Increasing land productivity through optimum cattle stocking rates

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Abstract

Elmba Rhodes (*Chloris gayana*, Kunth) grass is known to have wide climatic and soil adaptation; being persistent in growth under frequent grazing, producing high dry matter yield per hectare that is evenly distributed throughout the year. These characteristics make it a popular grass for improving grazing land in Kenya. General increase in beef output per hectare with increased stocking rate has been reported elsewhere. Hence the objective of the current study was to increase determine optimum cattle stocking rates when cattle were grazed on Elmba Rhodes grass paddocks by evaluating available dry matter, yearling Boran cattle daily weight gain and beef yield per hectare. Three paddocks were fenced in an established Elmba Rhodes grass field to match the experimental requirements. Eighteen yearling Boran cattle were distributed in a randomized complete block design to three treatments: stocking rates of two, four and six yearling Boran cattle per hectare. The yearlings were continuously grazed on their respective paddocks for 240 days. Their initial mean weights were 191.0, 191.9 and 189.3 , respectively. The data was subjected to analysis of variance and the means separated using Duncan's multiple range tests. The stocking rate significantly affected available dry matter, yearling Boran cattle daily weight gain and beef yield per hectare. The available dry matter recorded a decreasing trend of 3.9, 2.8 and 1.3 tonnes per hectare and yearling Boran daily weight gain and beef yield increased to an optimum and thereafter decreased with trends of 453.9, 480.5 and 200.2g; 108.9, 230.6 and 144.2 kg per hectare, respectively. Improved grazing land planted with Elmba Rhodes grass provided to grazing cattle up to 3.9 tonnes dry matter per hectare monthly, increased cattle growth rate to 480.5 g daily under continuous grazing and increased land productivity to the optimum beef yield of 230.6 kg per hectare. The optimum cattle stocking rate was 4 yearlings Boran was under continuous grazing on Elmba Rhodes grass. Further research should be done to determine the optimum cattle stocking rates for cattle grazing Elmba Rhodes grass in the various ecological zones in Kenya.

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Introduction

Rhodes grass (*Chloris gayana*, Kunth) has a wide climatic and soil adaptation (Bogdan, 1969) and is easy and economical to establish as it produces large quantity of viable seeds. It is therefore widely cultivated to improve grazing pasture land. A popular variety of Rhodes grass called Elmba heads early, has high dry matter yield and is persistent to frequent grazing (Boonman, 1978).

Much pasture agronomic work has been carried out in Kenya (Thairu, 1970 a, b) but these, lack measures of pasture grazing land productivity in terms of beef, milk and mutton output per hectare. Most reports refer to relatively short periods of grazing utilization and to mixed improved grassland of Rhodes grass with other types of grasses (Bogdan, 1969, Otim and Mugerwa, 1976).

Boran cattle have been bred in Kenya and are popular for beef production as they are adapted to a wide range of climatic conditions (Boran Cattle Breeders Society, 1990). Boran cattle are common among pastoralists and commercial beef ranchers. Low post-weaning Boran growth in pastoralist cattle leads to low mature body weight and late maturity (Cossins, 1985). These reduce land productivity through delayed first calving in heifers, while in steers; the time taken to reach slaughter weight is longer. Improved post weaning gain, therefore, will result in higher land productivity through increased mature weight which would be sold earlier, fetching higher incomes. Improved grassland through planting productive pasture

provides adequate feed which has been shown to play a vital role in enhancing post-weaning growth (Kayongo-Male, *et al*, 1977 and Abate, 1988).

The objective of the current study was to increase land productivity through the determination of optimum cattle stocking rates when cattle were grazed on Elmba Rhodes grass paddocks by evaluating available dry matter, yearling Boran cattle daily weight gain and beef yield per hectare.

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Materials and methods

Improved grazing land and beef cattle

Elmba Rhodes grass establishment involved breaking new land by ploughing and harrowing until a fine seedbed was achieved. Rhodes grass seeds were planted on the soil surface using a seed drill at 5kg per hectare. Single super phosphate was applied at 100kg per hectare during planting. Weeds were controlled using 2,4-D (2,4-dichlorophenoxy acid amine) post emergence. No nitrogen top-dressing was done and grazing was deferred during the first year to allow complete Rhodes grass establishment. The area was subsequently fenced into three paddocks according to experimental treatments. Water was reticulated into the paddocks and salt troughs were provided.

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Eighteen Boran weaned cattle were selected from a herd of 250 within KARI, Lanet. They were initially herded together for 180 days before the beginning of the experiment and were drenched against internal worms regularly and plunged into a dip weekly to kill ticks.

Experimental design and data collected

The 18 weaned cattle were randomly distributed into three equal and uniform groups according to weight in a randomised complete block design. The effects of stocking rate at three levels on available dry matter, average daily weight gain and beef output per hectare were studied. The stocking rates were 2, 4 and 6 weaned cattle per hectare denoted A, B and C respectively. The initial mean cattle weights were 191.0, 191.9 and 189.3kg in treatments A, B and C.

Grass samples were taken monthly in the continuously grazed paddocks. A quadrant was randomly thrown and all the grass within the quadrant was clipped and weighed. Five samples were taken along the paddock diagonal and were used to calculate available pasture.

The five samples per paddock were bulked and a sub-sample taken for laboratory analyses (Table 1). Cattle were weighed fortnightly to establish patterns of growth and determine beef output per hectare during the experiment lasting 240 days.

Table 1: Composition of Elmba Rhodes grass grazed by Boran cattle at different stocking rates

Components, per cent	Treatments		
	[1]A	B	C
Dry matter	46.7	49.3	44.7
Organic matter	91.1	90.9	89.2
Crude protein	4.9	5.5	6.2
Neutral detergent fibre	79.2	74.9	73.5

[1] A, B, C are cattle stocked at 2, 4 and 6 per hectare continuously grazed

Analyses

Pasture dry matter, organic matter and crude protein were determined according to the procedures of Association of Official Analytical Chemists (1990). Neutral and acid detergent fibre were determined according to procedures of Van Soest *et al.,* (1991). Analysis of variance was done on available pasture, cattle daily weight gain and beef output per hectare for a randomised complete block design. Separation of means was performed using Duncan's multiple range tests (1955).

Results

Available pasture and cattle growth performance

Stocking rate greatly affected (P<0.05) pasture availability (Table: 2). Cattle on A had the most pasture while those on C had the least pasture available. The pasture available to cattle stocked in treatments A, B and C was 3.9, 2.8 and 1.3 tonnes dry matter per hectare respectively.

Average daily gain was affected by stocking rate (P<0.05) (Tale: 2). Cattle stocked at A and B gained at a similar rate (P>0.05) but those on C had a significantly (P<0.05) lower gain. The average daily weight gains (ADG) were 453.9, 480.5 and 200.2g for cattle stocked at A, B and C respectively.

Beef output per hectare

The beef output was affected by the stocking rate (P<0.05) and a general increase in beef output per hectare occurred with increase in stocking rate (Table 2). The cattle stocked at B produced the most beef per hectare and those at A the least (P<0.05). The beef output was 108.9, 230.6 and 144.2 kg per hectare on treatments A, B and C respectively.

Table 2: Available pasture, average daily gain and beef output of cattle stocked at different rates while grazing on Elmba Rhodes grass

Treatments	Available pasture (tonnes, DM)	ADG (g)	Beef out put (kg)
[1]A	3.9[c]	453.9[b]	108.9[a]
B	2.8[b]	480.5[b]	230.6[c]
C	1.3[a]	200.2[a]	144.2[b]
SEM	0.42	106.3	27.9

[1] A, B, C are cattle stocked at 2, 4 and 6 per hectare continuously grazed

[abc] Means on the same column bearing different superscripts are different (P<0.05)

Discussion

Elmba Rhodes grass is known to be very persistent in growth (Boonman, 1977) and furthermore, tropical grasses have a rapid growth and fast maturation (Mwakatundu, 1977) so that the maturation may cause constant dry matter yield per hectare. However, cattle stocked at B and C exerted such a high grazing pressure that a reduction in available dry matter per hectare occurred. Overall, the Rhodes grass dry matter yields in this study were lower than those recorded by Thairu (1970a), Gastel, (1977) and Arkel, (1978). This may be due to nitrogen deficiency as the planted pasture was not top dressed with nitrogenous fertilizer.

The ADG recorded in the study is within the range of 290 to 490 g obtained by Otim (1975) and Otim and Laboke (1975) using beef steers grazed on improved pasture. The gains recorded by Kayongo-Male *et al* (1977) of 300 to 460g daily using heifers grazed on improved grassland without and with concentrate supplementation are not different from those in the current study. However, the ADG were higher than those recorded by Abate *et al.,* (1981) for dairy heifers. This may be due to site effect, Rhodes grass variety used and the breed of cattle. Boran cattle are known to efficiently use high fibre diets better than exotic cattle (Creek, *et al*. 1975). The cattle stocked at C had the lowest average daily weight gain due to the relatively low available dry matter. The low available dry matter is attributable to low recovery by Elmba Rhodes grass due to too frequent and heavy grazing.

There was a general increase in beef output per hectare with increase in stocking rate. The increased trend was, however, diminished beyond B. This can be explained by the low quantity and quality of available grazing with resultant lower ADG. The quality of the diet was lower below the stocking rate at B and beyond B shortage of pasture reduced beef output.

Conclusions and recommendations

Increased stocking rate reduced available pasture and ADG but increased beef output per hectare. Based on available pasture, cattle ADG and beef output, the optimum stocking rate was at four weaned Boran cattle per hectare. Elmba Rhodes grass withstood continuous grazing and to obtain adequate pasture, high ADG and beef output per hectare, Boran weaned cattle should be stocked at four cattle per hectare to increase land productivity under continuous grazing on Elmba Rhodes grass. Further research should be done to determine the optimum cattle stocking rates for cattle grazing Elmba Rhodes grass in the various ecological zones in Kenya. The effect of fertilizer application on the grassland herbage yield and land productivity should be determined.

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