The utilisation of maize-crop residues for overwintering livestock 3. Livestock performance as affected by different cattle to sheep ratios when grazing maize-crop residues

W.D. Gertenbach*, J.Viljoen, P.W. van H. Henning and J.A. Collyer
KwaZulu-Natal Department of Agriculture, P.O. Box 626, Dundee, 3000 Republic of South Africa

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During 1993, different ratios of cattle:sheep grazed maize-crop residues at the Dundee Research Station. The treatments comprised cattle only (T1; 8 heifers), high cattle:low sheep (T2; 6 heifers:8 wethers), low cattle:high sheep (T3; 4 heifers:17 wethers) and sheep only (T4; 36 wethers). A stocking rate of 2.3 LSU (large stock unit)/ha was applied to all treatments. Grazing commenced on 29 June 1993 and was terminated on 27 September 1993, providing 91 grazing days. Although the highest proportion of residues (54.8%) was utilised in T4, cattle alone or cattle with sheep had a larger live mass gain/ha than sheep only grazing the residues.

Gedurende 1993, het verskillende verhoudings van bees:skaap mielie-oesreste bewei op die Dundee Navorsingsstasie. Behandelings het behels slegs vleisbeeste (T1; 8 verse), hoë bees:lae skaap (T2; 6 verse:8 hamels), lae bees:hoë skaap (T3; 4 verse:17 hamels) en slegs skape (T4; 36 hamels). 'n Veebelading van 2.3 GVE (grootvee eenheid)/ha is by al die behandelings gebruik. Beweiding van die mieliereste het begin op 29 Junie 1993 en is gestaak na 91 weidae op 27 September 1993. Alhoewel die skape van T4, die hoogste verhouding oesreste benut het (54.8%), het beeste alleen of beeste saam met skape 'n groter lewendemassatoename/ha getoon as skape alleen.

Keywords: gain/ha, selective grazing

* Author to whom correspondence should be addressed at: KwaZulu-Natal Department of Agriculture, Private Bag X9059, Pietermaritzburg, 3200 Republic of South Africa.

Introduction

The value of maize-crop residues for the overwintering of dry beef cows was investigated (Crichton *et al.*, 1998; Gertenbach *et al.*, 1998) at the Dundee Research Station. Maize-crop residues are also a valuable source of winter roughage for sheep (Swart *et al.*, 1983; Esterhuyse *et al.*, 1988). A common management practice in maize-growing areas of Northern Natal is to graze cattle and sheep together on residues, on the assumption that sheep are able to utilise loose grain kernels, whereas cattle do not. However, there is a lack of information to corroborate this assumption, as well as on the correct cattle:sheep ratio required to utilise the residues optimally.

Experimental procedure

Cultivation of the land

Maize (HL8, a high-lysine cultivar) was established at a seeding rate of 38 000 plants/ha, on 8.732 ha land at the Dundee Research Station (which is situated at altitude 1219 m; latitude 28°10'S; longitude 30°19'E, where winters are dry and the summer rainfall is 777.3 ± 150.6 mm/annum). The

soil type was classified as a Hutton (MacVicar *et al.*, 1977). Following mechanical harvesting, maize cobs remaining on the land were picked up by hand.

Maize crop residue yield and experimental animals

Before and after grazing, the yields of crop residues on the lands and the composition of the residues were determined in the same way as with the previous trials at Dundee (Crichton *et al.*, 1998). Sussex heifers (mean live mass 281.8 ± 4.0 kg) were selected randomly from 43 replacement yearling heifers. The wethers (32.5 ± 0.4 kg initial live mass) were from a flock of relatively pure-bred merino sheep.

Treatments

Treatments consisted of various ratios of cattle and sheep grazing maize-crop residues. The mean stocking rate was 2.3 LSU/ ha. In this trial, one LSU (large stock unit) was taken as an animal which has the potential to ingest 10 kg dry matter per day, with dry matter intake equal to 10% of metabolic live mass (Jones *et al.*, 1985). Treatments were made up as follows:

Treatment 1 (T1): Eight heifers
(mean live mass 279.8 ± 5.8 kg, total 5.5 LSU)
Treatment 2 (T2): Six heifers plus eight wethers
(mean live mass 281.8 ± 6.7 & 32.9 ± 0.8 kg respectively; total 5.2 LSU)
Treatment 3 (T3): Four heifers plus seventeen wethers
(mean live mass 283.8 ± 8.2 & 32.4 ± 0.6 kg respectively; total 5.1 LSU)
Treatment 4 (T4): Thirty-six wethers
(mean live mass 32.2 ± 0.4 kg; total 4.9 LSU)

An area of 2.298, 2.116, 2.191 and 2.127 ha was allocated to T1, T2, T3 and T4 respectively, providing stocking rates of 2.4, 2.6, 2.3 and 2.3 LSU/ha. Continuous grazing was applied throughout.

Lick

Dundee lick (56.5% salt, 19.4% maize meal, 8.1% dicalcium phosphate, 16.0% urea) was supplied *ad libitum* and intakes were monitored weekly. The lick intake in T2 and T3 was not determined separately for cattle and sheep, owing to the practical problems associated with allowing differential access of heifers and wethers to the lick when running as a combined group.

Live mass

Initial and final live mass of the animals were recorded following the removal of food and water for 18 h. A full-fed live mass was recorded each week throughout the grazing period.

Statistical analysis

Live mass gain per animal was compared among treatments by analysis of variance.

Results

Grazing period

Grazing commenced on 29 June 1993 and was terminated on 27 September 1993 thus providing 91 grazing days.

Maize crop residue and maize grain yield

The maize grain yield was not recorded. The crop residue yields were 5.813, 5.792, 5.713 and 6.946 t/ha for T1, T2, T3 and T4 respectively (Table 1).

Live mass

The initial and final weights of the heifers and the wethers (Table 2) did not differ significantly. However, live mass gain per ha was 108.3, 109.0, 138.7 and 96.2 kg/ha for T1, T2, T3 and T4 respectively (Table 2).

Table 1 Maize-crop residue (t DM/ha) yield, yield of the components of the crop residues and % utilisation before and after grazing by different ratios of cattle:sheep (Treatment 1 = cattle only, Treatment 2 = 79% cattle:21% sheep, Treatment 3 = 56% cattle:44% sheep, Treatment 4 = sheep only)

	Treatment 1			Treatment 2			Treatment 3			Treatrnent 4		
	Before	After	Utilised	Before	After	Utilised	Before	After	Utilised	Before	After	Utilised
Component	(t/ha)	(t/ha)	(%)	(t/ha)	(t/ha)	(%)	(t/ha)	(t/ha)	(%)	(t/ha)	(t/ha)	(%)
Grain	0.428	0.000	100.0	0.084	0.000	100.0	0.292	0.000	100.0	0.563	0.000	100.0
Cob	0.451	0.895	-98.4	0.784	0.670	14.5	0.618	0.718	-16.2	0.842	0.772	8.3
Stalk	1.717	1.388	19.2	1.598	1.086	32.0	1.629	1.181	27.5	1.857	0.961	48.2
Leaf	2.676	1.101	58.9	2.458	1.391	43.4	2.111	1.180	44.1	2.860	1.219	57.4
Grass	0.541	0.148	72.6	0.868	0.323	62.8	1.063	0.477	55.1	0.824	0.265	67.8
Total	5.813	3.532	39.2	5.792	3.470	40.1	5.713	3.556	37.8	6.946	3.217	53.7

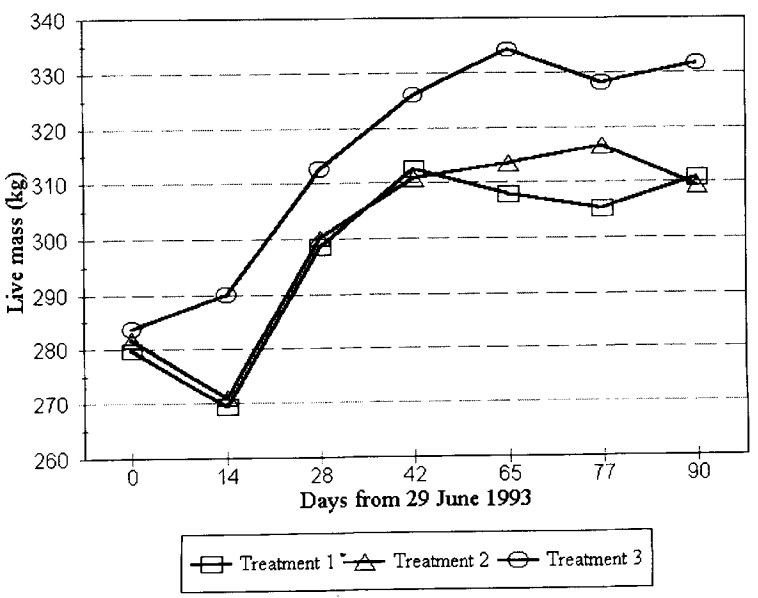

Figure 1 Live mass changes in heifers grazing maize-crop residues.

Table 2 Initial live mass, final live mass and numbers of heifers and wethers grazing maize-crop residues for 91 days at different cattle:sheep ratios (Treatment 1 = cattle only, Treatment 2 = 79% cattle:21 % sheep, Treatment 3 = 56% cattle:44% sheep, Treatment 4 = sheep only *)

	Animal numbers		Initial live mass		Final live mass		Live mass gain/ animal		Average daily gain		Live mass
	Heifers	Wethers	Heifers (kg)	Wethers (kg)	Heifers (kg)	Wethers (kg)	Heifers (kg)	Wethers (kg).	Heifers (kg/day)	Wethers (kg/day)	gain/ha (kg)
Treatment 1	8	0	279.8 ± 5.8		310.9 ± 6.2		31.1[a]		0.342		108.3
Treatment 2	6	8	281.8 ± 6.7	32.9 ± 0.8	309.3 ± 7.2	41.1 ± 1.1	27.5[a]	8.1[a]	0.302	0.089	109.0
Treatment 3	4	17	283.8 ± 8.2	32.2 ± 0.6	331.8 ± 8.8	39.2 ± 0.8	48.0[b]	7.0[a]	0.527	0.077	138.7
Treatment 4	0	36		32.2 ± 0.4		38.0 ± 0.5		5.8[b]		0.064	96.2

* Ratios were calculated as % LSU, where 1 LSU was taken as = 1 FU, with FU equivalent = 0.01 × Live mass$^{0.75}$ (Jones *et al.*, 1985)

[a, b] = figures in the same column with different superscripts differ significantly ($p < 0.05$) l

Live mass changes

Average daily gain (ADG) was 0.342, 0.302 and 0.527 kg/day for the heifers subjected to T1, T2 and T3 respectively. The respective ADGs for the sheep were 0.089, 0.077 and 0.064 kg/day subjected to T2, T3 and T4 (Table 2).

The heifers in T3 kept on gaining live mass, whereas the heifers subjected to T1 and T2 lost mass initially, before increasing in live mass (Figure 1). The wethers, on the other hand, appeared to gain mass from the start of grazing in all treatments up to day 65, whereafter the sheep in T2 retained live mass, whereas the sheep in T3 and T4 lost weight towards the end of the grazing period (Figure 2).

It is noteworthy that the cattle of T3 gained mass at a significantly greater rate than those of T1 or T2 during the initial grazing period, whereafter mean heifer live mass remained relatively constant in all treatments after day 42 of grazing (Figure 1).

Live mass gain per animal was significantly different among treatments with respect to the wethers only after 91 grazing days, whereas with the heifers the difference among treatments was significant from day 14 of grazing.

Lick intake

The heifers in T1 ingested 202 g of the Dundee lick per day, whereas the wethers in T4 ingested 28 g lick daily.

Utilisation

For T1 and T3, the cob fraction appears to have increased between the beginning and end of grazing (Table 1). This could be a sampling error or could be the result of cobs which were buried during reaping, being exposed by trampling and weathering. In all treatments, the maize grain was fully utilised, whereas the utilisation of the other fractions of the crop residues appeared to be very similar. The difference in utilisation of stalks between the heifers and the sheep could not be explained.

Discussion

Overall, 45.2% of residues were utilised. The proportion utilised is comparable to the utilisation of residues in the trial by Esterhuyse *et al.*, (1988). In this trial, where only sheep grazed the residues

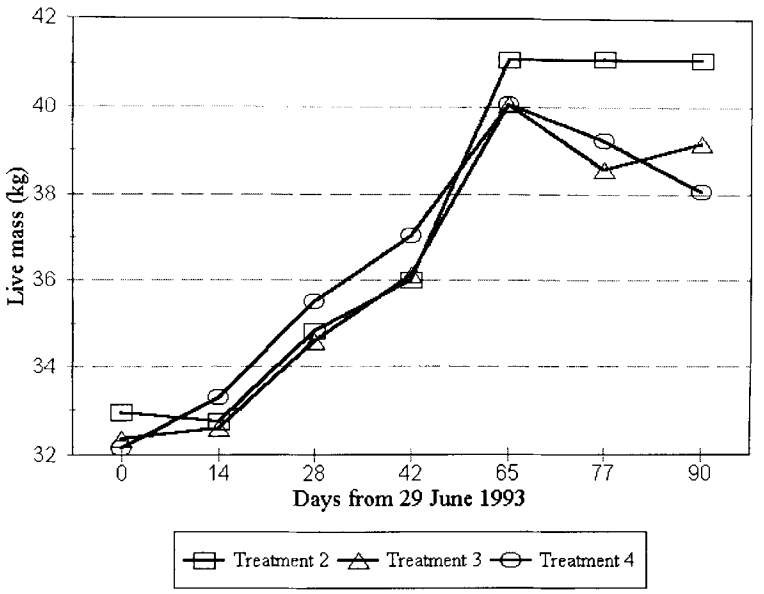

Figure 2 Live mass changes in wethers grazing maize-crop residues.

(T4), the highest proportion of residues (54.8%) was utilised, whereas the livestock subjected to T3 utilised the lowest proportion of residues (37.8%; Table 1). This finding could be the result of different weather conditions leading to differences in weathering of the residues, but this could not be demonstrated from the available data.

The enhanced growth of the heifers subjected to T3 (Table 2) could be the result of a number of factors. For example, there were only four heifers in this group, together with a large number of sheep, resulting in little or no competition between the heifers for food. Live mass gain/ha was much greater for T3 compared to other treatments. If this is the result of a lack of competition for food, the greater gain/ha could be reduced or even negated in the case where larger numbers of animals are grazed together on maize crop residues.

The average ADG of the sheep was 77 g/day, which is comparable to the ADG achieved by sheep in the trial by Swart *et al.* (1983), where sheep alone achieved 88 g/day, but was much lower than the ADGs of 114 g/day achieved in the trial by Esterhuyse *et al.* (1988).

Live mass gain/ha was greater where cattle alone (108.3 kg/ha) or cattle with sheep (109.0 and 138.7 kg/ha) grazed the residues, whereas sheep alone provided a lower gain/ha (96.2 kg/ha).

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