute's (CARDI's) mandate is to test and validate, at the farm level, production systems which utilize agricultural by-products as the main feed resource in a balanced ration to meet the nutritional needs of small ruminants. The primary purpose is to make small ruminant farming viable and to narrow the gap between production and the demand for meat and meat products as well as to reduce production cost.

Under the Caribbean Sheep Production and Marketing (CSPM) project funded by the Canadian International Development Agency (CIDA), production systems based on by-product feeding were evaluated. The major feed resource evaluated under this project was poultry litter, since Barbados produces in excess of 60,000 tonnes of dry poultry annually from 6 million broilers, in combination with other locally available agro-by-products.

Protein-energy supplements for lambs normally consist of imported soybean meal and maize along with an inorganic mineral premix. This makes lamb starter rations expensive and increases production cost. The cost of a poultry litter based ration is approximately 50% cheaper than commercially available concentrate.

Two production systems based on by-product feeding and one based on molasses/urea blocks were evaluated at the Greenland Research Station. The by-product rations used consisted of molasses, wheat middling, rice bran, poultry litter, leucaena leaves and mineral salts in varying combinations, intensively and semi-intensively.

The biological and economic efficiency of ewes as producers of lamb for finishing, as influenced by plane of nutrition and husbandry practices, were also evaluated.

The ewes were fed intensively (2.27 kg/h/d) and semi-intensively (0.45 kg/h/d from the last 6 weeks of pregnancy) on a ration which consisted of 45% poultry litter, 21% wheat middling, 15% rice bran, 10% molasses, 5% leucaena leaves and 2% mineral salts. These ewes produced lambs with average daily gains of 151 g and 113 g respectively, without creep feeding the lambs while those under the extensive system on molasses/urea blocks gained 115 g.
Lambs on starter rations, with poultry litter levels ranging from 0 to 40%, had average daily gains from 115 g to 153 g at the 40% to 0% level respectively. However, the results showed that the economic inclusion level for poultry litter in rations for lambs under 18 kg was most cost-effective at the 20% inclusion level. Dry matter intake expressed as kg/\(w^{0.75}\) and feed efficiency at the 20% level, suggest that at this level, rearing lambs for finishing in feedlot could be a viable and profitable enterprise.

**Pilot feedlot operated by Barbados Agricultural Management Company (BAMC)**

The pilot feedlot model in Barbados was constructed at a total cost of Bds$48,300 with $36,500 and $11,800 spent on construction of the feedlot and quarantine facilities respectively. The Ministry of Agriculture (MOA) contributed Bds$30,000 from the European Development Fund (EDF) livestock development project. This project was a follow-up to the pilot feedlot carried out by CARDI in collaboration with the MOA and Barbados Agricultural Society (BAS), and was designed to test and commercially validate the economic viability of a sheep feedlot operation utilizing, where possible, available local feed resources.

The capacity of the feedlot and quarantine units were 260 and 80 animals respectively. Lambs were brought in at an average weight of 18 kg at a price of Bds$4.40/kg live weight, and were supplied by members of the Barbados Sheep Farmers Association (BSFA). The fattened lambs were marketed through the BAS, at an average live weight of 41 kg at Bds$4.40/kg live weight.

**Projected benefits**

Initially, the feedlot is projected to market 600 animals annually, generating approximately 12,273 kg of quality lamb valued at Bds$122,000 on the domestic market. As domestic production of lamb meat was estimated at 56,000 kg (1994), and imported valued at $6.8 million, the feedlot will significantly impact on local production and contribute towards import substitution. To arrive at the net return per lamb, all costs including feed, non feed, initial fixed cost, daily non-feed cost, facility and equipment cost and initial fixed costs were considered. The figures in the following Table are based on a project net return of Bds$50.00 per lamb per week.

Based on records of average daily gain (ADG), animals which meet the phenotypic standards set for Barbados Blackbelly sheep will be sold locally and exported regionally and extra-regionally as genetically superior animals for breeding purposes.
### Table 1  Projected annual returns from sheep feedlot operation

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of lambs/week</th>
<th>Return/year (Bds$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>20</td>
<td>52,000</td>
</tr>
<tr>
<td>1997</td>
<td>20</td>
<td>52,000</td>
</tr>
<tr>
<td>1998</td>
<td>40</td>
<td>104,000</td>
</tr>
<tr>
<td>1999</td>
<td>60</td>
<td>156,000</td>
</tr>
<tr>
<td>2000</td>
<td>80</td>
<td>208,000</td>
</tr>
</tbody>
</table>

Source: Barbados Agricultural Marketing Company (1996)

**Value added**

Marketing of meat in Barbados has improved significantly in the past 20 years from the traditional sale of the product on the farm and in public markets, to the modern practice of selling specialized cuts in meat shops, supermarkets and mini-marts. Retailing of the meat is more organized than the production and/or slaughter of the animals. This is attributed to a more informed consumer whose taste and preferences are being influenced by North America.

As a result, the carcasses from the feedlot are marketed through the Agricultural Trading Company (ATCO), the marketing arm of the BAS, in differentiated cuts and priced according to the cut. In addition, some cuts are sold as deboned cuts which are sometimes seasoned, with a concomitant increase in price per kg. The pricing structure per kg of ATCO is as follows:

<table>
<thead>
<tr>
<th>Bds$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legs</td>
</tr>
<tr>
<td>Shoulders</td>
</tr>
<tr>
<td>Deboned legs</td>
</tr>
<tr>
<td>Ribs</td>
</tr>
<tr>
<td>Racks</td>
</tr>
</tbody>
</table>

The value added cuts are sold to hotels and restaurants. The sale of breeding animals could also be considered as having value added, since the price is much higher than the carcass price, regardless of the weight.