

GRAZING MANAGEMENT STUDIES WITH THAI GOATS

I. PRODUCTIVITY OF FEMALE GOATS GRAZING NEWLY ESTABLISHED PASTURE WITH VARYING LEVELS OF SUPPLEMENTARY FEEDING

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Summary

This report deals with the effect of levels of concentrate supplementary feeding (Nil, 0.25% BW and 0.75% BW) on the productivity of different genotypes (Thai native (TN), 25% Anglo-Nubian (AN), 50% AN and 75% AN) of female goats grazing newly established pasture in a tropical area. The major species of grass was *Brachiaria nutica* (33%) and of legumes was *Centrosema pubescens* (34%). There was no significant ($p > 0.05$) difference between nil and 0.25% BW supplementary feeding for growth rate ($g/kg^{0.75}/d$). However, goats fed 0.75% BW supplementary feeding had significantly ($p < 0.01$) higher growth rates than did other treatments. There was no significant ($p > 0.05$) difference among genotypes and between age for growth rate. There was no interaction between feeding and genotype for growth rate.

(Key Words : Grazing Management, Thai Goats, Grass-Legume Pasture, Supplementation)

Introduction

The productivity of goats in many tropical areas is often poor, and has been related to limitations of disease, nutrition, genotype and management (Devendra and Burns, 1983). Goat production in traditional village systems in these areas is often characterized by poor growth rates, high mortality and low reproductive rates. Increased goat productivity in village environments may be achieved mainly by controlling diseases through adequate housing, vaccination and anthelmintic use (Lambourne, 1985; Walkden-Brown, 1985) and improving nutrition by either concentrate feeding (Parawan and Ovalo, 1985; Pathasarathy, 1986) or provision of additional forage (Pathasarathy et al., 1984; Akbar and Alam, 1991; Muir and Jordao, 1991). Where these management systems are applied, improved genotypes may also further increase productivity.

The growth rate of goats is often lower after weaning (Ferh et al., 1976; Morand-Fehr, 1981; Ash and Norton, 1984; Singh et al., 1988).

Morand-Fehr (1981) reported that the growth rate of Alpine goats in France was high during the first 30 weeks of growth and then decreased from the age of 7 months onwards. During this later stage of growth, reproductive rhythm and feeding appear to be the factors affecting growth most (Morand-Fehr, 1981). In the sub-tropics, Ash and Norton (1984) found that the post-weaning growth rate of Australian Cashmere kids grazing improved pastures was poor, especially in the autumn period despite adequate quantity and quality of pasture. This may be due to a low genetic potential for growth rate. Pralomkarn et al. (1994b) reported that under improved management in Thailand, the growth rate of goats from 3-6 months of age was greater than that from 6-9 months of age.

At the Prince of Songkla University (PSU) in southern Thailand, a program of research is being undertaken to evaluate the impact of various management strategies on goat productivity. The systems being studied vary from traditional village systems to the grazing management of goats on improved tropical pastures. Milton et al. (1987) have reported studies with Thai native (TN) and TN \times Anglo-Nubian (AN) goats in which improved management substantially increased goat productivity. These studies used high levels of concentrate supplementation to all classes of goats, and there is now a need to determine

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the minimum levels of supplements needed to sustain this productivity in pasture based grazing systems.

The objectives of the present study were therefore to determine the growth response of young female goats of different genotypes to different levels of supplementary feeding whilst grazing improved tropical legume/grass pastures. This information will be used to optimize the use of expensive concentrate supplements in grazing systems for goats in this environment.

Materials and Methods

Location and climate

The study was conducted at the Small Ruminant Research and Development Centre research farm, Faculty of Natural Resources, PSU, Khong Hoi Khong (KHK), Hat Yai, Thailand. The facility established as part of the Thai-Australian PSU project, and is located at 7°N, 100°30'E. The region has a tropical humid climate with a mean annual rainfall of 2,094 mm with a dry period extending from January to April with marked incidence of rainfall in May-June and in October-November. Temperature varies from 20 to 35°C, with relative humidity of 63-88% and has 50 min difference in daylength between solstices (Milton et al., 1987).

The soils are classified as low humic gleys (pH 5.2) and are deficient in nitrogen, phospho-

rus, potassium, calcium and sulphur.

Animals and their management

Ninety eight female goats were used. These goats were born on the campus farm in March-April, 1989 (24) and 1990 (74) and their management was as described by Milton et al. (1991). All goats were drenched to control intestinal parasites (Panacur, 125 mg fenbendazole/kg BW, Hoechst Veterinary GmbH, Germany; and Mansonil-M, 100 mg niclosamide monohydrate/kg BW, Bayer Australia Ltd.) immediately prior to introduction to the experimental treatments. The experimental area consisted of 4 × 1.3 ha paddocks, and all goats were grazed in each paddock on a 4 week rotation. Goats were drenched with Ivomec (1 ml 1.0% w/v ivermectin, Division of Merck Sharp & Dohme B. V., Netherlands) before moving to new paddocks. All goats were housed overnight in sheds with access to pastures from 08:00 to 17:00 h daily.

Experimental design

The design was a 3 × 4 × 2 factorial in completely randomized design. Treatments were supplementation (None, 0.25%, and 0.75% BW), genotype (Thai native (TN), 25% Anglo-Nubian (AN), 50% AN, and 75% AN), and age (1 and 2 year old). The number of goats in each treatment group is shown in table 1. The experiment lasted approximately 4 months, commencing on 18 April until 18 August 1991.

TABLE 1. NUMBER OF GOATS USED IN THE STUDY

Age	Thai native		25% AN		50% AN		75% AN		Total
	1	2	1	2	1	2	1	2	
Supplement									
Nil	2	4	12	3	8	1	1	—	31
0.25% BW	2	4	12	2	8	1	3	—	32
0.75% BW	3	5	11	3	9	1	3	—	35
Total	7	13	35	8	25	3	7	—	98

Diets and feeding methods

Three supplementary treatments used were, nil (control), 0.25% and 0.75% BW daily. Concentrate was composed of corn, palm kernel cake, soybean meal, rice bran, molasses, ground oyster shell, salt and dicalcium phosphate. The chemical composition (% DM basis) of the concentrate was 11.4 ME MJ/kg, 15.0 crude protein (CP), 7.9 ether extract, 11.2 crude fiber, 1.11 Ca and

0.63 P. After separation into groups, concentrate supplements were offered each morning from a feed trough in the shed. Supplement allocations were adjusted fortnightly. Clean water was freely available at all times from a water trough.

Pasture establishment and management

Four paddocks of 1.3 ha grass/legume pastures were used. These pastures were established be-

tween May and September, 1990. The application of fertilizer (kg/ha) during land preparation was 200, 50 and 50 for rock phosphate, potassium chloride and ammonium sulphate, respectively. The pastures were sown with *Panicum maximum* cv. Hamil, *C. pubescens*, *Stylosanthes hamata* cv. Verano and *Pueraria phaseoloides* in May 1990 at seed rates of 12, 6, 6 and 6 kg/ha, respectively. Chopped stolons with 2-4 nodes of *B. mutica* were planted at a spacing of 50 cm × 50 cm (four stolons per hole) in August, 1990. Urea (100 kg/ha) was applied in October, 1990 after the establishment of *B. mutica*. After being grazed, each paddock was slashed and urea (100 kg/ha) was applied.

Measurements

Goats were weighed every 2 week throughout the experiment. Pasture sampling were carried out before and after grazing in each paddock. Quadrate measuring (0.16 square meter) was used to randomly sample 0.1% of each paddock. The area within the quadrate was harvested using clippers. The harvested materials were oven dried at 70°C for 48 h to determine dry material yield. Dry samples were hand sorted into grass leaf, grass stem, legume leaf and stem, weed and dead material and weighed after redrying. The N content of the major pasture components was also determined (AOAC, 1960).

Statistical analysis

The significance of differences between treatments were carried out by analysis of variance using the generalized linear model procedure of Statistical Analysis System (SAS, 1987).

Results

Pasture establishment and dry matter production

An average DM yield before grazing for four paddocks was 5,132 kg/ha. *B. mutica* and *C. pubescens* were the major forage component of pasture which represented about 68% of the total pasture (table 2). Analysis of variance showed that there were no significant ($p > 0.05$) differences between pasture component yields at either the beginning or the end of each 4 week grazing cycle. Table 2 also shows mean values of dry matter yield with SE for different species at the beginning and the end of the grazing period and total yield, grazed during the experimental period.

There was a significant ($p < 0.05$) reduction in the yields of all pasture components over the 4 weeks of grazing. Total yield grazed was associated with proportion of forage in the pasture where *B. mutica* and *C. pubescens* were the two species which consumed most (1,139 and 1,124 kg, respectively). Leaf-stem ratios of *B. mutica* significantly ($p < 0.05$) declined (0.7 to 0.3) during the grazing period.

TABLE 2. DRY MATTER YIELDS (kg/ha) WITH STANDARD ERROR OF PASTURE COMPONENTS BEFORE AND AFTER GRAZING

Pasture species	Before grazing	After grazing	Total yield grazed
<i>P. maximum</i> cv. Hamil	359 ± 229	84 ± 66	275
<i>B. mutica</i>	1,694 ± 420	555 ± 199	1,139
<i>C. pubescens</i>	1,745 ± 442	521 ± 148	1,224
<i>S. hamata</i> cv. Verano	205 ± 268	50 ± 62	155
<i>P. phaseoloides</i>	308 ± 286	67 ± 92	241
Weed	205 ± 179	50 ± 61	155
Dead material	616 ± 158	336 ± 116	280
Total	5,132 ± 861	1,663 ± 345	3,452

Effect of supplementation, genotype and age on growth rate

Figure 1 shows the changes in mean live weight of goats during 16 weeks of the experiment. Goats fed high level of supplementary feeding (0.75% BW) gained more weights when compared with goats given low level of supple-

mentary feeding (0.25% BW) and without supplementation. Table 3 shows initial live weight, final live weight and least squares means of live weight gain (g/kg^{0.75}/d) of goats during three experimental periods. At all periods, goats given high level of supplementary feeding had significantly ($p < 0.05$) higher growth rates than

TABLE 3. LEAST-SQUARES MEAN, WITH STANDARD ERROR (SE) OF LIVE WEIGHT GAIN (g/kg^{0.75}/c) OF GOATS DURING FOUR PERIODS

Parameter	Initial BW (kg)	Period of calculation (week)			Final BW (kg)
		0-8	8-16	0-16	
Age (year)					
1 (74)	22.9 ± 0.46	3.0 ± 0.31	1.1 ± 0.20	2.1 ± 0.19	25.4 ± 0.41
2 (24)	25.0 ± 1.02	3.2 ± 0.53	0.9 ± 0.34	2.1 ± 0.33	28.0 ± 0.93
Genotype					
TN (20)	21.2 ± 0.93	3.6 ± 0.50	1.4 ± 0.32	2.5 ± 0.31	24.2 ± 0.91
25% AN (43)	22.4 ± 0.54	3.4 ± 0.38	1.2 ± 0.25	2.3 ± 0.24	25.0 ± 0.51
50% AN (28)	25.7 ± 0.80	2.3 ± 0.48	0.8 ± 0.31	1.5 ± 0.30	27.7 ± 0.75
75% AN (7)	26.7 ± 1.40	3.2 ± 0.89	0.7 ± 0.58	2.0 ± 0.56	29.7 ± 1.16
Supplement					
Nil (31)	23.5 ± 0.74	1.8 ± 0.47 ^a	0.7 ± 0.30 ^a	1.3 ± 0.29 ^a	25.1 ± 0.68
0.25% BW (32)	23.8 ± 0.80	2.7 ± 0.45 ^a	0.7 ± 0.29 ^a	1.7 ± 0.28 ^a	25.9 ± 0.66
0.75% BW (35)	23.0 ± 0.72	4.8 ± 0.43 ^b	1.6 ± 0.28 ^b	3.2 ± 0.29 ^b	27.0 ± 0.72

() Number of goats in each category.
 Mean within columns in each parameter with different subscripts differ significantly (p < 0.01).

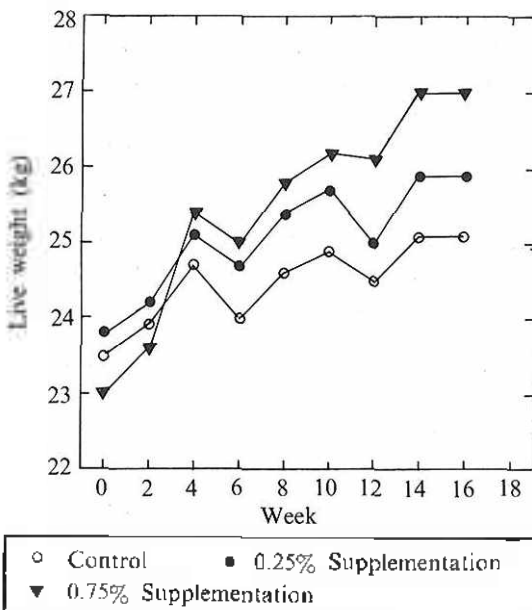


Figure 1. The changes in mean live weight of goats during the experimental period.

did goats given low level or without supplementary feeding. There was no significantly (p > 0.05) difference between low and without supplementation. There were no effects (p > 0.05) of age and genotype on growth rate.

Discussion

Pasture establishment and production

After 6-8 months of establishment, the pastures established well and produced 5,132 kg/ha DM. *B. mutica* and *C. pubescens* seem to be suitable in this environment. At this stocking rate (75 goats/ha), edible forage yield of 4,311 kg/ha seem to be sufficient for 4 weeks grazing. However, CP content of forage in this study was low (7.6 and 11.2% for *B. mutica* and *C. pubescens*, respectively) when compared with those of tropical grass and legumes (10.6 and 16.7%, Minson, 1990) and the minimum requirement for ruminants (9% CP) which is recommended by ARC (1980). CP content in forage is affected by growth stage of plant and soil fertility. In Thailand, CP values for *B. mutica* varied from 10.2% in urca fertilized soil (Tinnakorn, 1988) to 4.7 in low fertile soils (Manidool et al., 1984). Low CP content of forage at grazing time in this study may be due to both plant maturity and low soil fertility. Although fertilizers were applied, soil nutrient loss might have occurred by leaching during a big flooding during November-December, 1990. Results from this study suggest that pasture quality especially CP content is limited in this area.

Effect of supplementation on growth rate

In the first period of the trial, all goats gained weight as a result of good pasture condition and possibly some compensatory gain. However, in the second period, while goats grazed in the third

and fourth paddocks, weight gain of goats declined. For the whole experimental period, goats supplemented with high concentrate (0.75% BW) gained more weight than those in nil and low supplementation. These are possibly because of increased dietary protein supply through supplementary feeding.

Weight gain of goats that grazed pasture only during 16 weeks of study was only 14 g/d (1.3 g/kg^{0.75}/d). This value was similar to those of Australian Cashmere female weaner goats grazed on *Digitaria decumbens*/*Macroptilium atropurpureum* (14 g/d) or N-fertilized *D. decumbens* (23 g/d) at the stocking rate of 60 goats/ha (Norton et al., 1990a). However, these values were lower than those of Nubain crossbred goats grazed on *D. decumbens* in Taiwan (47 g/d) (Hsieh and Hsu, 1992), Malaysian Katjang goats continuously grazing (16 weeks) on *Digitaria setivalva* at a stocking rate of 60 goats/ha in Malaysia (36 g/d) (Chen and Devendra, 1990), those of Australian Cashmere females grazed on oats-rye grass pasture (59 g/d) (Norton et al., 1990b), or local Mozambican weaner goats rotationally grazed on grass-legume improved pastures (70 g/d) (Muir and Jordao, 1991).

The TN female goats (less than 2 years of age) grazed on improved pasture and offered about 1-1.2% BW of concentrate gained 45 g/d (Milton et al., 1987). In this management, weaner goats up to 9 months of age gained 103 and 80 g/d for male and female, respectively (Pralomkarn et al., 1994b). The other study (Kochapkeec et al., 1993) with Anglo-Nubian crosses showed that weaner bucks grazed on native pasture in village environment under internal parasite control only maintained their weights. However, when they were supplemented with concentrate (1.2% BW), growth rates of those were 63 and 90 g/d for those in undrenched and drenched group, respectively. All goats in the present study received adequate both quality and quantity feed, therefore, they can increase live weight gains through the experimental period. Pralomkarn et al. (1994a) reported that energy requirement for maintenance and growth for TN and AN × TN goats were similar with the values of 363 kJ ME (metabolizable energy)/kg^{0.75}/d and 25.2 kJ ME/g, respectively. These authors also found that the minimum nitrogen requirements for maintenance of live weight were 4.4 g DCP (digestible crude

protein)/kg^{0.75}/d and the requirements for live weight gain were 0.225 g DCP/kg^{0.75}/d. Results of the present study suggest that the performance of goats grazing on improved pasture depends on quality of forage and amount of concentrate supplementation. Differences in growth rate among genotypes of goats in this study could not be detected. The reason is possibly the limitation of nutrient supply for cross-bred animals, therefore, they could not perform their genetic potential. Further study should be carried out at higher levels of concentrate supplementation using weaner animals to obtain optimal growth rate.

Economic aspect

Goat in Thailand are mainly raised by small-farmers. Commercial goat farms are rare partly due to a lack of economic analysis data. The present study revealed the following points. If each goat in each treatment is assumed to eat the same amount of concentrate, concentrate consumed per kilogram gain for TN, 25% AN, 50% AN and 75% AN was 4.4, 4.2, 6.9 and 8.3 kg, respectively. This means that 50% and 75% AN needed more concentrate for each unit of gain. If the live-goat price is 40 Baht/kg and concentrate cost is 4 Baht/kg, net income (income from the sale of goat less feed cost) for each goat would be 64, 75.2 and 75.6 Baht for nil, 0.25% BW and 0.75% BW supplementation, respectively, during the 4 month period. These results suggest that concentrate supplementation is not much better than unsupplemented grazing in terms of net income. Moreover, cross-bred goats need more concentrate per gain than native ones.

Acknowledgements

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