A comparison of goat growth performance in a communal and commercial farming system in the Central Eastern Cape Province, South Africa.

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Abstract
There exists a dichotomy in the farming systems, in the Eastern Cape Province, namely communal and commercial farming systems. These systems are characterised generally by “poor” and good management practices, respectively. There exists a perception that the performance of animals from the communal farming system is below that of animals from a commercial system. A lot of information is available concerning various aspects of livestock production in the commercial farming system, but, such information on the communal farming system is lacking. The aim of this study was to compare animal performance in a communal area, with performance on a commercial farm. Data on live weights of indigenous goats was obtained by monthly weighing of goats from a village in a communal farming system. These data were compared with goat data obtained retrospectively from the University of Fort Hare Research farm, which in this study is used to represent the commercial system. The mean weights of goats $\pm$ SD, (corrected for age) from the commercial system were 1.2 times higher than those of goats from the communal system ($P<0.01$). The mean weights of male goats from both sites, were 1.1 times greater than those of females ($P<0.01$). Generally, goats from the commercial farm had 1.1 times higher average daily weight gains (ADG) than those from the communal system, except in Autumn 1996, when both male and female goats from the communal system gained better than those from the commercial farm. Females from the commercial farm lost weight at this time of the year ($-80.00g \pm 127.00$), compared to females from the communal system, which were gaining weight at a rate of $50.00g \pm 60.01$. Male goats from the commercial farm also gained least ($30.00 \pm 46.00g$) in Autumn, compared to their counterparts from the communal system ($40.00g \pm 20.00g$). The decline in ADG in Autumn, of goats from the commercial farm could be managerial in that the farm practices Autumn kidding. Nutrition could also be a factor because, the available herbage on the veld is of a low crude protein content, low digestibility and at a mature stage of growth, compared to that in the communal system which could be of a higher crude protein content and digestibility, at an actively growing stage.

Introduction
There exists a dichotomy in the farming systems, in the Eastern Cape Province, namely communal and commercial farming systems. This dichotomy is also noted in the aims for farming, whereby the majority of farmers in the communal system keep livestock for a number of purposes; e.g. milk, meat, and ceremonial slaughtering (Duvel. and Afful, 1994). In comparison with the aims of the commercial farmers which is to achieve faster growth, less mortality, high turnover which all translate into higher profits. Productivity from goats in the communal farming system, which is based on the extensive
system, is said to be poor with a low weaning rate, a high mortality rate and low turnover (Bembridge and Tapson (1993).

The commercial system is characterised by “good” management practices, like feed supplementation in the form of lucerne hay, mineral licks and concentrates. Periodic treatment against gastrointestinal worms with anthelmintics, and specific breeding periods are used which result in a correspondingly short kidding period. Goats are dipped to control tick infestation and tick borne diseases. Live body weight of each animal is taken once a month, and these are used to determine growth rates, on the basis of which, selection for replacement stock is made.

Due to the unconventional production practices in the communal farming systems, there exists a perception that the performance of animals from these areas (communal farming system) is below acceptable levels, with the commercial system being used as the gauge. There is lack of information to prove otherwise. This study will give insight into the general performance of goats in the communal farming area.

The aim of this study was to compare goat performance in a communal area with that of goats from a commercial farm.

Materials and Methods

Study site
The study was conducted at Koloni, Middledrift district, Eastern Cape province, South Africa (32°53’50”S, 27°04’50”E). The livestock production system is of a communal type. It is situated in veld type number 7, which is the Eastern Cape thorn veld (Acocks, 1975), and receives about 500mm of rainfall per year (CV 22.7%) (Goqwana, 1998). The stocking rate for 1997 was 330 SSU/658 ha (Goqwana, 1998). Vegetation is dominated by Acacia karoo, which contributes more than 70% of the botanical composition. Other species include Coddia rudis, Grewia occidentalis, Scutia myrtina, Rhus and Maytenus species (Goqwana, 1998).

University of Fort Hare Research farm
The University of Fort Hare Farm’s livestock section, Honeydale (32°47’37”S, 27°06’58”E) is 1113.6ha in size and represents a commercial farming system. The farm is stocked at 4 ha/AU and veld management practices are based on applying correct stocking rates and rotationally grazing the livestock in paddocks of which one third is rested annually. Fire is applied when some paddock are deemed to be encroached by trees or shrubs and goats are kept to control bush in conjunction with fire. The veld type is the False Thornveld of the Eastern Cape (Acocks, 1975), and the average annual rainfall is 620mm (CV 24%).

Management of the goats
Koloni (Communal system)
Animals are kraaled in the night, and let out to graze midmorning at around 10.00 am. In the evening, 4.00-5.00pm, the animals are collected from the
veld, to be kraaled. No specific breeding season is followed, leaving animals to breed whenever possible, this results in a prolonged kidding period. No specific feed supplementation is given to the goats and other stock, but they are allowed access to stover. All live stock are not weighed. There is minimal use of anthelmintics to control gastrointestinal worms, and a number of owners use herbal medications to treat their goats. Selection and culling of animals on the basis of their live weight gain, as replacement stock, is not practised, and there is a high degree of inbreeding in their stock.

Honeydale (Commercial system)
Animals are kept in a night paddock, and let out to graze at about 7:30 am, and are brought back to base at about 3:00 pm. A specific breeding season from 15th October to 30th November (6 weeks) is used. As a result, the kidding season takes place in March and April, after a gestation period of 5 months. No feed supplementation is given to the goats, except that protein blocks are given during droughts. Periodic treatment against gastrointestinal worms is done with anthelmintics. Goats are dipped to control tick borne diseases and ectoparasites. Live body weight of each animal is taken once a month, and this is used to determine growth rates, on the basis of which, selection for replacement stock is made.

Data collection
Communal system
A total of 70 goats of various age groups and sexes were selected and ear tagged at random on a dipping day at the village dipping tank. There after, goat owners with tagged animals were requested to avail the tagged animals on specific days on which the animals were to be weighed. On each weighing day, goats were collected in one kraal where weighing was done, using a dial scale hooked at the end of a lever, that was mounted on a vertical steel pipe, which had been inserted in a hole in the ground. A leather strap was used to hoist the goats, legs down on to the scale. Body weights were recorded once a month.

Estimation of the age of the goats was made, by determining the stage of eruption of the permanent incisor teeth. All goats with no permanent teeth were taken to be less than one year of age, those with one, two, three or four pairs of permanent incisor teeth erupted, were 1.5, 2, 3, or 3.5 years of age, respectively.

From a total of 70 goats that were tagged initially, data for only 39 goats is reported on in this article. This is as a result of many missing data, due to some owners not bringing their animals to be weighed on days when it was very cold (Winter), or when it was drizzling. Some of the goats died and others were slaughtered or sold.

Commercial system
Data for 109 Nguni type goats, were obtained retrospectively from the University of Fort Hare Research farm, which, in this study, is used to represent the commercial system of farming.
Seasons are grouped as follows: Summer (December – February); Autumn (March –May); Winter (June – August) and Spring (September- November).

**Data analysis**
Data were analysed for Anova, F and t-tests using the Genstat for Windows 3.2 programme.

**Results**

*Mean weights of goats from the communal and commercial systems*
The mean weights of goats (corrected for age) from the commercial system were 1.2 times higher (Table 1), than those of goats from the communal system (P<0.01).

| System       | Season |  |
|--------------|--------| |
|              | Summer | Autumn | Winter | Spring  |
| Communal     | 28.31  | 29.85   | 31.68  | 32.16   |
| Commercial   | 36.64  | 39.02   | 37.33  | 37.84   |

*Mean weights of male and female goats*
Generally, the mean weights of male goats from both sites were 1.1 times greater than of the females (P<0.01), however, there was no significant difference in live weight between the two sexes in summer. (Table 2)

| Gender       | Season |  |
|--------------|--------| |
|              | Summer | Autumn | Winter | Spring  |
| Males        | 35.42  | 9.57    | 40.52  | 42.36   |
| Females      | 34.44  | 35.88   | 34.31  | 34.31   |

*Mean body weights of male and female goats from the communal and commercial farming system in the various seasons*
Male goats from the communal system had a slight increase in body weights, with a peak in spring (Table 3). Male goats from the commercial system showed a linear increase in body weight, with a maximum weight in spring. Female goats from the communal system showed a linear increase in weight with a peak in winter, which then reduced in spring. Female goats from the commercial system showed a peak in body weight in autumn.
Table 3  Mean body weights, (Kg) (±SD), of male and female goats from the
communal and commercial farming systems, in various seasons

<table>
<thead>
<tr>
<th>System</th>
<th>Summer</th>
<th>Autumn</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communal</td>
<td>26.99 (11.50)</td>
<td>29.34 (10.80)</td>
<td>29.10 (8.20)</td>
<td>30.47 (6.80)</td>
</tr>
<tr>
<td></td>
<td>30.29 (11.10)</td>
<td>32.65</td>
<td>33.48 (10.30)</td>
<td>31.33 (10.50)</td>
</tr>
<tr>
<td>Commercial</td>
<td>29.45 (15.50)</td>
<td>34.31 (13.50)</td>
<td>35.31 (11.30)</td>
<td>36.74 (10.40)</td>
</tr>
<tr>
<td></td>
<td>38.56 (15.00)</td>
<td>40.29 (13.00)</td>
<td>37.80 (9.50)</td>
<td>38.05 (8.70)</td>
</tr>
</tbody>
</table>

Mean average daily gain
Generally, goats from the commercial system had 1.1 times higher average
daily weight gains (ADG) than those from the communal system (Table 4),
except in Autumn, when both male and female goats from the communal
system gained better than those from the commercial farm. In autumn, female
goats from the commercial farm lost weight, compared to females from the
communal system, which were gaining weight during the same period. The
bucks from the commercial farm also gained in autumn compared to their
counterparts from the communal system. Females from the communal system
lost weight in summer and spring, whereas their counterparts from the
commercial system gained weight in summer, and slightly so in Spring.

Table 4  Mean ADG (g/day) ± SD of male and female goats from the
communal and commercial system, in the various seasons.

<table>
<thead>
<tr>
<th>System</th>
<th>Summer</th>
<th>Autumn</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communal</td>
<td>34.97+</td>
<td>43.69+</td>
<td>12.85+</td>
<td>59.90+</td>
</tr>
<tr>
<td></td>
<td>10.25+</td>
<td>52.30+</td>
<td>11.30+</td>
<td>6.94+</td>
</tr>
<tr>
<td>Commercial</td>
<td>110.85+</td>
<td>28.57+</td>
<td>44.75+</td>
<td>97.66+106.00</td>
</tr>
<tr>
<td></td>
<td>82.73+</td>
<td>83.48+</td>
<td>26.25+</td>
<td>3.86+</td>
</tr>
</tbody>
</table>

Discussion
The difference in body weight of goats from the communal compared to those
from the commercial system could be due to several factors:

- The first is management. The goats are allowed to forage at different times
  in the different systems. Normally, goats and sheep in the communal
  farming system, are released at about 10.00 a.m. This is due to a belief that
dew on the grass contains some disease causing organisms, which could
infect the animals if they were to graze very early in the morning. Another
reason for letting the small stock out late is fear of vermin like jackals and
foxes, which will have moved deeper in the bushes and forests by
midmorning.
- Goats have been recorded to start foraging on their own about 30 minutes
  before sunrise in summer and 40-45 minutes after sunrise in winter
  (Sharma, Saini, Singh and Ogra, 1998). The morning feeding period
  commences at daylight and continues until midmorning (10:00 - 11:00) and
a second major meal begins 2-3 hours prior to sunset. This diurnal pattern of foraging shows that goats in the communal system start grazing at a time when they should be resting, possibly to avoid heat stress. The grazing practice in the communal system, most likely affects feed intake of these goats. Diurnal feeding pattern in goats may be modified by factors such as forage availability, environmental stress such as heat and rain, frequency of feeding and amount of feeding (Sharma et al., 1998).

- Malnutrition is the other possible reason, and it is known to be the most important cause of low production rates in communal systems (Bembridge and Tapson, 1993). Malnutrition could be caused by the late release of the goats from kraals, coupled with the long distance walked from the residential sites to the foraging camps. At the end of the day, the animals will have inadequate feed intake. This in itself drains the animals energy reserves. Locomotion associated with foraging and increased amount of time spent obtaining food is important as it can account for a significant part of the total energy requirement in goats (Sharma et al., 1998).

- A possible gastrointestinal nematode parasitism in goats from the communal system could also have led to their being lighter. The adverse effects of undernutrition on the productivity of ruminants, is further exacerbated by infection with gastrointestinal parasites, particularly when climatic conditions are warm and moist (Anindo, Toe, Tembely, Mukasa-Mugerwa, Lahlou-Kassi and Sovani, 1998). However, a high level of nutrition can mitigate the effect of endoparasitism (Mukasa-Mugerwa, Kasali and Said, 1991).

- A lack of selection and culling of poor performing stock in the communal area, as practised in the commercial system, leads to a more heterogeneous flock which could have masked the performance of good performers, thus resulting in the general lower weights. The practice of inbreeding in the goat flocks from the communal system could also have contributed to the lower body weights.

- Male animals were heavier than females (Table 2). Males are in the majority of cases born heavier than females, this also translates in heavier weaning weights and growth rates for the male. The steroid hormone levels could have a role in this aspect, where by, testosterone has a higher anabolic effect than estrogen. On the other hand, females face greater physiological stress in the form of pregnancy, kidding and nursing the kids, which drains the female’s body reserves, thus lowering their body weights.

- The reasons for body weight differences seen in Table 3, could have possibly been due to presence of a more nutritive source of grazing as a result of the beginning of the rainy season. Male goats from the communal system showed a slight lowering in their body weight during winter, which could be due to the colder weather at this time of the year, however, their female counterparts did not show this trend. So the cause could not have been the weather. Another possibility could have been the breeding season. As is the case with many other seasonal breeders, goats exhibit a seasonal growth cycle independent of available nutrition and driven by changes in voluntary feed intake (Walkden-Brown, Norton and Restall, 1994b). This cycle is characterised by a depression in voluntary feed intake and growth
during the autumn and early winter months when testosterone concentrations are highest, suggesting that it may be mediated in part by gonadal steroids (Walkden-Brown, Restall, Scaramuzzi, Martin and Blackberry, 1997).

- Male goats from the commercial system, showed a linear increase in body weight, with a maximum weight in spring, which could be due to the male goats being at a stage of linear growth (growth curve), on average, male goats were 1 year old. But could also be due to their being supplemented with concentrates before, during and just after the breeding season.

- Female goats from the communal system showed a linear increase in weight with a peak in winter, which then reduced in spring. Goats in the communal system start breeding in autumn, which could explain the peak increase in live body weights in winter. This is the time when the goats were heavily pregnant. The decrease in body weight in spring could be due to the female goats nursing their kids at this time of the year and in some cases, being milked by the owners. It could also be due to an increase in the internal parasite load, which tend to increase during the time when the body is under stress. Female goats from the commercial system showed a peak in body weight in autumn. This is the time when they could have been heavily pregnant, since the commercial system practices spring mating - Autumn kidding, this results in a corresponding reduction in body weight in winter, which is the time when they would be nursing the kids.

A possible explanation why goats from the commercial system had a higher ADG (Table 4) could be that, in the commercial system, animals with a faster growth rate are selected to become replacement stock, whereas, animals with a slower growth rate are selected against and are eventually culled. Selection per se is not practised in the communal system. As a result, goats from the communal system have a more heterogeneous growth rate than goats from the commercial system, which could have led to their having a lower ADG than those from the commercial system.

The commercial farm in this study practices autumn kidding, during this time, the does are under stress caused by kidding and suckling of the kids, this goes to explain the negative ADG shown by the females from the commercial system. However, the physiological stress of the nursing does, could have been confounded by the quality of available herbage on the veld. Whereby, the practice of controlled stocking and grazing in the commercial system, leads herbage to grow to mature stage where it contains low crude protein and digestibility, coupled with frost at this time of the year, which leads to excessive defoliation of available browse.

The decrease in ADG of male goats from the commercial system in Autumn, could have been influenced by the poor quality herbage available on the veld, which could also have been confounded by the possibility of the bucks having had a depressed voluntary feed intake and growth during autumn, when testosterone concentrations are at their peak (Walkden-Brown et al., 1997). The high testosterone concentration during the breeding season is reported to directly inhibit voluntary feed intake (Walkden-Brown et al., 1997).
The negative ADG exhibited by the female goats from the communal system, during spring and summer seasons, could have been due to the fact that kidding takes place at this time of the year. As there is no specific breeding period practised in the communal system, the kidding season expands over a wide period, which coincides with a loss of weight. Coupled with this is the fact that some of the goats are milked by their owners, which might increase body demands for nutrients that are of low quality and quantity at this time of the year. Proteins and digestible nutrients decline after the rainy season with the onset of winter in natural pastures, and this causes major constraint to ruminant productivity as a whole (Sharma et al., 1998).

Conclusion
Goats from the communal farming system were lighter and had a lower average daily weight gain compared to similar goats in a commercial farming system. This difference in goat performance could be due to a number of factors like, management, nutrition, health, breeding practices, selection to mention but a few. Improvement in growth performance of flocks from the communal system could be effected by implementation of basic management practices used in the commercial systems. However, one should not forget the purpose why farmers in the communal system keep livestock. For them it would appear, their aim is to increase numbers as opposed to individual animal performance (Duvel and Afful, 1994). On a production per unit area basis, however, communal systems could perform better than the commercial systems due to the high number of livestock kept per unit area in the communal areas, which could be at the expense of the veld.

References


University of Pretoria.


