Animal production potential of three important fodder grasses of Sri Lanka

I. Live-Weight Gains with Sheep

L. A. Goonewardene and R. R. Appadurai
Department of Animal Husbandry,
University of Sri Lanka

(Received April, 1972)

INTRODUCTION

The changes in feeding value with growth, of three important fodder grasses of Ceylon, namely Pusa giant Napier (a hybrid resulting from a cross between *Pennisetum purpureum* shumac and *Pennisetum typhoideum* Riche), Guinea B a popular ecotype of *Panicum maximum* Jacq, and the setaria variety Nandi (*Setaria sphacelata* shumac. Stapf and Hubbard) were described in an earlier paper (Goonewardene and Appadurai 1971). All three are high tonnage grasses and offer considerable promise for animal production particularly in the mid-country, where climate and topography favour the development of fodder grasses suitable for zero grazing. The studies reported in this paper were designed to assess the potential of these grasses for animal production, by feeding artificially dried grass prepared from chopped samples of each herbage to penned sheep in a controlled feeding trial. The experiment was conducted on the University farm at Dodangolla.

MATERIALS AND METHODS

Artificially dried grass.—The three fodder grasses used in the study were fertilized at 300 lb. N per acre per year, and harvested at the 30 day interval of cutting, exactly as described in the earlier paper. The cutting height, similarly, was 6 inches above ground level as in the previous experiment. The harvested herbage was chopped in the laboratory into small pieces about 1-3 inches long, and the chopped grass was dried in a Unitherm drying oven at 100°C for 6 hours till a constant weight was achieved. The dried grass was then bagged and stored for use.

Breed of sheep.—The animals used for the study consisted of pure bred Bikaneri sheep, both males and females, ranging in age between 5-7 months. The Bikaneri is a long wool Indian breed of sheep, adapted to the drier regions of North India. The breed is about average in production characters achieving generally about 80 lb. body weight in a year under good management. In recent years this breed of sheep has been introduced into Sri Lanka, but their value for mutton production, and their potential on improved pasture has not been fully assessed.

Design and layout.—The layout of the experiment was a randomized block with four replications. All the animals were housed throughout the experimental period in a sheep house constructed on pillars with a slatted floor and sides made of arecanut reapers, to provide adequate ventilation. Each animal was separately housed in a cubicle 5 ft. × 5 ft. (Plate 1). Altogether 12 animals were used for the study, comprising 6 males and 6 females.

Feeding.—Each day, during an experimental period of 70 days, weighed quantities of artificially dried grass of the three species under study were placed in a specially designed feed through in each cubicle. Water and a standard mineral mixture were provided ad lib for each animal. Each morning, before fresh feed was put into the trough, the balance feed remaining in the trough from the previous day's supply was carefully collected, weighed and recorded. Herbage consumption per animal was calculated for each day.

Digestibility.—'In vitro' determinations of dry matter digestibility, were carried out on samples of each fodder used in the study.

Sampling procedure.—The animals were introduced into the cubicles and to the new feeding regime about a week prior to the actual commencement of the trial. Immediately prior to the commencement of the trial, each animal was weighed repeatedly in a Gascoign animal balance for 3 consecutive days, and the mean weight assumed as the initial weight. Subsequently the animals were weighed at regular 10-day intervals throughout the experimental period of 70 days. The experiment commenced on July 16, 1971.

RESULTS

Live-weight gains.—Mean live-weight gains of the sheep at 10-day intervals, as well as the mean total percentage increases in live-weight over the entire experimental period, on the three fodder grasses is shown in Table 1.

TABLE I.—Mean live-weight gains of sheep at 10-day intervals

		Days									
		0	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*Total*	% *increase*
Pusa Giant	lb.	35.75	44.25	47.75	50.00	52.00	55.00	55 75	58.50	22.75	63.64
	kg.	16.23	20.08	21.68	22.70	23.61	24.97	25.31	26.56	10.33	
Guinea B	lb.	36.25	44.75	47.25	49.00	51.75	52.25	52.50	54.25	18.0	49.66
	kg.	16.46	20.32	21.45	22.25	23.49	23.72	23.84	24.63	8.17	
Setaria	lb.	36.75	44.25	45.50	46.75	51.00	51.50	51.50	52.50	15.25	41.50
	kg.	16.68	20.09	20.66	21.22	23.15	23.38	23.38	23.60	6.92	

Co-efficient of variation — 16.2%.

L.S.D. 5% to compare any 2 of Treatment means — 5.23.

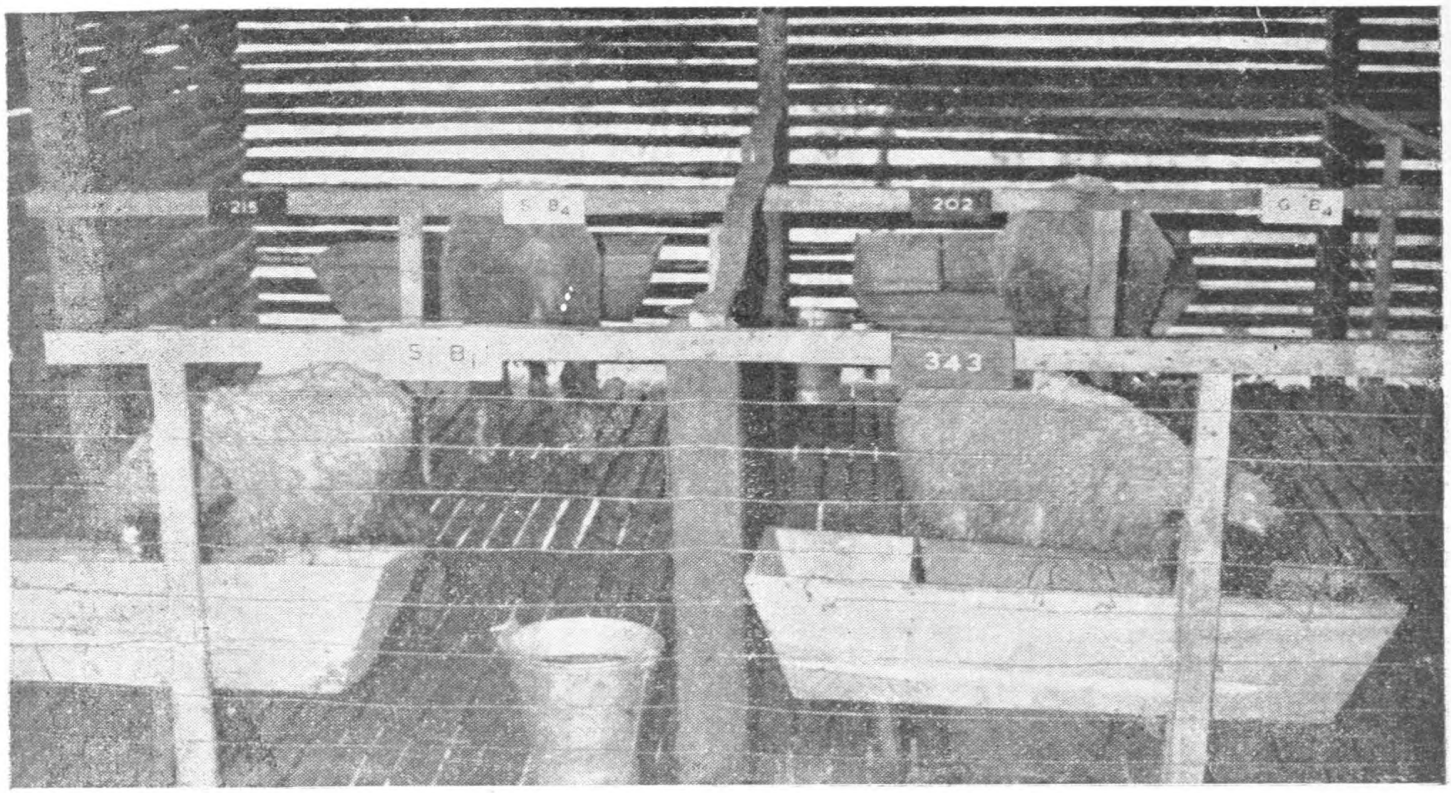


PLATE 1.—Bikaneri sheep separately housed and on artificially dried grass in a controlled feeding trial.

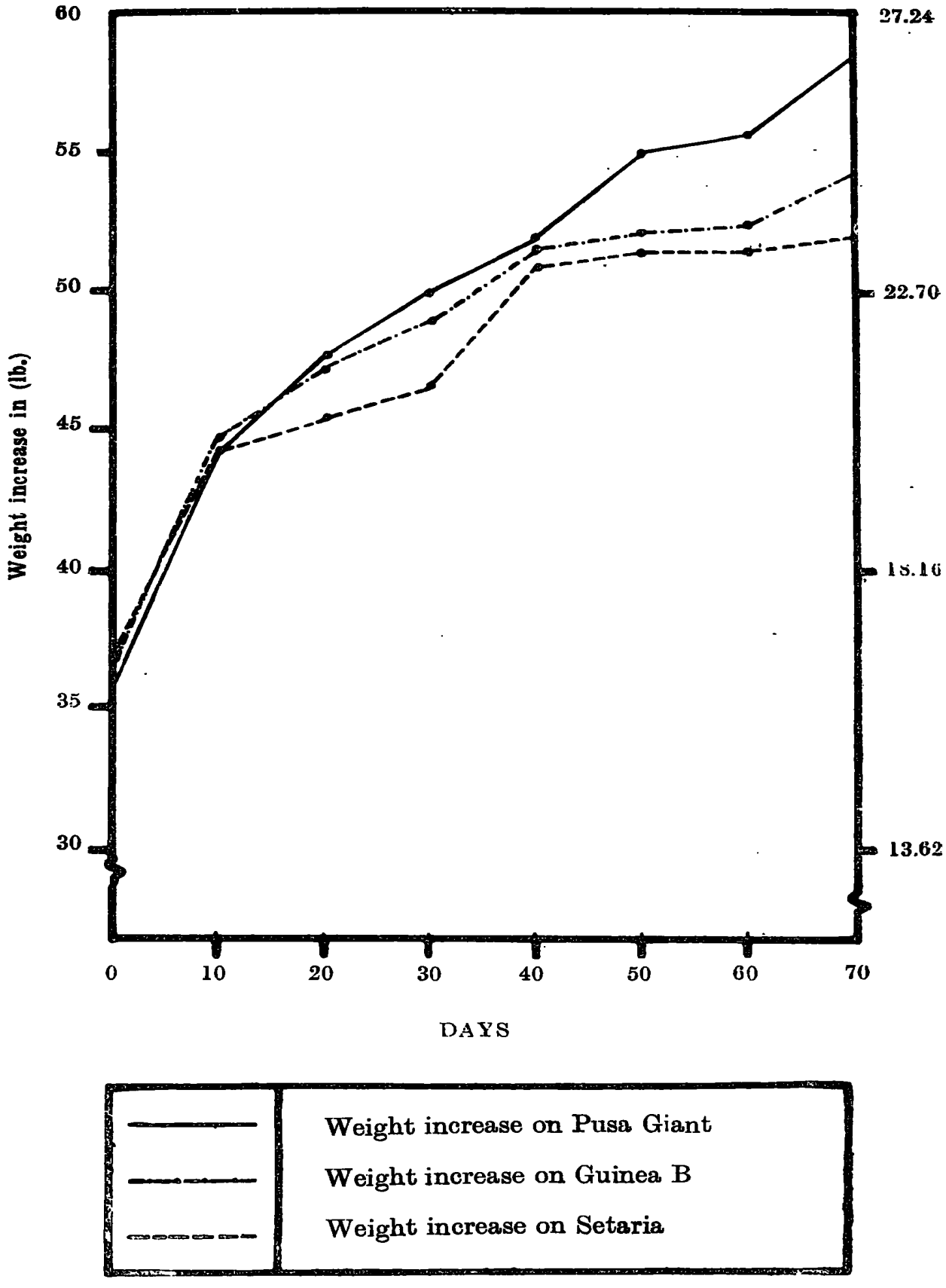
All animals recorded significant live-weight gains during the experimental period. Live-weight increases were most pronounced in the animals fed on Pusa Giant Napier, with a mean increase in live-weight of 22.75 lb. (10.33. kg), a 63.64 per cent. increase over the initial weight. Guinea B produced the second highest increase amounting to 18.00 lb. (8.17 kg) while Setaria came third with an increase of 15.25 lb. (6.92 kg). Pusa Giant Napier was significantly superior to Setaria ($P = 0.05$), and was the best of the three grasses used in the study. (Fig. 1).

The relationship between dry matter digestibility, daily herbage consumption, and live-weight gain is shown in Table 2.

Herbage consumption rates, per day were highest with Pusa Giant Napier (839. 73 g), with Guinea B being a close second (821.60 g), while the lowest consumption was recorded with Setaria (682.96 g). From table 2 it is clear also that Pusa Giant Napier has a higher dry matter digestibility compared to the other two grasses. This would explain the higher intake observed in the case of Pusa Giant, and also the rating of the other two grasses in respect of their nutritive value and consumption.

Consumption and body weight.—Table 3 shows how consumption changes with body weight, in the case of Pusa Giant Napier the best of the three fodders, and Setaria the poorest of the three fodders. Fig. 2 illustrates this relationship in respect of all three fodders at 10-day intervals throughout the experimental period. In all cases consumption increased with increases in body weight. But at about the same body weight, there is a marked difference in consumption levels between Pusa Giant and Setaria. For example at an average body weight of 52.0 lb (23.6 kg.), daily consumption of Pusa Giant is of the order of 1.93 lb (877.9 g) whereas for Setaria the daily consumption is of the order of 1.43 lb (653.7 g). These figures confirm the view that herbage intake is governed primarily by its dry matter digestibility which in the present case was 66.6 per cent. for Pusa Giant Napier, compared to 53.7 per cent. for Setaria.

Figure I


60
55
50
45
40
35
30
Weight increase in (lb.)
27.24
22.70
18.16
13.62
0
10
20
30
40
50
60
70
DAYS
Weight increase on Pusa Giant
Weight increase on Guinea B
Weight increase on Setaria

3—K 11914 (4/72)

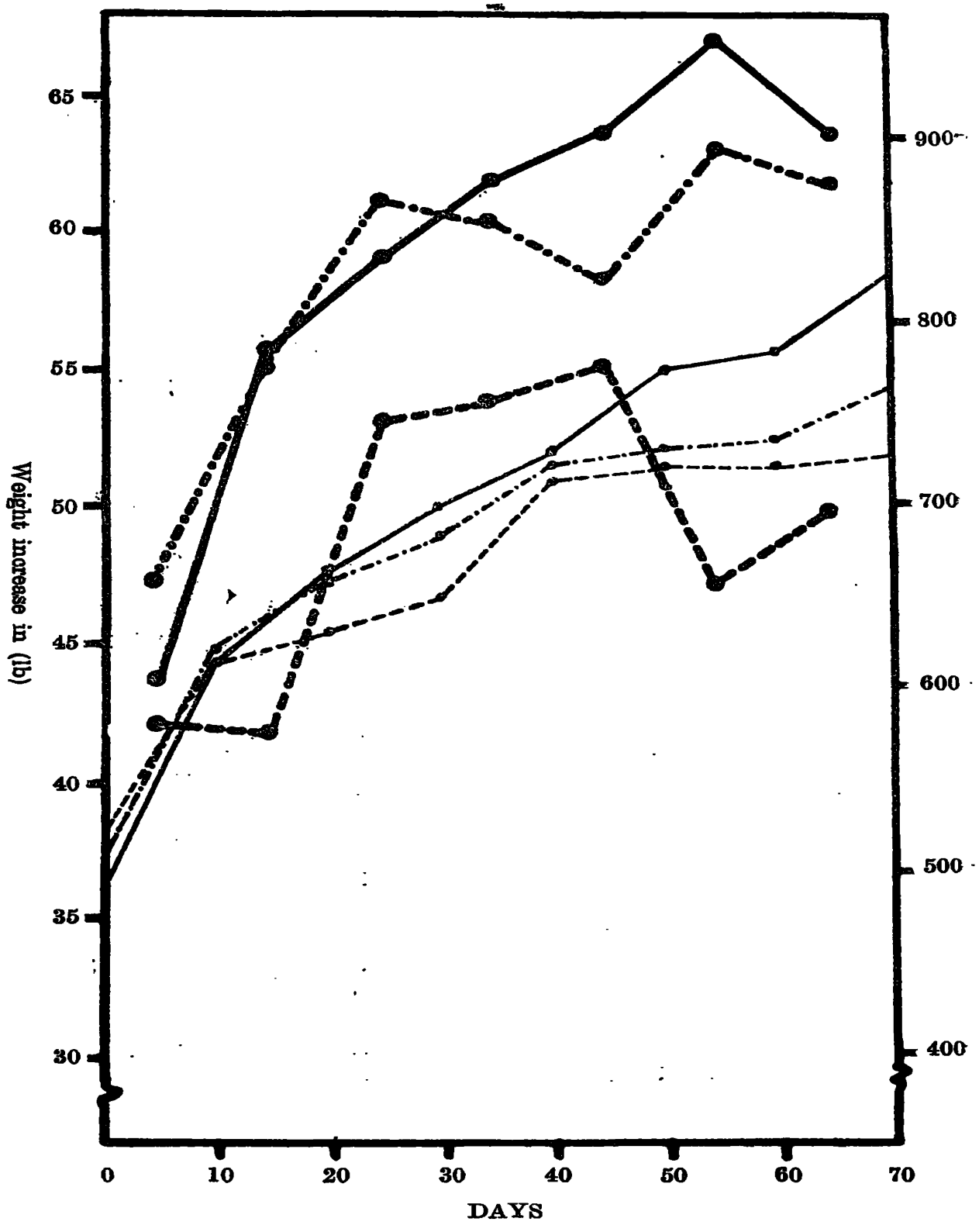
TABLE 2—Relationship between digestibility, intake and live-weight gain

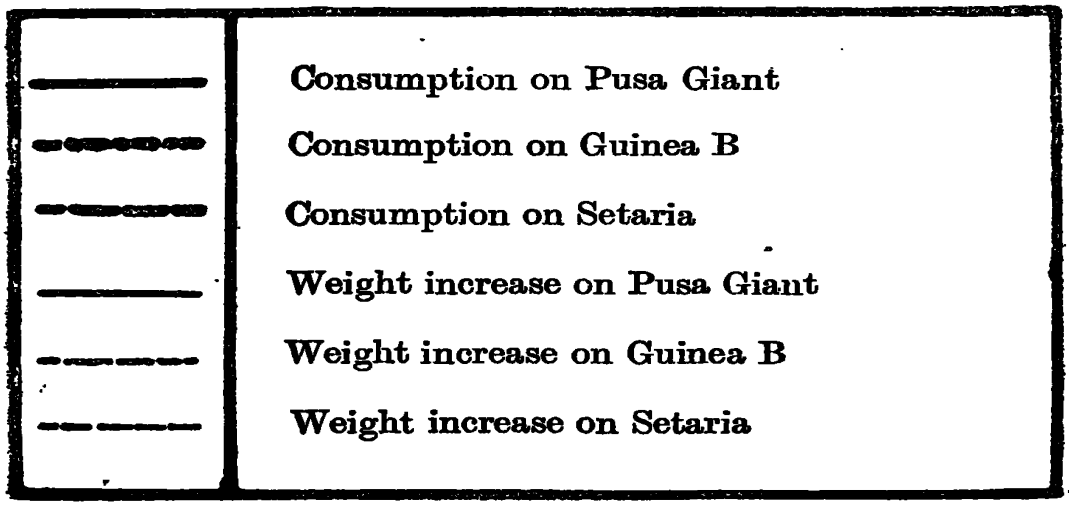
	% *o. m. digestibility (in vitro)*	*mean Intake per day*		*mean Live-weight gain per day*	
		lb.	*g.*	*lb.*	*g.*
Pusa giant	66.6 ..	1.85	839.73 ..	0.325	147.55
Guinea B	62.3 ..	1.81	821.60 ..	0.257	116.68
Setaria	53.7 ..	1.50	682.96 ..	0.218	98.97

TABLE 3—Relationship between herbage consumption and body weight

Days	*Pusa giant*				*Setaria*			
	Body weight		*Herbage consumption*		*Body weight*		*Herbage consumption*	
	lb.	*kg.*	*lb.*	*kg.*	*lb.*	*kg.*	*lb.*	*kg.*
20 ..	47.75	21.68..	1.75	794.8..	45.50	20.66..	1.27	574.5
40 ..	52.00	23.61..	1.93	877.9..	51.00	23.15..	1.66	754.9
60 ..	55.75	25.31..	2.10	955.6..	51.50	23.38..	1.43	653.7

Figure 11


65
60
55
50
45
40
35
30
900
800
700
600
500
400
Weight increase in (lb)
0
10
20
30
40
50
60
70
DAYS


Consumption on Pusa Giant
Consumption on Guinea B
Consumption on Setaria
Weight increase on Pusa Giant
Weight increase on Guinea B
Weight increase on Setaria

DISCUSSION

Blaxter (1960) after examining the live-weight gains of sheep fed on hay of widely differing quality, indicated that a tremendous drop in animal production would result from a fall in digestibility from 76 to 46 per cent. He reported that while intake dropped from 3.3 lb. d.m. per day to 2.1 lb d.m. per day, live-weight gain was reduced from 0.33 lb per day to 00.2 lb per day. The present results confirm the findings and lend further support to the widely held view that digestibility is the most important single factor determining the feeding value of grass whether for grazing, hay, silage, or as artificially dried grass. Pusa Giant Napier on account of its higher digestibility, showed a higher herbage intake and produced a significantly higher live-weight gain when fed to sheep. On the basis of digestibility, Guinea B was the second best fodder in terms of feeding value, and both in terms of intake and live-weight gains of sheep, ranked second to Pusa Giant Napier. Setaria was the poorest of the three grasses under study in all these respects. The present results confirm the findings of the earlier study (Goonewardene and Appadurai 1971) wherein the same rating was observed on the basis of crude protein contents in the herbage dry matter.

Two further important conclusions arise from the present trial. The first is in relation to the potential of the Bikaneri breed of sheep on improved pasture in the mid-country of Sri Lanka. When fed on high quality Pusa Giant Napier, the sheep averaged live-weight gains of 0.325 lb per day (147.55 g) which closely approximates the live-weight gains achieved by Blaxter (1960). on good quality hay with temperate breeds of sheep, (0.33 lb per day). Guinea B approximated the medium type of hay used in Blaxter's experiment, and was second in order of merit. These results suggest that the hitherto unwarranted criticism of the Bikaneris as an unsuitable breed of sheep for Sri Lanka on account of poor growth rates, can only be justified on the basis of the poor quality herbage fed to the sheep, particularly in the drier parts of South Sri Lanka. Indeed, the versatility of the breed is such that they are likely to play a significant role in our programmes for mutton production if only their full potential on improved pasture can be realized. The second important conclusion, of considerable economic significance for animal production arises from the relationship that exists between grazing quality and the level of concentrate feeding that would be required for example for milk production.

Evidence is available that even with medium digestibility of around 60 percent, it should be possible to meet both maintenance and production requirements of cows producing around 1½ gallons of milk per day. (Mahadevan 1966). Guinea B, fertilized at 300 lb per acre and cut at monthly intervals, has such a digestibility. Pusa Giant Napier, the best performer, on the other hand shows distinctly superior qualities in this regard with a digestibility of nearly 66.6%. Applying Mahadevan's table this should be adequate to produce around 3 gallons of milk per day. Since these are all high tonnage grasses, with high carrying capacities, the economic opportunities that could arise out of a careful appraisal and evaluation of such fodders for animal production in Sri Lanka, cannot be overstated. The studies presented here with sheep only suggest the possibilities.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the assistance given in the form of a research grant by the Division of Animal Production and Health of the Department of Agriculture. The assistance of Mr. R. H. Alexander of the West of Scotland Agricultural College, in carrying out 'invitro' analysis of herbage samples is gratefully acknowledged. Our thanks are also due particularly to Mr. A. W. B. Lekamge the Dairy Manager, and Mr. H. A. Arulgnanam for their assistance in the field, and to Miss. T. Shanmugam, Statistician for the statistical analysis of the data.

REFERENCES

BLAXTER K. L. (1960). Proc. 8th International Conference. p. 479-84.

GOONEWARDENE and APPADURAI (1971) *Trop. Agriculturist.* (Vol. Cxxvii No. 3 & 4 pp. 145—51.

MAHADEVAN P. (1966) *Trop. Science. IX. 5.*