TABLE 2

Stolon root development and disease resistance of F_5 families and control lines

Accession		Stolon roots* g m^{-2}		Diseased leaves m^{-2}
		dry season	wet season	
17–33 (F_5)		1.21	1.25	1.29
17–87 (F_5)		1.15	1.21	1.70
C. pubescens (Colombia)		0.73	0.68	7.20
C. pubescens (Ecuador)		n.m.	n.m.	4.50
L.s.d.	$P < 0.05$	0.26	0.35	0.30
	$P < 0.01$	0.35	0.40	0.44

* Transformed values $\log_{10}(X+1)$
n.m. = not measured.

DISCUSSION

In South and Central America, the centre of origin and diversity of *Centrosema*, a high degree of ecotypical variation exists within species of *Centrosema*. This is manifested in morphological and agronomic characters, also in adaptation to climatic extremes and edaphic conditions within tropical latitudes. Forage programs should fully exploit this naturally occurring variability. However, if the desired combination of characters does not exist, it may be possible to create such variability by crossing contrasting ecotypes.

The two intraspecific hybrid lines 17–33 and 17–87 described in this paper possess several desirable forage characters not available in other *Centrosema* cultivars used commercially. Apart from a high forage yield coupled with greater stolon development, strong field resistance to cercospora leaf spot, other fungal diseases and mosaic leaf virus were obtained from the cross. The lines 17–33 and 17–87 are currently being evaluated under grazing prior to seed multiplication and bulking as a new experimental line which should have considerable agronomic potential.

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TECHNICAL NOTE:

STUDIES ON IMPROVED PASTURES IN THE NORTHERN THAI HIGHLANDS

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ABSTRACT

Improved pastures in the Thai Highlands were grazed at the pressures of 210 and 420 kg liveweight ha^{-1}. Half of the cattle at each grazing pressure received a monthly drench with an anthelmintic. Ingested herbage quality and quantity were estimated from *oesophageal fistula samples which indicated that low feed intakes may limit productivity more than low feed quality. Liveweight gains of cattle receiving anthelmintic treatment and grazing at the low grazing pressure were significantly higher than those of other cattle during the wet season.*

INTRODUCTION

Improved pasture species suited to the highland regions of northern Thailand have been determined (Gibson and Andrews 1978) and the increased animal production potential from these pastures has been quantified (Falvey and Andrews 1979).

Establishment and management of improved pasture in the Thai highlands is particularly expensive due to the remoteness and ruggedness of the region. Maximization of animal production is therefore essential. Factors of importance in this respect are the possibility of mineral deficiencies and increased levels of internal parasites. Falvey and Gibson (1981) have determined that mineral deficiencies are unlikely to be of importance. Internal parasites are present at low levels in cattle grazing native grasslands at low stocking rates but have been shown to be a major constraint to sheep in the highlands, primarily because of the differences in grazing behaviour which lead to sheep voluntarily imposing a higher grazing pressure on a smaller area than do cattle (Falvey and Reitschel 1978).

MATERIALS AND METHODS

The experiment was conducted in the highlands north of Chiang Mai, Thailand (altitude 1,500 m; latitude 19°N).

Pastures composed of axillare (*Macrotyloma axillare*), Greenleaf desmodium (*Desmodium intortum*), signal grass (*Brachiaria decumbens*), setaria (*Setaria sphacelata* var. *sericea* cv. Nandi) and paspalum (*Paspalum dilatatum*) were established in March 1977 with the application of 300 kg ha^{-1} of rock phosphate, 50 kg ha^{-1} of triple superphosphate and 100 kg ha^{-1} of gypsum. A six hectare area of pasture was subdivided into four paddocks and six young native cattle introduced in December 1978 and rotated between two 1 hectare paddocks (3.0 beasts ha^{-1}; an initial biomass of 420 kg ha^{-1}) while another six were rotated between two 2 hectare paddocks (1.5 beasts ha^{-1}; an initial biomass of 210 kg ha^{-1}). Cattle grazed the paddocks for 9 hours per day and were yarded overnight.

Pasture composition and yield were estimated by the dry weight rank technique (Haydock and Shaw 1975) and samples were analysed for nitrogen and phosphorus. Three oesophageally fistulated cattle were used to sample pastures at each grazing pressure at four times during the study; samples were analysed for nitrogen and *in vitro* digestibility. An observer recorded the number of prehensory bites per sampling. Every four weeks, three animals at each grazing pressure were drenched with an anthelmintic (Thiobendazole; Merck, Sharp and Dohme).

Fire destroyed one paddock of each grazing pressure in March 1979 and the remaining paddocks were then set stocked with younger cattle to the same grazing pressures for the continuation of the experiment.

RESULTS

Mean proportions of pasture components and total dry matter on offer for the two grazing pressures at five sampling dates are presented in Table 1 and the nitrogen and phosphorus contents of pasture components are presented in Table 2. Dry matter availability decreased during the study particularly at the higher grazing pressure.

Mean nitrogen content, *in vitro* digestibility values, number of bites per minute and bite size from oesophageally fistulated cattle are recorded in Table 3. Nitrogen contents were lowest in the cool dry season although *in vitro* digestibility levels were highest at this time.

TABLE 1

Mean proportions of pasture components (% DM) and the mean total dry matter on offer for improved pastures grazed at two grazing pressures

	Grazing pressure at commencement (kg body weight ha^{-1})	Improved legume (%)	Improved grass (%)	Native grass (%)	Weed (%)	Total dry matter (kg ha^{-1})
February 1979	210	25	3	52	21	1600
	420	32	4	47	18	2570
June 1979	210	26	10	42	23	880
	420	27	19	27	27	690
September 1979	210	29	12	36	23	1530
	420	31	16	23	29	890
December 1979	210	29	12	34	24	2340
	420	30	20	23	34	1130
March 1980	210	35	17	27	22	720
	420	33	20	28	19	510

TABLE 2

Mean nitrogen and phosphorous contents (g kg^{-1} DM) of pasture components for the two grazing pressures at five sampling dates

Pasture Component	Sampling Date and Chemical Element											
	February 1979		June 1979		September 1979		December 1979		March 1980		Mean	
	N	P	N	P	N	P	N	P	N	P	N	P
M. axillare leaf	26.9	2.2	28.5	2.6	29.0	2.5	28.0	2.0	26.2	2.4	27.7	2.3
M. axillare stem	7.8	0.8	15.5	1.9	17.0	1.7	13.3	1.5	9.9	0.8	12.7	1.3
D. intortum leaf	20.9	2.2	30.7	3.0	34.0	2.9	31.2	2.4	25.3	2.4	28.4	2.6
D. intortum stem	6.5	1.1	18.7	2.1	20.4	2.0	12.5	1.7	9.4	1.8	13.5	1.7
Improved grass	9.0	1.2	17.7	2.6	14.0	2.8	9.7	1.7	9.3	1.1	11.9	1.9
Native grass	4.7	0.8	12.0	1.6	11.0	1.3	7.0	1.2	5.6	1.1	8.1	1.2
Weed	9.5	1.4	22.2	3.2	19.5	3.7	19.0	2.0	11.2	1.3	16.3	2.3

TABLE 3

Mean nitrogen content and in vitro *digestibility of extrusa samples, number of bites per minute (per animal) and bite size (per animal) for cattle grazing improved pastures at two grazing pressures at four seasonal periods.*

Seasonal period	210 kg bodyweight ha^{-1}				420 kg bodyweight ha^{-1}			
	Nitrogen (g kg^{-1} DM)	*In vitro* digestibility (% DM)	No. bites (min^{-1})	Bite size (g DM)	Nitrogen (g kg^{-1} DM)	*In vitro* digestibility (% DM)	No. bites (min^{-1})	Bite size (g DM)
Mid-wet season	20.0^{a}	64.8^{a}	15.4^{a}	0.40^{a}	21.3^{a}	52.3^{b}	12.6^{a}	0.37^{a}
Late-wet season	14.9^{b}	49.6^{b}	11.6^{ab}	0.56^{a}	17.9^{b}	41.0^{b}	12.1^{a}	0.44^{a}
Cool-dry season	11.7^{b}	70.8^{a}	8.5^{b}	0.63^{a}	7.9^{c}	68.6^{a}	11.9^{a}	n.a.
Hot-dry season	19.1^{a}	39.6^{b}	8.4^{b}	0.50^{a}	14.5^{b}	42.1^{b}	10.0^{a}	0.56^{a}

Means within a column followed by the same superscript do not vary significantly ($P<0.05$)
n.a. = not available

Mean liveweight gains per head during the dry season prior to burning in March 1979 and in the subsequent wet season are presented in Table 4. No significant interactions ($P<0.05$) were recorded between grazing pressure and anthelmintic treatment nor were there any significant differences ($P<0.05$) between treatments before March 1979. During the 1979 wet season, the low grazing pressure with anthelmintic treatment showed significantly higher ($P<0.05$) liveweight gains and the high grazing pressure without anthelmintic treatment showed significantly lower ($P<0.05$) liveweight gains than other treatments.

TABLE 4

Mean liveweight gains of cattle grazing improved pastures at two grazing pressures under two anthelmintic treatment regimes

Grazing Pressure (kg liveweight ha^{-1})	Anthelmintic	Liveweight change (g hd^{-1} day^{-1})	
		6.12.78-28.3.79	21.6.79-7.11.79
210	+	+58[a]	565[a]
	—	—85[a]	337[b]
420	+	—13[a]	297[b]
	—	—45[a]	189[c]

Means within a column followed by the same letter do not vary significantly ($P<0.05$).

Eggs of the parasite groups trichostrongylids, amphistomes and coccidial oocysts were detected at levels up to 800 epg in the faeces of cattle not receiving anthelmintic while levels for cattle receiving anthelmintic did not exceed 100 epg.

DISCUSSION

This study and that of Falvey and Andrews (1979) suggest that a suitable grazing pressure for mixed axillare, Greenleaf desmodium, setaria and paspalum improved pasture in the northern Thai highlands is less than 210 kg animal biomass ha^{-1} (approximately one native beast ha^{-1}). Higher grazing pressure reduced pasture availability and animal productivity, which decreased even further in the absence of anthelmintics.

The nitrogen content of leaves of the pasture legumes and the analyses of samples collected from oesophageally fistulated cattle suggest that a diet of adequate quality was ingested by cattle except during the cool dry season for the higher grazing pressure. Cattle had access to pastures for only nine hours each day; the number of bites per minute varied from 8.4 to 15.4 so the number of bites per day was 4536 to 8316. Bite size varied from 0.40 to 0.63 g dry matter and when combined with the estimated number of bites, the calculated maximum daily intake varied from 2.27 kg DM in the hot dry season to 5.12 kg DM in the late wet season. Thus total dry matter intake may have limited production of these cattle, particularly in the dry season.

Restricted grazing time in this experiment limited animal productivity from these improved highland pastures. Animal productivity was further reduced by worm parasite burdens in untreated cattle. This information indicates that further study is required of grazing times and stocking rates before implementation of an improved pasture program in the northern Thai highlands can begin

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