The effect of overnight kraaling on sheep production in the sourveld areas of the Eastern Cape Province, South Africa

C.B. Nowers*, L.M. Nobumba & J. Welgemoed
Döhne Agricultural Development Institute, Department of Rural Development and Agrarian Reform, Private Bag X15, Stutterheim, 4930, South Africa

Abstract

It is a common practise in communal areas to kraal sheep at night. This study was conducted to determine the effect of overnight confinement on sheep growth and wool production under favourable grazing conditions. The project on Dohne Sourveld commenced during September 2007 and was replicated over three years. A total of 100 Dohne Merino wethers between 12 and 14 months old were randomly allocated into two treatment groups: an unrestricted group (Control) and a group kraaled from 16:00 until 08:00 the following morning (Kraal). The treatments commenced during September of each year and continued until sheep were shorn the following August. The sheep in both treatments were stocked at similar stocking rates and rotational grazing was applied. The body weights of wethers were recorded fortnightly. Fleece weights of the animals of both groups were recorded at shearing. Midrib samples were taken for determination of certain fibre traits. Faecal samples from 20% of each treatment group were taken at two weekly intervals to determine nematode parasite levels. Phosphorous (summer licks) and protein (winter licks) were supplemented ad lib. to both treatments. The same vaccination and animal health program were applied to both treatments. Sheep were only dosed in a treatment group when average faecal internal parasite counts exceeded levels above 1000 eggs/gram. Although animal performance varied during the three years, no significant differences were found in weight gains between animals in the treatment groups. Lower than expected infestation levels of *H. contortus* were found in the Kraal group. Wethers in this treatment received only one additional drenching for two of the three years. Greasy fleece weight, fibre diameter and clean yield percentage were similar. Clean wool yield percentage of kraaled sheep was consistently lower than those of sheep in the control group. Results suggest that if sheep are kraaled at night in properly constructed confinement structures (correct slope, sufficient drainage, etc.) from 16:00 until 08:00, with sufficient quantity and quality grazing throughout the unrestricted period, wool production and body weight should not be negatively affected.

Keywords: sheep, kraaling, overnight confinement, communal sheep, live weight gain, sheep production

*Corresponding author: christo.nowers@drdar.gov.za

Introduction

The Eastern Cape is predominantly a rural province as 60% of its population lives in pastoral communities. They are characterised by a subsistence economy based primarily on livestock production underpinned by state welfare grants and urban migrant remittances. Approximately 90% of the provincial land surface is natural veld only suited for extensive livestock production (de Wet & van Averbeke, 1995; CSIR, 2004). This underscored by the fact that the Eastern Cape is, where animal numbers are concerned, the most important province in the republic of South Africa (National Department of Agriculture, 2012). Livestock production will therefore always be a major resource and component of agricultural production in this province. However, communal livestock systems contribute very little to the cash economy in terms of sales for slaughter to the market (Bembridge, 1987).

Livestock in communal systems are generally managed with an absolute minimum of infrastructure, the only fixed facility being kraals where animals are confined at night (Bembridge & Tapson, 1993). This is common practice in the communal areas of the former Ciskei and Transkei (Smith, 1961; Bembridge, 1987; Mvinjelwa *et al.*, 2014) and other territories (Nsoso & Madimabe, 2003). Due to the lack of fences, the presence of predators and stock theft (Mapiliyao, 2010), cattle and sheep are kraaled at night. They stay until mid-morning whereby prime early morning grazing time is reduced. It is common belief that restricting daily grazing hours and kraaling sheep at night contributes to high mortality levels (± 25%), low reproduction rates (± 56%), low weaning rates (± 47%) and a low turnover (Bembridge, 1989). All this contribute to a very low off-take (± 6 - 9%) and poor economic returns (Boonzaier *et al.*, 1990). The approved practice is to let cattle
and sheep out of the kraal ½ hour after sunrise and to return them to the kraal ½ hour before sunset (Smith, 1961). It is not uncommon that communal livestock is kept in kraals as late as 10:00 and returned as early as 15:30, times depending on the convenience of herders (M.N. Zide, personal communication). The effect of kraaling on communal sheep production is further exacerbated by a quantitative shortage and quality of forage availability during the day caused by the deterioration of range condition and the more than double the recommended ecological carrying capacity (Boonzaier et al., 1990).

Limited and conflicting information is available in literature on the effect of night kraaling (overnight confinement) on growth and production of cattle and especially sheep. Hunter (1990) showed that kraaling sheep at night results in dirty wool and low clean wool yields of communal sheep in Lesotho. Ye et al., (1999) found in China lower wool fibre density and clean wool yield in sheep kept on pasture during the day and housed at night, than sheep permanently on pastures. Bayer (1990) concluded that some restriction of grazing time is not a severe limitation as cattle can compensate through increased grazing efficiency. Jung et al. (2002) found that reducing time on pasture and increasing walking time may compromise animal welfare and performance. Smith (1961) and Iason et al. (1999) found that ruminants increase the intake rates by grazing for longer periods during the day and delaying their resting and ruminant activities to the night. Müller et al. (2011) concluded that overnight confinement did not affect animal performance negatively. Several studies have however shown that the restriction of night grazing can become an important factor for intake and animal performance if the availability of forage (Iason et al., 1999; Ayantude et al., 2001) and/or forage quality are low (Joblin, 1960). Mapekula & King (2016) found that animal growth was negatively affected by kraaling where animals had no access to feed and water.

Aforementioned led to assumptions that kraaling per se is a management practice that is wrongly adapted by small-scale landholders and severely limits improved communal livestock production. Overnight kraaling of sheep is therefore generally condemned as one of the communal managerial practises responsible for low livestock performance. This study was undertaken to investigate the effect of restricted daily foraging time, as result of night kraaling, on the growth and wool production of sheep managed under favourable grazing conditions.

Material and Methods

This study was conducted at the Döhne Agricultural Development Institute (Döhne A.D.I.)(27E 29’ E, 32E 29’ S) located in the Dohne Sourveld of South Africa (Acocks veld type 36) (Acocks, 1988) with mean annual rainfall of 688 mm.

The investigation commenced during mid-September of each year and continued until sheep were shorn during the following August. The study was replicated for three years (2007 to 2009). A total of 100 Dohne Merino wethers (varying in age between 10 and 12 months) were randomly allocated on stratification of body weight and age into two treatment groups: a group kept on veld for 24h/day (Control) and a group kraaled from 16:00 to 08:00 the next morning. The latter group had no access to feed or water when kraaled. The kraal was an open facility with no roof and the floor was sloped at ± 3º-5º to allow for sufficient drainage. A floor surface area of 2 m² was allocated per sheep. The manure in the kraal was removed every six months. Before the treatments started, sheep were weighed, ear tagged according to the treatment and treated against internal parasites.

The sheep in both treatments were stocked in the same camp during the day. The recommended stocking rate for Dohne Sourveld (1 ha/3 Small Stock Units (SSU)) was applied with rotational grazing between four adjoining homogenous camps. Sheep in both treatments were shepherded into the kraal at 16:00 upon which sheep from the Control group were immediately allowed to leave the kraal area. This procedure ensured a similar degree of disturbance to each treatment group. The same vaccination and animal health programme was applied to sheep in both treatments. The body weight of wethers was recorded fortnightly after overnight fasting and the fleece weights of the animals of both groups were recorded at shearing. Midrib samples were taken for determination of certain fibre traits. Faecal samples from 20% of each treatment group were taken at 2 weekly intervals to determine internal nematode parasite levels using McMaster egg counting slides. Sheep were only dosed in a treatment group when average parasite egg counts exceeded 1000 eggs/gram. Phosphorous (summer licks) and protein (winter licks) were supplemented ad lib.to both treatments. Control sheep had continuous access to water and licks and the Kraaled sheep only during the daytime.
Standard analyses of variance were performed on growth and production data. Tukey-Kramer multiple comparison test and Student’s t-LSD were calculated at the 5% significance level to compare treatment means (NCSS, 2007).

Results and Discussion

Table 1 show the frequency of drenching as applied per treatment group over the three treatment periods. Samples were analysed on 65 occasions over the three year period. Sheep in the Control treatment were dosed four times during each of the treatment periods whilst sheep in the Kraal treatment received one additional drenching during the 2007/2008 and 2009/2010 period. A total of 12 drenchings was applied to the Control treatment compared to the 14 applied to the Kraal treatment (Table 1). This represented a 18.5% and 21.5% proportional infestation rate of total faecal sampling. Haemonchus contortus (H. contortus) is the most significant internal parasite found in sheep managed on sourveld at Döhne A.D.I. and the local strain is extremely resistant to most anthelmintic groups (Dr. A. Fisher, personal communication). This constant challenge by H. contortus and the inherent low resistance of sheep to this parasite necessitated the dosing program applied (dosing when eggs per gram faeces exceeds 1000) to prevent production losses. Since large numbers of sheep is closely confined during overnight kraaling, the possibility was anticipated that it could contribute to increased internal parasite infection (Louw & Read, 1991; Williams & Warren, 2004) which could adversely affect growth rates. The confinement of sheep in a kraal concentrates sheep and infective parasites onto the same small area with closer contact with their faeces. This was not found in this study where sheep in the both treatments showed similar parasite infestation levels throughout most of the study period, with only one additional deworming of sheep in the Kraal treatment during December 2007 and in December 2009. Facilities with good drainage in a properly constructed kraal should reduce the survival of the parasites (Kumar et al., 2013). The regular removal of manure, the allowance of adequate floor space and sufficient drainage enabled sheep in this study to resist and tolerate internal parasites infestations better that sheep kraaled under communal conditions.

Table 1

<table>
<thead>
<tr>
<th>Year</th>
<th>Control Grp (Unrestricted grazing)</th>
<th>Kraal Grp (Restricted night grazing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2008</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2009</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>14</td>
</tr>
</tbody>
</table>

The results for the fleece traits measured in the treatments are presented in Table 2. No differences (P>0.05) were found between treatments for clean fleece weights, fibre diameter and clean yield. This is in agreement with Mapekula (2013) and Mapekula et al. (2016) who found that overnight kraaling had no negative effects on fibre diameter and clean yield percentage but in contrast to their finding on clean fleece weight. Ye et al. (1999) found in China that wool fibre density (P<0.01) and clean wool yield (P<0.01) in sheep kept on pasture during the day and housed at night was lower than sheep permanently on planted pastures. This is in contrast with the findings in this study where night confinement had no significant effect on clean wool yield. Hunter (1990) reported that in Lesotho the wool productivity and clean wool yields were low and that the wool was dirty. He speculated that is was ascribed to the practice of kraaling sheep at night and grazing on cultivated fields during the day. Although not significant, the clean yield percentage of kraaled sheep in this study was consistently lower than those of sheep in the control group. The regular removal of yard manure and a properly constructed confinement area (kraal) in this study possibly contributed towards the fleece characteristics not significantly affected by overnight kraaling. The findings in this study is thus in agreement with Mapekula et al. (2013) who concluded that overnight kraaling had no negative effects on wool production per se.
Table 2 Fleece traits (± s.e.) of sheep in the Control and Kraal treatments

<table>
<thead>
<tr>
<th>Year</th>
<th>Clean fleece weight (kg)</th>
<th>Fibre diameter (µm)</th>
<th>Clean yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control Grp</td>
<td>Kraal Grp</td>
<td>Control Grp</td>
</tr>
<tr>
<td>2007</td>
<td>2.49 ± 0.1</td>
<td>2.58 ± 0.1</td>
<td>20.34 ± 0.5</td>
</tr>
<tr>
<td>2008</td>
<td>3.28 ± 0.1</td>
<td>2.98 ± 0.1</td>
<td>21.26 ± 0.6</td>
</tr>
<tr>
<td>2009</td>
<td>2.95 ± 0.1</td>
<td>2.77 ± 0.1</td>
<td>19.59 ± 0.5</td>
</tr>
<tr>
<td>Average</td>
<td>2.89 ± 0.1</td>
<td>2.79 ± 0.1</td>
<td>20.38 ± 0.5</td>
</tr>
</tbody>
</table>

No significant differences measured for traits between treatments (P>0.05)

The body weight changes of sheep in both treatments are presented in Table 3. The results for the weight trends of sheep are depicted in Figure 1 (2007/2008), Figure 2 (2008/2009) and in Figure 3 (2009/2010). Although animal performance varied during the three years, no differences (P >0.05) were found in weight gains and weights at the end of the trial between treatments. The body weight change of sheep at the end of the study was however, although not significant (P>0.05), for each of the three years consistently lower in the Kraal treatment. Animal performance, as measured by weight gains, were similar (P>0.05) between treatments for each of the three years. Offering additional grazing time on sourveld to sheep during the night did not increase their performance and this is in contrast with the findings of Mapekula (2013) and Mapekula et al. (2016) who concluded that kraaling affected body weights negatively. The differences between the findings of this study and the aforementioned study can be ascribed to the different veld type (Upper False Karroo veld – Acocks veld type 36) (Acocks, 1988) on which sheep were managed and also due to the shorter time (five months) that sheep were treated in their study on overnight confinement.

Table 3 Average starting and end body weights and body weight changes (± s.e.) of sheep in the Control and Kraal treatments

<table>
<thead>
<tr>
<th>Year</th>
<th>Start body weight (kg)</th>
<th>End body weight (kg)</th>
<th>Body weight changes (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control Grp</td>
<td>Kraal Grp</td>
<td>Control Grp</td>
</tr>
<tr>
<td>2007</td>
<td>35.3 ± 0.9</td>
<td>35.8 ± 0.9</td>
<td>51.6 ± 0.8</td>
</tr>
<tr>
<td>2008</td>
<td>35.6 ± 0.8</td>
<td>36.4 ± 0.8</td>
<td>59.2 ± 0.9</td>
</tr>
<tr>
<td>2009</td>
<td>37.2 ± 0.9</td>
<td>36.5 ± 0.9</td>
<td>53.7 ± 0.9</td>
</tr>
</tbody>
</table>

No significant differences measured between treatments at different stages (P>0.05)

Romney et al. (1996) found no serious production disadvantages when goats were tethered for periods as long as eight hours. They concluded that the goats were able to alter their behaviour to compensate for limited time available for grazing. This agrees with the findings of Müller et al. (2012) who concluded that offering additional time on pasture at night does not increase feed intake or sheep performance. Live weight gain of sheep in their study was not different between continuous grazing and day time grazing which agrees with the findings of our study. This is in contrast with Ayantunde et al. (2002) who found lower cattle performance when grazing time was restricted to daytime. The studies of Arnold (1985) and Ayantunde et al. (2002) revealed that animals normally do not show any significant grazing activity during the night. The hypothesis of Prache et al. (1998) that sheep try to avoid night grazing by means of more efficient grazing in the morning is supported by Müller et al. (2012).

Several studies have, however, shown that during periods of low forage availability (Iason et al., 1999; Ayantunde et al., 2001) and/or low quality (Joblin, 1960) additional night grazing (continuous grazing) become important to sustain intake and animal performance. By increasing their daily forage time sheep can compensate for a decrease in available fodder present, which is not case with overnight kraaling (Allden & Whittaker (1970). Nicholson (1987) found with cattle an intensification of eating in response to a restriction of grazing time. This could possibly explain the findings of Smith et al. (2006) that access of seven hours to Ogaden cattle sufficient pasture access time to achieve daily voluntary food intake and that supplementary forage and extended grazing access had no significant effect on dry matter intake or live weight gain. This compensatory behaviour could further explain why animal performance in the current study, conducted under...
optimal grazing conditions, was not adversely affected by overnight confinement for as long as 16 hours. Livestock kraaled under communal conditions, where there is a constant lack of quantity and quality grazing (Boonzaier et al., 1990), will however find it difficult to compensate for a decrease in forage mass and quality by trying to extend their grazing time during the day (Ayantunde et al., 2001; Joblin, 1960; Arnold, 1985). This is supported by the findings of Ayantunde et al. (2000) and Mapekula (2013) who found that sheep that were kraaled during the night during the dry season needed supplementation to maintain animal performance.

**Figure 1** Live weight changes of sheep in the Control and Kraal treatments during 2007/2008

**Figure 2** Live weight changes of sheep in the Control and Kraal treatments during 2008/2009

**Figure 3** Live weight changes of sheep in the Control and Kraal treatments during 2009/2010

Citation of this paper: Appl. Anim. Husb. Rural Develop. 2017, vol 10, 9-16: www.sasas.co.za/aahrd/
From the aforementioned it seems that behavioural responses of sheep, to overnight food restriction by kraaling, were able to counteract the reduction in daily grazing time only where food availability was high. In contrast to short swards, such as associated with communal grazing areas, overnight grazing restriction will lead to a reduction in total daily feed intake with subsequent lower animal performance. The quality of sourveld (crude protein (CP) content) is at its highest (between 6.6% and 9% CP) in spring and declines during late summer and reaches a low point about 2.5% CP before the onset of spring growth (Lyle, 1999). Protein supplementation during the winter period, as provided during this study, is therefore critical to improve the ability of ruminants to digest roughage and considerably enhances the animal’s voluntary feed intake. It is a rare occurrence that smallholder farmers ever offer supplementation to their animals. The low adoption rate of supplements in communal areas will further decrease the possibility that sheep kraaled at night will make better use of the feed that it ingests during periods of low forage quality. This study was done on non-productive sheep. The effect of kraaling on productive sheep warrants further investigation.

**Conclusion**

Findings from this study suggest that the productivity of sheep confined at night in properly constructed structures (correct slope, sufficient drainage, etc.) from 16:00 to 08:00 provided with sufficient quantity and quality grazing for the unrestricted period should not be affected negatively. Considering the risk of stock theft and the threat posed by predators as well as the importance of sheep manure as fertilizer for food crops, the common practice of kraaling of sheep at night seems to be an adequate management practice for farmers if applied correctly.

**Acknowledgements**

The authors gratefully acknowledge the Eastern Cape Department of Rural Development and Agrarian Reform for funding this project and to the general workers of the Döhne A.D.I. for their dedicated management of experimental animals.

**References**


