EFFECTS OF GRAZING SYSTEMS ON PASTURE PRODUCTION AND QUALITY OF *BRACHIARIA BRIZANTHA* AND LIVEWEIGHT GAIN OF LAMBS

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(Received by the editor 29 July 1996)

ABSTRAK

GINTING, SIMON P. dan K.R. POND. 1996. Pengaruh sistem penggembalaan terhadap produksi dan kualitas pastura *Brachiaria brizantha* serta pertambahan bobot badan domba. *Jurnal Ilmu Ternak dan Veteriner* 2 (2): 110-113.

Siklus penggembalaan panjang yang melebihi màsa hidup parasit cacing di pastura dapat mengurangi tingkat kontaminasi parasit, namun pada saat yang sama mungkin pula menekan kualitas pastura yang tersedia bagi produksi ternak. Penelitian bertujuan untuk mempelajari pengaruh sistem penggembalaan terhadap produksi dan kualitas *Brachiaria brizantha* serta pengaruhnya terhadap pertumbuhan domba. Dalam penelitian ini digunakan 72 ekor domba ekor tipis Sumatera berumur dari 3 sampai 4 bulan. Ternak dibagi menjadi tiga kelompok dan secara acak digembalakan di pastura dengan sistem penggembalaan sebagai berikut: GM1 periode penggembalaan 6 minggu diikuti periode istirahat 6 minggu, GM2 periode penggembalaan 1 minggu diikuti periode istirahat 6 minggu dan GM3 periode penggembalaan 12 minggu diikuti periode istirahat 12 minggu. Produksi pastura tertinggi (P<0,01) pada GM3. Komposisi tajuk sebelum digembalakan tidak berbeda (P>0,10) antar perlakuan, namun setelah penggembalaan proporsi batang tertinggi dan proporsi daun terendah (P<0,01) pada GM3. Kecernaan hijauan dikonsumsi tidak berbeda (P>0.10) antar perlakuan. Kandungan protein kasar lebih rendah (P<0,05) pada GM3 dan tidak berbeda antara GM1 dan GM2. Pertambahan bobot badan harian domba berkisar dari 29 g sampai 35 g dan tidak berbeda antar perlakuan (P>0,10). Disimpulkan bahwa siklus penggembalaan selama 12 minggu dapat meningkatkan produksi hijauan tanpa mengakibatkan penurunan konsumsi pakan, kecernaan dan konsentrasi protein hijauan yang dikonsumsi. Dari sebab itu, sistem penggembalaan ini dapat dipertimbangkan dalam upaya mengendalikan perkembangan parasit pada pastura.

Kata kunci: Sistem penggembalaan, ketersediaan hijauan, kualitas hijauan, domba

ABSTRACT

GINTING, SIMON P. and K.R. POND. 1996. Effects of grazing systems on pasture production and quality of *Brachiaria brizantha* and liveweight gain of lambs. *Jurnal Ilmu Ternak dan Veteriner* 2 (2): 110-113.

Grazing cycle beyond parasite survival time can reduce the level of parasite contamination, but at the same time it may depress the quality of available forage for animal production. A study was conducted to evaluate the effects of grazing management systems on the production and quality of *Brachiaria brizantha* and the performance of lamb grazing this pasture. A total of 72 male lambs aged from 3 to 4 months were used. The lambs were divided into 3 groups and randomly allocated to receive one of the following grazing treatments: GM1-pastures were grazed for 6 weeks and then rested for 6 weeks, GM2-pastures were grazed for 1 week and then rested for 6 weeks, and GM3-pastures were grazed for 12 weeks and then rested for 12 weeks. The herbage mass measured before and after grazing was greatest (P<0.01) for GM3. Canopy compositions before grazing was not different (P>0.10) among the three grazing methods, while after grazing, the proportion of stem fraction was highest and leaf fraction was lowest for GM3 (P<0.01). The *in vitro* dry matter digestibility (IVDMD) of plucked samples were not different (P>0.10) among the grazing methods. The crude protein (CP) concentration was lower (P<0.05) for GM3 as compared for GM1 and GM2, and a difference of two percentage unit may be of biological important. The changes in IVDMD and CP concentration of the plucked samples collected throughout grazing cycle remained reasonably steadily. Average daily gains (ADG) were low and not different (P>0.10) across grazing treatment and ranged from 29 to 35 g. It was concluded that a 12-week grazing cycle while could increase the herbage mass of *Brachiaria brizantha* did not decrease feed intake, the digestibility and the crude protein concentration of the consumed forage. Therefore, this grazing system could be considered as a means to control parasite establishment on pastures.

Key words: Grazing systems, herbage mass, forage quality, sheep

INTRODUCTION

Grazing systems in which animals, particularly small ruminants, are associated with tree crops are becoming more important in regions where tree crop plantations are the major commercial crops. Animal production in these systems is constrained by gastro-intestinal parasites which can cause substantial animal production losses (CHARMICHAEL, 1990). Resting pastures beyond the parasite survival time can break the life cycle of the parasite, and thus reduce the level of parasite contamination. However, resting pastures up to 10 weeks can substantially decrease the quality of the available forage.

The objectives of this study were to examine the production and quality of pasture and the liveweight gain of lambs grazing *Brachiaria brizantha* at three management systems differing in the grazing and resting periods.

MATERIALS AND METHODS

Animals, pastures and grazing

A total of 72 male lambs between 3 and 4 months of age were selected from a flock at the Sungei Putih Research and Assessment Installation for Agricultural Technology. Average initial body weights were 10.9 kg (±2.3 kg).

Land area that had not been used for grazing livestock for at least the previous three months were planted to *Brachiaria brizantha* grass. The soil was typically red yellow podzolic. Vegetative materials were planted at intervals of 1.0 m within rows and 0.5 m between rows. The pasture was divided into two plots of equal size (replicate one and replicate two). Each land replicate was then subdivided into three plots of 0.25 ha for three grazing managements. Thus, stocking rate was set at 48 lambs/ha for each grazing system. The grazing management treatments were: GM1-Pastures were grazed for 6 weeks and then rested for 6 weeks, GM2-Pastures were grazed for 1 week and then rested for 6 weeks, and GM3-Pastures were grazed for 12 weeks and then rested for 12 weeks.

To provide for rotational grazing management, each plot of GM1 and GM3 were subdivided into two subplots (0.125 ha each). Each plot of GM2 was divided into seven subplots (0.0357 ha each). A pre-experiment cutting management was conducted to provide 6, 6 and 12 weeks regrowth on the first grazing rotation of GM1, GM2 and GM3. After each plot was cut, nitrogen was applied in the form of urea at the rate of 100 kg N/ha/year in a one-time application.

During the 9-month experiment period, continuous weeding was performed to keep the pasture being dominated by *Brachiaria brizantha.* The animals were put in the assigned plots at approximately 08:30 hours where they were allowed to graze until 16:30 hours each day. No water or artificial shade were provided in the paddocks. Body weights were recorded biweekly.

Forage yield

Forage yield was estimated using the visual technique of HAYDOCK and SHAW (1975). Immediately prior to the animals being rotated onto each subplot, forage yields were estimated by determining the scores of 40 quadrats, which were positioned in the subplots using stratified random sampling. Calibration scales were constructed by scoring and then harvesting eight quadrats per subplot (16 quadrats per grazing treatment). Regression equations of dry matter yield on scale rating from the 16 calibration quadrats were calculated, and used to estimate the dry matter yield of each of the 40 quadrats.

Residual forage dry matter yield was measured each time the animals were moved off a pasture by harvesting 40 quadrats positioned using stratified random sampling in each subplot. Residual forage in each quadrat was manually cut to about 10 cm above ground level, weighed and oven dried to determine the dry matter concentration.

Feed intake

Six animals randomly selected from each grazing treatment were used to estimate fecal output. Each animal was dosed with chromic oxide as described by POND *et al.* (1987). Daily dry matter intake was estimated using the relationship DMI = FO/(1 - IVDMD/100), where DMI is dry matter intake, FO is fecal output and IVDMD is *in vitro* dry matter digestibility expressed as a percent. To estimate the apparent digestibility of the forage, the IVDMD of pluck samples were used. Pluck samples were taken each week from each grazing treatment throughout one full rotation with one sample from each of the two replicates per sampling time. In addition, pluck samples were taken each of 6 weeks for the weekly rotation treatment. The pluck samples were immediately put into a freezer and later freeze dried and analysed for IVDMD.

Characterization of pasture canopy

Pasture canopy in GM1, GM2 and GM3 were characterized as described by BURNS *et al.* (1992). Characterization in each grazing system was conducted before and after grazing. Eight quadrats in each subplot were cut at 10 to 15 cm stubble, placed in paper bags and immediately stratified in the field. Each class (leaf, stem and dead materials) was immediately weighed in the laboratory then oven dried to determine the dry matter concentration.

Statistical analyses

Data (herbage mass, canopy characteristic, fecal output, feed intake and average daily gains) were analysed as a randomized complete block design with two replicates. Analysis of variance was conducted using the general linear procedures of SAS (1985). Differences among grazing managements were examined with the Waller-Duncan k-ratio t-test with K=100 (STEEL and TORRIE, 1980).

RESULTS AND DISCUSSION

Forage quality

No significant differences ($P>0.10$) were noted among the three grazing systems in IVDMD of the plucked samples (Table 1). The mean IVDMD values ranged from 67.1 to 69.9%. The pluck samples consisted mainly of leaves which probably accounts for higher values than the 61.5% reported by MERKEL (1994). Crude protein (CP) was least ($P<0.05$) in GM3 (11.5%), while it was not different between GM1 and GM2 (13.9 vs 14.6%). These CP concentrations were all above the minimum level (6.0 %) required to meet the requirement of rumen bacteria (MINSON, 1990). Digestibility and crude protein concentration of most tropical grasses are depressed as the forage matures (MINSON, 1990). A large decline in concentration occurs generally after about 8 weeks of regrowth (KRETSCHMER and PITMAN, 1994). In the present study, the changes in IVDMD and CP concentrations of plucked samples collected throughout the grazing cycles, particularly from GM1 and GM3 remained reasonably steadily with time. The selection by the animals of the leaf fraction and in particular, of the new growing leaves, may have moderated their fluctuation. This suggested that the forage prehended and consumed from GM1, GM2 or GM3 pastures were not substantially different in quality as judged by the IVDMD and the CP concentration of the plucked samples.

Table 1. Mean (± SE) *in vitro* dry matter digestibility (IVDMD) and crude protein (CP) concentrations of plucked samples from pastures under three different grazing management systems

Treatment	IVDMD (%)	CP (%)
GM1	69.9 ± 1.8	13.9 ± 0.7
GM2	68.8 ± 2.1	14.6 ± 0.7
GM3	67.1 ± 1.2	11.5 ± 0.2
MSD	NS	NS

GM1=Two pastures in which one was grazed by animals for six weeks and then rested for six weeks
GM2=Seven pastures in which one was grazed by animals for one week and then rested for six weeks
GM3=Two pastures in which one was grazed by animals for twelve weeks and then rested for twelve weeks
MSD=Waller-Duncan minimum significant difference

Herbage mass

The mean herbage mass (HM) was measured just before grazing and immediately after grazing (Table 2) representing the initial and residual HM. Pastures in the GM3 had the highest (P<0.01) mean initial HM. The mean HM for GM1 did not differ (P>0.10) from that for GM2. The residual HM for GM3 remained the highest (P<0.01). The greater initial HM from GM3 probably associated with the longer rotational cycle (12 week) which caused a higher and denser pasture after the resting period.

Table 2. Herbage mass (mean ± SE) before and after grazing under three grazing management systems

Grazing management	Herbage mass (kg DM/ha)	
	Before grazing	After grazing
GM1	1,224 ± 112	508 ± 49
GM2	1,083 ± 46	488 ± 18
GM3	2,788 ± 158	707 ± 63
MSD	293	182

GM1=Two pastures in which one was grazed by animals for six weeks and then rested for six weeks
GM2=Seven pastures in which one was grazed by animals for one week and then rested for six weeks
GM3=Two pastures in which one was grazed by animals for twelve weeks and then rested for twelve weeks
MSD=Waller-Duncan minimum significant difference

Pasture canopy

The canopy separation before grazing (Table 3) showed that the percentage of leaf fraction did not differ (P>0.10) among the three grazing systems. However, the stem fraction from GM3 (43%) was higher (P<0.01) than from GM1 (31%), although did not differ from GM2 (37%). The percentage of dead tissue from GM1 and GM2 were similar (19%), and it was greater (P<0.01) than from GM3 (10%). The canopy separation after grazing showed that the percentage of leaf was greater (P<0.01) in GM2 compared to GM3, but it was not different between GM1 and GM2 or between GM1 and GM3. The stem and dead tissue did not differ (P>0.10) among the three grazing systems. Canopy composition of either GM1, GM2 or GM3 pastures showed a shift in the rank between the leaf and stem tissues as grazing progressed indicating the preference of sheep for leaf tissues.

Table 3. Canopy composition of pastures (mean ± SE) at three grazing management systems

Plant fraction	Grazing management	Before grazing	After grazing
Leaf, %	GM1	49.2 ± 2.9	29.8 ± 2.5
	GM2	43.6 ± 2.3	34.7 ± 2.4
	GM3	46.9 ± 3.4	22.3 ± 3.2
	MSD	NS	8.3
Stem, %	GM1	31.3 ± 2.5	42.0 ± 2.4
	GM2	37.1 ± 2.3	40.2 ± 2.0
	GM3	43.0 ± 2.8	48.3 ± 3.1
	MSD	8.8	NS
Dead, %	GM1	19.3 ± 3.6	28.7 ± 2.4
	GM2	18.6 ± 3.4	25.4 ± 2.6
	GM3	10.0 ± 3.9	23.0 ± 3.1
	MSD	8.9	NS

GM1=Two pastures in which one was grazed by animals for six weeks and then rested for six weeks
GM2=Seven pastures in which one was grazed by animals for one week and then rested for six weeks
GM3=Two pastures in which one was grazed by animals for twelve weeks and then rested for twelve weeks
MSD=Waller-Duncan minimum significant difference

Feed intake and daily gains

Total dry matter intake (g/kg BW/d) were not different (P>0.10) among grazing treatments (Table 4). The rate of intake across grazing treatments ranged from 4.1 to 4.3% BW, which suggests that HM was sufficient on all three grazing systems. In addition, the IVDMD of available forages was reported previously not to differ among grazing systems. These might have moderated the variation in feed intake among the grazing treatments.

Across grazing managements, average daily gains (ADG) were not different (P>0.10). The ADG were relatively low which were comparable to gains expected from lambs under limited nutrition (REESE *et al.*,1990; SIMANIHURUK *et al.*,1994.).

Table 4. Dry matter (DM) intake and Average Daily Gain (ADG) of lambs grazing *Brachiaria brizantha* under three management systems

Grazing systems	Fecal output (g/kgBW/d)	DM intake (g/kgBW/d)	ADG (g)
GM1	13 ± 0.29	42 ± 0.90	35 ± 4.5
GM2	13 ± 0.48	41 ± 0.77	39 ± 4.4
GM3	14 ± 0.51	43 ± 0.93	29 ± 4.3
MSD	NS	NS	NS

GM1=Two pastures in which one was grazed by animals for six weeks and then rested for six weeks
GM2=Seven pastures in which one was grazed by animals for one week and then rested for six wekks
GM3=Two pastures in which one was grazed by animals for twelve weeks and then rested for twelve weeks
MSD=Waller-Duncan minimum significant difference

CONCLUSIONS

Grazing method with a 12-week grazing cycle could increase the HM from *Brachiaria brizantha* pastures without a significant decrease in forage quality as judged from the IVDMD, CP concentration and intake data. Therefore, this grazing system could be adopted in order to control parasite establishment on pastures. The ADG of lambs grazing this pasture indicated the low capacity of *Brachiaria brizantha* to support high performance of growing lambs when this forage was offered as a sole diet. Feed supplement is, therefore, necessary to increase the gain of lambs grazing *Brachiaria brizantha.*

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