Performance of beef steers on Smuts finger grass and Nile grass pasture in northern Natal

2. Feedlot performance following summer grazing

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In a previous trial, weaner steers were wintered at one of three growth rates (0, 0.3 and 0.6 kg/day) after which they grazed either Smuts finger grass (*Digitaria eriantha* spp *eriantha*) or Nile grass (*Acroceras macrum*) pastures, each at one of three stocking rates (6, 8 and 10 steers/ha) over the summer grazing period. In the present trial, the eighteen-month-old steers originating from that trial were subjected to four different feedlotting systems. The feeding regimes comprised a farmers' mix (FM), feeding with beef pellets and whole maize (BPM), feeding finisher feed with milled hay (FFH), and a complete feed (TR). Steers were fed to a set target mass. Average daily gains of 1.859 ± 0.056, 1.799 ± 0.091, 2.119 ± 0.067 and 1.981 ± 0.042 were measured for the FM, BPM, FFH and TR treatments, respectively. No relationship between the preceding wintering levels, summer stocking rates or summer pasture on the one hand and feedlot growth rates or mass gain on the other hand were found.

In 'n vorige proef is speenosse oorwinter teen een van drie groeipeile (0, 0.3 en 0.6 kg/dag) waarna hulle óf Smutsvingergras (*Digitaria eriantha* spp *eriantha*) óf Nylgras (*Acroceras macrum*), elk teen een van drie veebeladings (6, 8 en 10 osse/ha) bewei het. In hierdie proef is die agtienmaandoue osse afkomstig van die vorige proef onderwerp aan vier verskillende voerkraalstelsels. Die voedingstelsels het behels die voer van 'n boeremengsel (FM), die voer van vleisbeeskorrels saam met heel mielies (BPM), die voer van afrondvoer saam met gemaalde hooi (FFH) en 'n volvoer (TR). Die osse is gevoer tot 'n teikenmassa. Gemiddelde daaglikse toenames was 1.859 ± 0.056, 1.799 ± 0.091, 2.119 ± 0.067 en 1.981 ± 0.042 vir die FM, BPM, FFH en TR behandelings onderskeidelik. Geen verband tussen die vorige wintergroeipeile, somerveebeladings of somerweiding aan die een kant en voerkraalgroeitempo of massatoename aan die ander kant, is gevind nie.

Keywords: On-farm feedlotting, pre-feedlot treatment, sub-tropical pastures.

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Introduction

Hancock *et al.* (1987) investigated the relationship between the performance of Hereford steers grazing three different pastures (tall fescue, orchardgrass and brome grass) and their subsequent performance in a feedlot. The live mass of these steers at the start of pasture grazing was 260 kg and they entered the feedlot at a mean live mass of 345 kg. The steers were fed for periods ranging from 130 to 139 days, at which stage they weighed 522 kg on average. Citing Hodgson (1977), the amount of grain fed to livestock to achieve carcass finish could be reduced by pasture grazing prior to feedlot finishing.

In previous research at the Dundee Agricultural Research Station, both Smuts finger grass (*Digitaria eriantha* spp *eriantha*) and Nile grass (*Acroceras macrum*) pastures were shown to have good potential as summer pasture for growing out yearling steers, but carcass finish was lacking (Part 1). Subsequent to the poor carcass grades achieved at slaughter in the first year of the trial, steers were fattened in a feedlot before being slaughtered. This article is a report on the results obtained from feedlotting the steers originating from the third year (1989/90) of the Smuts finger grass and Nile grass trial.

Experimental procedure

Previous treatment

In the final year of the preceding trial (Part 1), 108 weaner steers were bought during July 1989, divided into three groups and fed to achieve growth rates of 0, 0.3 and 0.6 kg/day during winter. During the subsequent summer, the steers from each wintering level were subdivided into six groups of six steers each, which grazed either Smuts finger grass or Nile grass pastures, each at one of three stocking rates (6, 8 and 10 steers/ha). Sixty of the steers were randomly selected from the original 108 steers and allocated to the feedlot trial which is the subject of this report. The steers were crossbreeds of mixed origin.

The selected steers' mean weight was 182.1 ± 4.5 kg at weaning, 218.5 ± 6.3 kg at the commencement of summer grazing the Smuts finger grass and Nile grass pastures, and 275.3 ± 5.7 kg at the termination of summer grazing on entry into the feedlot.

Treatments

Three feedlot feeding systems and a ration based on poultry litter were compared for on-farm feedlotting. The 60 steers were blocked by mass and randomly assigned, within blocks, to one of five groups. One group of steers was assigned to the initial slaughter group and railed to the abattoir immediately. Defining 'target mass' to be the average mass of the first group of steers judged visually to have achieved carcass finish, the remaining four groups were allocated to one of the following feedlot treatments:

Treatment 1: These steers were fed farmers' mix (FM) to the target mass.

Treatment 2: This group of steers were fed beef pellets (pelleted roughage and supplement) and whole maize (BPM) to a mass 1% less than the target mass (to compensate for the lower gut fill resulting from a reduced dry matter intake of this highly concentrated diet: Dr G.A. Jacobs — pers. comm.). The beef pellets (BPs) and whole maize were fed in separate troughs.

Treatment 3: This group of steers were fed finisher feed and milled Eragrostis hay (FFH) to the target mass. The finisher feed (FF) and hay were fed in separate troughs.

Treatment 4: These steers were fed complete feed (TR) to the target mass.

Carcass finish was assumed to be a fat thickness which would allow the slaughtered animal to be graded Super A (A2 and A3 in the carcass classification system of 1992) or Prime B (B2 and B3 in the 1992 carcass classification system).

The FM comprised maize meal (62.5%), feed grade urea (0.5%), salt (0.5%), feedlime (0.5%), poultry litter (22%) and milled Eragrostis hay (14%).

The BPs, FF and TR were commercially produced products from a local feed milling company. The ingredients of these feeds were not known, but all contained an ionophore. A chemical analysis was made of feed samples taken each week (Table 1) from the commercial feeds, the FM, whole maize and milled hay.

Table 1 Chemical analysis of feeds used in feeding steers a home mix, beef pellets plus whole maize, finisher feed plus hay and a complete feed

Feed	Dry matter (%)	Protein (% DM)	Estimated energy content* (MJME/ kg DM)
Home mix	88.4	13.5	10.35
Beef pellets	91.5	30.7	9.58
Whole maize	92.7	8.7	12.06
Finisher feed	89.4	13.5	11.47
Milled hay	92.2	7.6	8.16
Complete feed	89.8	12.2	10.42

* Calculated using the formula (MAFF, 1984):
ME (MJ/kg DM) = 0.0226(Crude protein) + 0.0192(Crude fibre) + 0.0177(Nitrogen free extract) + 0.0407(Ether Extract)

Feedlot management

On entry into the feedlot, the steers were de-wormed, dipped and vaccinated against anthrax, quarter evil and botulism. A growth implant was administered (trenbolone acetate + oestradiol-17-ß). Feedlotting commenced in the second week of May 1990. The steers were fed once a day between 07:00 and 08:00. Rations were supplied *ad libitum* and weekly intake by the different groups was monitored. Water troughs were cleaned and refilled once a day.

Initial live mass and final live mass were determined after fasting for 18 h. Average daily gain (ADG) was calculated as the difference between initial and final live mass divided by the number of days in the feedlot.

Statistical analysis

ADG and average daily carcass gain (CADG) were compared by analysis of variance and covariance, with initial carcass mass as covariate. The initial carcass mass (Table 4) of the steers subjected to the four feeding regimes was calculated using the regression of carcass mass on initial live mass of the initial slaughter group.

Results

Adaptation to the feeds

A 'bent stick' regression analysis of live mass (the steers were weighed weekly without prior fasting) on days in the feedlot (Draper & Smith, 1966) indicated that the steers of the FFH treatment were adapted to the feed and were gaining mass after one week, whereas the steers fed FM and TRs were only adapted to their feeds after three weeks in the feedlot. The steers of the BPM treatment took five weeks to adapt to their feeding regime.

One of the steers in the BPM treatment did not adapt to eating whole maize and continued to lose mass, resulting in its withdrawal from the trial. A second steer in this treatment died of bloat on day 70. Thus, in the BPM treatment there were only 10 steers from which data were collected.

Feeding period and feed intake

The steers of the FFH treatment were in the feedlot for 70 days, the TR treatment for 78 days and the steers in both the FM and BPM treatments were fed for 91 days. During this time the daily dry matter intake (DMI) of the steers in the BPM treatment was lower than in any of the other treatments (Table 2).

Live mass changes

Mean live mass gain was 168.9 ± 5.1, 163.7 ± 8.3, 148.2 ± 4.7 and 154.5 ± 3.3 kg at ADGs of 1.859 ±0.056, 1.799 ± 0.091, 2.119 ± 0.067 and 1.981 ± 0.042 kg/day for the steers in the FM, BPM, FFH and TR treatments respectively (Table 3).

Carcass mass changes

The initial slaughter group had an average live mass of 280.9 ± 32.1 kg. The cold carcass mass was 129.6 ± 17.1 kg. These steers graded A3 (A0 in the 1992 carcass classification system), with a conformation score of three and fat thickness score of one.

Initial carcass mass, cold carcass mass (i.e. end mass) and carcass gain did not differ significantly (P = 0.40, 0.35 and 0.35, respectively) between treatments.

Table 2 Feed intake/steer of steers fed a farmers' mix (FM), beef pellets and whole maize (BPM), finisher feed and milled hay (FFH) and a complete feed (TR) over feeding periods of 91, 91, 70 and 78 days, respectively

Treatment	1 (FM)	2 (BPM)	3 (FFH)	4 (TR)
Whole maize (kg)		677.4		
Milled hay (kg)			100.3	
Beef pellets (kg)		206.5		
Finisher feed (kg)			847.3	
Total feed intake (kg)	1146.5	883.9	947.6	1028.8
DMI (kg/day)	11.14	8.98	12.14	12.00

Table 3 Initial live mass, final live mass, live mass gain and average daily gain (ADG) in steers subjected to fattening in a feedlot on a farmers' mix (FM), beef pellets plus maize (BPM), finisher feed plus hay (FFH) and complete feed (TR)

Treatment	1 (FM)	2 (BPM)	3 (FFH)	4 (TR)
Initial live mass (kg)	251.1 ± 12.2	260.5 ± 12.0	276.4 ± 10.5	273.4 ± 7.8
Feeding period (days)	91	91	70	78
Final live mass * (kg)	$434.5^{a} \pm 13.7$	$429.2^{ab} \pm 15.6$	$413.8^{b} \pm 13.0$	$420.0^{ab} \pm 9.4$
Live mass gain * (kg)	$168.9^{a} \pm 5.1$	$163.7^{ab} \pm 8.3$	$148.2^{b} \pm 4.7$	$154.5^{ab} \pm 3.3$
ADG * (kg/day)	$1.859^{b} \pm 0.056$	$1.799^{b} \pm 0.091$	$2.119^{a} \pm 0.067$	$1.981^{ab} \pm 0.042$

* Adjusted for covariate initial live mass
a,b = Treatment means with different superscripts differ significantly ($P \leq 0.05$)

CADG was significantly greater ($P \leq 0.05$) for the FFH treatment compared to the other treatments. The CADG of the steers in the BPM treatment was significantly less than the CADG of the TR steers ($P \leq 0.05$), but did not differ significantly from the FM treatment (Table 4).

It is noteworthy that six of the 46 animals slaughtered cut teeth and were therefore graded in the B group for age. For all comparisons, the B grade carcasses were grouped with the A grade carcasses of comparable fat thickness and conformation score.

Mean fat thickness over the eye muscle was 6.96 ± 0.34, 6.75 ± 0.82, 6.57 ± 0.66 and 7.12 ± 0.62 mm for the FM, BPM, FFH and TR treatments respectively. Even though fat thickness did not differ significantly between treatments (P = 0.92), there were more carcasses that were graded A2 (class > A3 in the 1992 carcass classification system; Table 4) in the TR treatment compared to the other treatments.

Pre-feedlot treatment

No relationship between post-weaning winter growth rate, summer growth rate, stocking rate on summer pasture or summer pasture on the one hand and feedlot growth rates or feedlot gain on the other hand was found. Although Hancock *et al.* (1987) worked with different pastures and animals fed to a much higher final mass than was the case in the present investigation, their findings also showed that there are no differences in ADG, DMI or feed conversion at feedlotting between steers grazing different pastures prior to entry into the feedlot.

Economic analysis

The gross margins for the FM, BPM and FFH, although small, were positive, whereas the gross margin for the TR treatment was negative (Table 5). To compare treatments directly, the gross margins were calculated using the same hypothetical steer in all treatments, bought at the same price and achieving the same carcass grade. The differences in gross margin are therefore the result of differences in feed costs and feeding periods (which were the result of differences in ADG) related to the relevant treatments. Prices prevalent during May 1993 were used for the financial calculations.

Discussion and conclusions

Although significant differences were observed for final live mass and live mass gain, no significant differences were observed in cold carcass mass or carcass gain between treatments, which is not surprising in view of the fact that the animals were fed to the same final mass. However, ADG and

Table 4 Initial carcass mass, cold carcass mass, carcass gain, carcass average daily gain (CADG) and number of carcasses in each grade in steers subjected to fattening in a feedlot on a farmers' mix (FM), beef pellets plus maize (BPM), finisher feed plus hay (FFH) and a complete feed (TR)

Treatment	1 (FM)	2 (BPM)	3 (FFH)	4 (TR)
Initial carcass mass (kg)	118.9 ± 7.1	124.4 ± 6.7	131.8 ± 5.9	131.0 ± 4.8
Cold carcass mass* (kg)	245.2 ± 8.7	241.0 ± 10.0	235.4 ± 8.5	236.4 ± 5.8
Carcass gain* (kg)	118.6 ± 4.4	114.4 ± 5.9	108.8 ± 4.0	109.7 ± 2.7
CADG* (kg/day)	$1.305^{bc} \pm 0.048$	$1.258^{c} \pm 0.064$	$1.555^{a} \pm 0.058$	$1.407^{b} \pm 0.035$
Carcasses/grade (SA, A1, A2)	11,1,0	9,1,0	9,3,0	9,0,3

* Adjusted for covariate initial carcass mass
a,b = Treatment means with different superscripts differ significantly ($P \leq 0.05$)

Table 5 Income, costs and gross margin/steer for steers subjected to fattening in a feedlot on a farmers' mix (FM), beef pellets plus maize (BPM), finisher feed plus hay (FFH) and a complete feed (TR)

Item	Treatment 1 (FM)	Treatment 2 (BPM)	Treatment 3 (FFH)	Treatment 4 (TR)
Income:				
Carcass	1364.50	1364.50	1364.50	1364.50
Offal	55.69	55.69	55.69	55.69
Hide	67.00	67.00	67.00	67.00
Costs:				
Steer				
Purchase value	743.53	743.53	743.53	743.53
Interest	35.22	35.22	27.09	30.19
Transport	17.00	17.00	17.00	17.00
Feed				
Price	479.25	478.83	516.69	581.27
Interest	22.70	22.68	18.83	23.60
Transport	24.08	18.56	19.90	21.60
Marketing				
Slaughtering	123.04	123.04	123.04	123.04
Transport	17.00	17.00	17.00	17.00
Total income	1487.19	1487.19	1487.19	1487.19
Total costs	1461.82	1455.86	1483.07	1557.23
Gross margin	25.37	31.33	4.12	−70.04

CADG differed significantly between treatments (Table 3 and Table 4) and it was concluded that differences in growth rate was the major reason for differences between treatments. The resulting different time periods spent in the feedlot, requiring more feed, as well as differences in the cost of the different feeds per unit weight, were the major causes of differences in gross margin between treatments. In practice, the time lapse (21 days) from the time steers fed a 'fast' ration are market ready to the time steers on a 'slow' ration achieve the same carcass finish could play a role in deciding profitability. However, because beef prices could differ as much from day to day as they do from month to month, the choice of a 'fast' ration is only warranted if there is a certainty of price reductions (like those seen from time to time after the Easter and Christmas periods) or increases. In the case where feedlot space is limited and steers are fed in sequence, a shorter time in the feedlot could be advantageous.

Where a farmer has his own maize, the system of feeding the beef pellets with the whole maize has a number of advantages, including that milling of the maize is not necessary and the amount of feed that has to be transported is drastically reduced. However, this feeding system has the problem that some animals, especially older animals, often do not take to eating whole maize. An example is cited in this article.

It is noteworthy that when costing expenses, the consumer price of maize was used. The use of home-grown maize could lead to improved price margins in the FM and BPM treatments.

The fact that no relationship with previous treatment and feedlotting was found indicates that feedlotting of eighteen-month-old steers can be undertaken without knowledge of the animals' previous treatment. Extremes of overfeeding or underfeeding could negate this statement.

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