

EFFECT OF FREQUENCY OF CUTTING ON YIELD AND CHEMICAL COMPOSITION OF FOUR TROPICAL GRASSES

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Abstract : Experiments were conducted to study the effect of frequency of harvesting on yield and chemical composition of four tropical grasses, Guinea 'A' (*Panicum maximum*, Jacq.) Iluk (*Imperata cylindrica*), Signal grass (*Brachiaria brizantha*) and Napier breed 21 (Cross between *Pennisetum purpureum*, Schimac and *Pennisetum americanum*, L.) Forage was harvested at three stages of plant growth, corresponding to 4,5 and 6 weeks after previously cutting the foliage. At each harvesting, the herbage was cut to a height of 5 cm from the ground and the forage from three replicates were collected and weighed separately. Sub samples were taken for chemical analysis. The results show that the productivity of the four grasses were low and not significantly affected by the frequency of harvesting. The chemical composition of the grasses were partly affected by the frequency of cutting. The results suggest that fertilization may be required in the abandoned tea plantation areas to obtain optimum yield and quality of forage.

Key words : Chemical composition, cutting frequency, tropical grasses, yield,

INTRODUCTION

Expansion of the ruminant industry in tropical countries including Sri Lanka, is limited by the lack of good quality forage throughout the year. Seasonal rainfall in most parts of Sri Lanka results in a fluctuating supply of pasture. There is an urgent need therefore to identify drought resistant grasses for periods of short feed supply. Guinea grass (*Panicum maximum*, Jacq.) eco type 'A', Signal grass (*Brachiaria brizantha*), Iluk (*Imperata cylindrica*) and Napier breed 21 (cross between *Pennisetum purpureum*, Schimac and *Pennisetum americanum*, L.) in Sri Lanka, are resistant to drought and grow rapidly. Dairy farmers utilize Iluk and in particular Guinea 'A' as the main source of forage for their cattle, rather than attempting to eradicate and replace them with improved varieties.

Iluk is considered a widespread weed in many parts of the tropics. However, young leaves in the early vegetative stage of growth are eaten by livestock. This grass is a rhizomatus perennial with deeply penetrating roots. It is therefore tolerant to burning and grows in soil of low fertility. Signal grass is a loosely tufted, perennial grass with a free rooting habit. It therefore produces a large quantity of roots per unit area and is excellent for soil and water conservation and fertility build up. Signal grass is also relatively drought resistant and aggressive against all type of weeds. Napier breed 21 is a tall perennial grass with deep roots that can tap water from the lower soil horizons. It is widely believed that increasing frequency of defoliation increases the dry matter yield while decreasing the quality of forage.¹⁻⁷ However, data on the effect of frequency

of cutting on yield and quality of many tropical grasses are insufficient especially in abandoned tea plantation areas. The objective of the present study was to investigate the effect of frequency of harvesting on yield and chemical composition of four tropical forages in an abandoned tea plantation area.

METHODS AND MATERIALS

Four grasses namely Guinea 'A', Signal grass, Iluk and Napier breed 21 were grown at the Mawela farm, University of Peradeniya, Peradeniya (longitude 80° 29'E, latitude 7° 13'N, elevation 485 m) in reddish brown latasolic soil. This farm is established in an abandoned tea plantation and was not fertilized for about ten years.

Plots measuring 4x4 m for all four grasses were arranged in a randomized block design with three replicates. Forage was harvested at three stages of plant growth, corresponding to 4, 5 and 6 weeks after cutting the foliage. The grasses were cut uniformly with sickles to height of 5 cm from ground level prior to the commencement of the trial. Experiments were carried out for 12 month period (September 1989 to September 1990). When harvesting, the herbage was cut to a height of 5 cm from the ground and the forages from the three replicates collected and weighed separately. The sub samples taken were dried in an Unitherm oven at 55°C to a constant weight for determination of dry matter. All analyses were made on oven-dried grass samples that were ground to pass a 1 mm sieve. The samples were analysed for moisture, nitrogen by Kjeldhal method, crude fibre and ash content according to Association of Official Analytical Chemists.⁸ Data were statistically analysed by ANOVA, two factor factorial Method.⁹

RESULTS

Dry matter yield and chemical composition of four grasses as affected by frequency of cutting are presented in Table 1. Frequency of cutting did not significantly affect the dry matter yield of all four grasses. However, crude protein and ash content of Guinea 'A' grasses were significantly decreased ($P < 0.05$) with increasing cutting interval. Increasing the cutting interval also resulted in an elevated crude fibre content in Guinea 'A', Iluk and NB 21 grasses. Table 1 also presents the average yield of dry matter and the chemical composition of the four grasses. The highest dry matter yield was observed in Guinea 'A' whereas Iluk had the lowest. The crude protein and ash content in NB 21 and the crude fibre content in Guinea 'A' were highest, whereas Iluk recorded the lowest ($P < 0.05$) ash value.

The correlation coefficients between dry matter yield and chemical composition of all four grasses for different frequency of cuttings are shown in Table 2. According to this, positive correlation of crude fibre content and negative correlation of crude protein and ash content with dry matter yield were obtained.

Table 1: Effect of frequency of cutting on dry matter yield and chemical composition of four tropical grasses.

Grass	Cutting interval weeks	Dry matter yield ton/ha/yr	CP %	CF %	Ash %
Guinea 'A'	4*	7.5 ± 1.0	13.4 ^a ± 0.4	32.2 ^a ± 0.7	9.0 ^a ± 0.2
	5**	6.3 ± 0.8	13.0 ^a ± 0.4	33.5 ^b ± 0.7	8.6 ^b ± 0.3
	6***	6.6 ± 0.9	10.7 ^b ± 0.6	35.6 ^c ± 0.8	8.4 ^b ± 0.4
	Av.#	6.8 ^a ± 0.9	12.4 ^b ± 0.3	33.8 ^a ± 0.5	8.7 ^b ± 0.2
Signal grass	4*	6.3 ± 0.9	10.8 ± 0.7	31.3 ± 0.7	5.9 ± 0.2
	5**	4.3 ± 0.6	11.3 ± 0.8	30.5 ± 0.8	6.3 ± 0.3
	6***	5.2 ± 0.7	10.8 ± 0.9	30.9 ± 0.7	6.1 ± 0.3
	Av.#	5.2 ^b ± 0.5	11.0 ^c ± 0.4	30.9 ^c ± 0.4	6.1 ^d ± 0.2
Iluk	4*	1.5 ± 0.3	11.7 ± 0.6	31.2 ^a ± 0.5	7.0 ± 0.3
	5**	1.6 ± 0.2	10.7 ± 0.6	32.0 ^a ± 0.6	7.9 ± 0.4
	6***	1.0 ± 0.1	9.6 ± 0.6	33.4 ^b ± 0.6	6.8 ± 0.4
	Av.#	1.4 ^c ± 0.1	10.7 ^c ± 0.4	32.2 ^b ± 0.3	7.3 ^c ± 0.2
NB-21	4*	5.7 ± 1.4	16.7 ± 0.7	29.9 ^a ± 0.4	14.0 ± 0.4
	5**	4.9 ± 0.8	15.6 ± 0.9	30.6 ^a ± 0.7	14.0 ± 0.4
	6***	6.8 ± 1.4	14.9 ± 0.8	32.2 ^b ± 0.8	13.6 ± 0.4
	Av.#	5.8 ^b ± 0.7	15.7 ^a ± 0.5	30.9 ^c ± 0.4	13.9 ^a ± 0.3

Means with different superscripts in a column for 4,5 and 6 weeks are significantly different ($P < 0.05$).

Means with different superscripts in a column for Av. are significantly different ($P < 0.05$).

* mean of 12 repeated cuttings in triplicate ± standard error of the means (SEM).

** mean of 10 repeated cuttings in triplicate ± SEM.

*** mean of 8 repeated cuttings in triplicate ± SEM.

mean of 90 values ± SEM.

CP = Crude protein

CF = Crude fibre

Av. = Average

Table 2: Correlation coefficients between dry matter yield and chemical composition.

Grass	Frequency of cutting (weeks)								
	4*			5**			6***		
	CP	CF	Ash	CP	CF	Ash	CP	CF	Ash
	-----%-----								
Guinea 'A'	-0.6	0.1	-0.5	-0.1	0.3	-0.1	-0.8	0.9	-0.6
Signal grass	-0.2	0.2	-0.5	-0.3	-0.1	-0.4	-0.4	0.3	-0.8
Iluk	0.2	0.3	0.5	0.0	0.2	-0.3	-0.5	0.9	-0.6
NB-21	-0.7	0.3	0.1	-0.5	0.8	0.2	-0.6	0.7	0.0

* mean of 12 repeated cuttings in triplicate.

** mean of 10 repeated cuttings in triplicate.

*** mean of 8 repeated cuttings in triplicate.

DISCUSSION

According to the results, crude protein and ash content of Guinea 'A' was decreased whereas crude fibre content of Guinea 'A', Iluk and NB 21 were increased with increasing cutting interval. These results are in agreement with the other workers.¹⁰⁻¹⁶ In general, plants in the juvenile stage have high ratio of leaf to stem and greater accumulation of total photosynthate. With maturity, cell wall constituents in older leaves increase and cell elongate resulting in less succulent leaves. In addition, the translocation of photosynthate from actively photosynthesizing leaves to the senescent leaves occurs. Consequently, lengthened cutting intervals are considered to have an increase in the content of dry matter and fibre; an increase, then a decrease or fluctuation in total dry matter production; a decrease in leaf: stem ratio, percentage of crude protein and mineral content and, a rapid decline in animal intake and digestibility.

On the other hand, crude protein content of all four grasses in this experiment were somewhat higher, compared, with the results of the other researchers.^{10,13,16-20} This higher percentage of crude protein may have been due to the poor regrowth of these grasses. According to the results, positive correlation of crude fibre content and negative correlation of crude protein and ash content with dry matter yield for all four grasses were obtained. The correlation coefficient values were very much higher at six weeks cutting interval compared to other two cutting intervals. Furthermore, the values were much higher for Guinea 'A' and NB 21 compared to other two grasses. These correlation values are in agreement with the other workers.^{10,13,16,18,21}

In conclusion, it can be said that the productivity of all four grasses were not affected by frequency of cutting however, dry matter yields were low compared to average values reported by other workers in different land areas.^{10,13,16,18,21} However, chemical composition of the grasses were affected by the frequency of harvesting and, the regrowth of all four grasses were very low throughout the experimental period.

Being an abandoned tea land without fertilizer for about ten years may have created a soil which is very poor in organic matter, nitrogen and some of the minerals and, this in turn may have caused the poor performance of all four grasses in this particular land. Therefore, the results of this experiment suggest the necessity of fertilization in order to obtain the optimum yield and quality of forage in abandoned tea plantation areas.

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