

Changes in feeding value with growth in three important fodder grasses of Ceylon

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INTRODUCTION

The potential value of fodder grasses for intensive dairy development on undulating and somewhat steep lands in the marginal plantation areas of the mid-country in the wet zone of Ceylon is under study at the present time. Indeed in such a situation planted pastures for grazing have only a limited value. On the other hand, fodder grasses with their high yield potential can be effectively utilized for zero grazing under intensive management. In the current context of Ceylon's progress towards agricultural diversification of marginal tea and rubber lands in the mid-country, the prospects for milk production from grass established on these lands has been repeatedly highlighted. It is therefore necessary to demonstrate clearly the capacity for dry matter production and the feeding value of the recommended fodders in the mid-country situation before an intensive programme of dairy development can be activated under the programme of Crop diversification. Studies were therefore undertaken in order to compare the performance of three important fodder grasses of Ceylon, in respect of their potential for sustaining dairy production, particularly under high levels of nitrogen fertilization in the mid-country wet zone of Ceylon. This paper reports the results of the first phase of the investigations designed to study the changes in feeding value during re-growth following defoliation of the three species of fodders. The experiment was conducted at the Department of Animal Husbandry, University of Ceylon, Peradeniya.

MATERIALS AND METHODS

Three important fodder grasses for the mid-country, namely Pusa giant Napier, *Setaria* and Guinea were included in the study.

Pusa giant Napier is a hybrid derived from a cross between ordinary Napier (*Pennisetum purpureum*. Schumac) and the millet (*Pennisetum typhoideum*. Riche). The Setarias are popular grasses of Africa, and selections of high digestibility obtained from them have been introduced into Ceylon. The variety used in the trial was *Setaria sphacelata*. Schumac. Stapf and Hubbard (Variety Nandi.) Guinea B is a popular ecotype of *Panicum maximum*. Jacq. well established in this country.

The fodder grasses were established in the field about two months prior to the actual commencement of the trial. The lay out was a split plot design with four replications. Each sampling sub-plot measured 10 ft. $\times$ 5 ft. and the size of each main plot was 20 ft. $\times$ 15 ft. Plants were regularly spaced in each plot at a distance of 2' $\times$ 2'. Prior to the commencement of the trial all plots were cut uniformly to a height of 6" above ground level. In addition, all plots were fertilized uniformly with a basal application of 100 lb. and 50 lb. P₂O₅ and a uniformly high nitrogen application at the rate of 300 lb. N per acre per year. Since the intention was to compare the response of the three fodder grasses to this high nitrogen application during a single period of re-growth following defoliation, the amount of N applied was calculated appropriately for the experimental period. The experiment commenced on March 14, 1971.

SAMPLING PROCEDURE

Since the main purpose was to study the changes in feeding value during uninterrupted growth within a cutting cycle of two months, it was decided to sample every 10 days, each time removing cumulative growth from the time of sampling plots. There were six such plots for each fodder grass and the total period of sampling was 60 days. At each sampling, the herbage was cut to 6" from ground level as at the commencement, and the entire sample of herbage was then dried in a Unitherm drying oven at 100°C for six hours. A representative sub-sample was used for the determination of crude protein. Two grams of this sample were digested and distilled. The distillate was collected into 0.1 N sulphuric acid and titrated against 0.1N sodium hydroxide using bromo cresol green indicator. The crude protein was estimated by multiplying the Nitrogen content by 6.25. This figure was used as an index of feeding value of the herbage dry matter. Tiller counts were made at the end of 30 days and again at the end of the experimental period.

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RESULTS

Mean crude protein contents of the herbage dry matter in respect of the three grasses at each sampling date are shown in table 1. The mean total protein yields in Kg per plot are shown in table II. Pusa giant Napier significantly out yielded the other two grasses in total protein yields. (P 0.01). Pusa giant was also superior to Setaria in respect of crude protein, at the final sampling at 60 days (P 0.05) but was just short of the significance level in respect of Guinea B. At the end of the experimental period, the decline in protein content was particularly marked in the case of Setaria, which proved to be the poorest in terms of quality.

Mean yields of herbage dry matter at each sampling date, (mean cumulative growth) for the two months of growth are shown in table III. Pusa giant Napier significantly out yielded Guinea B at 50 days but was not significantly superior to Setaria, although the yields appeared to be higher. This trend was maintained till the end of the experimental period. The percentage difference in mean total yield towards the end of the experimental period was 10.9% between Pusa giant, the highest yielder, and Guinea B, the poorest yielder. The initial growth and yield of Pusa giant Napier was not as rapid as that of Setaria. During this time, Setaria also showed a distinctly higher tiller number than either Pusa giant Napier or Guinea B.

Setaria retained this superior stooling habit at the final sampling at the end of 60 days. The yield of Guinea B was the lowest of the three species.

The changes in feeding value with growth in the three fodder grasses is shown in figure 1.

TABLE I.—Mean crude protein percentage in herbage dry matter

Date of Sampling	..	24/3	..	5/4	..	15/4	..	25/4	..	5/5	..	15/5
Days of growth	..	10	..	20	..	30	..	40	..	50	..	60
Pusa giant Napier	..	21.52	..	22.06	..	16.58	..	12.58	..	13.03	..	12.20
Setaria	..	10.58	..	16.75	..	14.14	..	11.43	..	11.11	..	9.03
Guinea B	..	16.35	..	20.03	..	14.77	..	10.45	..	10.28	..	9.72

Coefficient of variation (sub. plot)=12.66%

L. S. D. at 5% to compare two varieties for the same date of cutting=2.61

L. S. D. at 1% to compare two varieties for the same date of cutting=3.57

TABLE II. —Total Protein Content in Kg.

Date of Sampling	..	24/3	..	5/4	..	15/4	..	25/4	..	5/5	..	15/5
Days of growth	..	10	..	20	..	30	..	40	..	50	..	60
Pusa giant Napier	..	4.23	..	20.78	..	54.44	..	76.38	..	97.94	..	103.23
Setaria	..	6.24	..	20.72	..	47.12	..	62.15	..	79.67	..	72.98
Guinea B	..	3.04	..	16.95	..	34.33	..	45.41	..	64.15	..	73.90

Coefficient of variation (sub. plot)=27.30%

L. S. D. at 5% to compare two varieties for the same date of cutting=19.46 kg. per plot.

L. S. D. at 1% to compare two varieties for the same date of cutting=26.60 kg. per plot.

TABLE III.—Mean herbage dry matter yields in grams—(Cumulative growth)

Date of Sampling	..	24/3	..	5/4	..	15/4	..	25/4	..	5/5	..	15/5
Days of growth	..	10	..	20	..	30	..	40	..	50	..	60
Pusa giant Napier	..	197	..	941	..	3,232	..	6,152	..	7,503	..	8,480
Setaria	..	580	..	1,255	..	3,326	..	5,477	..	7,076	..	7,893
Guinea B.	..	188	..	849	..	2,322	..	4,383	..	6,277	..	7,643

Coefficient of variation (sub. plot)=17.59%

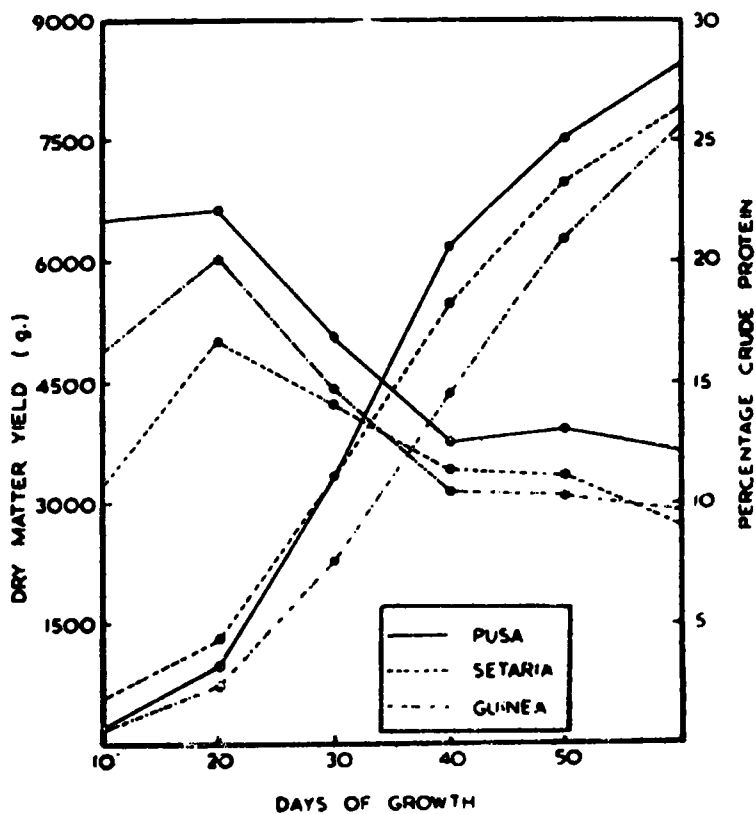
L. S. D. at 5% to compare two varieties for the same date of cutting=1087.34 grams per plot.

L. S. D. at 1% to compare two varieties for the same date of cutting=1496.24 grams per plot.

TABLE IV.—Mean number of productive tillers at 30 days and 60 days of growth

	30 days	60 days
Pusa giant Napier	.. 45	.. 35
Setaria	.. 111	.. 93
Guinea B.	.. 85	.. 76

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There was an inverse relationship between herbage yield and its feeding value in all three fodder grasses. In all cases the protein content showed an initial increase and then a rapid decline with growth. This may be attributed partly to the time lag between the application of the fertilizer and its uptake by the plants.

DISCUSSION

The significance of high nitrogen pastures for increasing animal production in Ceylon has been highlighted in several recent experiments (Appadurai 1970). Applied nitrogen produces a linear increase in herbage yield and also has a marked effect on herbage quality. Two important conclusions arise from the results of the present trial. The first significant finding is in respect of the changes that occur in feeding value as the plants progress towards maturity which can be favourably influenced by high nitrogen. As illustrated in figure 1, there was a decline in feeding value with increasing maturity. Even so on account of the high level of nitrogen application used, the lowest level reached in crude protein content was higher than that reported elsewhere in literature for the three grasses. Pusa giant Napier was outstanding in this respect with a crude protein content of 12.2% in the dry matter after 60 days of growth. Values for percentage protein during the experimental period for the three grasses ranged from 22.06 to 12.20 in Pusa giant Napier, 16.75 to 9.03 in *Setaria*, 20.03 to 9.72 in Guinea B. Secondly, the relationship between herbage yield and feeding value was inverse, suggesting that choice of cutting dates will involve a compromise between yield and quality. The point of intersection for Pusa giant Napier occurred around the 35th day at which time the crude protein content was about 15%.

This is not an unduly close frequency for cutting, but the evidence indicates that extending the cutting interval to 60 days would almost result in a doubling of the yield. The other two grasses showed similar, although less spectacular trends. Recent evidence indicates that grasses with ten percent crude protein in the dry matter could be expected to meet the nutritional requirements of tropical cows yielding one gallon of milk per day (Whyte, Moir and Cooper 1959). High nitrogen applications such as practised here can thus be expected to produce more milk from grass on account of its enhanced feeding value. Based on these findings the economic opportunities that would arise if the marginal tea and rubber lands in the mid-country are planted with fodder grasses such as Pusa giant Napier for milk production from grass cannot be overemphasised.

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REFERENCE

1. APPADURAI R. R. (1970) Ed. The development of the cattle industry in Ceylon. Proceedings of a Symposium. P. 38.
2. WHYTE R. R. MOIR T. R. G. and COOPER J. P. (1959) Grasses in Agriculture. P. 143.