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Effect of Cutting Management on Growth and Yield of Sabai Grass (*Eulaliopsis binata*): Intercropped with Horticultural Plants under Acid Lateritic Soils of India

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Abstract: A field experiment was carried for two years to find out the effect of cutting management, on growth, yield of sabai grass and the suitability of sabai grass cultivation in association with different horticultural plants in acid lateritic fallow lands under rainfed condition. The performance of sabai grass was studied in association with four horticultural plants viz., drumstick (*Moringa oleifera*), pomegranate (*Punica granatum*), ber (*Zizyphus jujuba*) and sapota (*Pouteria sapota*) under two cutting management viz., one cut during November and two cuts during November and March. It was found that growth parameters like leaf length, canopy coverage and number of tillers per clump of sabai grass were superior in two cuts management as compared to one cut management in both the years. Two cuts management recorded 29.6 and 33.4% higher dry leaf yield as compared to one cut management in the first year and second year respectively. Among the four horticultural plants, the superiority of performance of intercropped sabai grass was in the order of sapota, pomegranate, ber and drumstick.

Key words: Sabai grass, horticultural plants, cutting management

Introduction

The traditional land use system has become very fragile and unsustainable due to unchecked and excessive exploitation, leading to large scale degradation and consequent creation of wastelands. At the global level about 2322 m ha of wastelands have been estimated, 50% of which are found in Asia alone (ISRIC-UNEP, 1990). In India about 175 million ha of the total geographical area is subjected to various processes of land degradation due to soil erosion resulting during rainy season (Singh *et al*., 1994a). These lands are characterized by low organic matter and nitrogen status, poor availability of phosphorus and poor retention capacity for both moisture and nutrients (Basu *et al*., 2006). Moreover, due to untimely and irregular distribution of rainfall, during the crop season they may be subjected to periodical drought. In addition to that low income and poor resource to credit, inputs and modern technologies, forced most farmers to keep these lands fallow for several years resulting into creation of wastelands. However, these lands can be made cultivable and productive by adopting suitable silvopasture production systems (Viswanatham *et al*., 1998). Cultivation of suitable horticultural plants and grass species can be most efficient scientific program to improve these lands.

Sabai grass (*Eulaliopsis binata* (Retz.) C.E. Hubb), a perennial plant, is cultivated as a commercial crop in China, India, Pakistan, Nepal, Bhutan, Mayanmar, Thailand, Malaysia and Phillipines. In India it is grown in the states of West Bengal, Bihar, Jharkhand, Orissa, Punjab, Haryana, Jammu and Kashmir, Himachal Pradesh, Madhya Pradesh and Uttar Pradesh. Its thin and long leaves with high

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quality fiber constitute a major raw material for paper industries (Barik, 1998; Gupta, 2006), also the flexibility and strength properties of the leaves are utilized for making ropes and other rope based utility items (Basu *et al*., 2006; Gupta, 2006).

One of the reasons for low yield of this grass is the practice of taking one cut in the year only. Since the information are lacking on this aspect, the present investigation was carried out to find out the effect of cutting management and suitability of association of sabai grass with some horticultural plants like sapota (*Pouteria sapota*), pomegranate (*Punica granatum*), ber (*Zizyphus jujuba*) and drumstick (*Moringa oleifera*) under rainfed condition.

Materials and Methods

The experiment was conducted during 2003-'04 to 2004-'05 at Golghoria village, Kharagpur, India in red lateritic soil (Alfisol). The land was kept fallow for last 25 years. The climate of this region is warm humid and the soil is sandy loam with well drainage facility. The fertility status of the soil was low in terms of organic carbon, nitrogen, phosphorus and potassium with pH value of 5.4. The experiment was laid out in a split plot design, where four horticultural plants viz., drumstick (*Moringa oleifera*), sapota (Pouteria sapota), ber (*Zizyphus jujuba*) and pomegranate (*Punica granatum*) were treated as main plot effect and two cutting managements viz., one cut in year during November and two cuts per year during November and March were treated as sub-plot treatments.

All the horticultural plants and slips of sabai grass with 10-12 tillers per slip were planted during the 2nd week of July. Pits of 1×1 m were made at a distance of 7×5 m for plantation of sapota, 5×5 m for ber and pomegranate and 4×5 m in case of drumstick. Data were recorded on growth parameters of sabai grass like leaf length, canopy coverage and number of tillers per clump at harvest and dry leaf yield.

The recorded data were analyzed with the help of analysis of variance (ANOVA) for Split Plot Design (SPD). Least Significant Differences (LSD) were conducted at a 5% level of probability, where significance was indicated by F-test (Gomez and Gomez, 1984).

Results

Cutting managements and various horticultural plants had significant effect on growth parameters like leaf length, canopy coverage and number of tiller per clump of sabai grass.

In the first year the lowest leaf length was recorded in association with drumstick, which was followed by ber. However, no remarkable difference was observed in association with sapota and pomegranate. In the second year also the performance of sabai grass was superior in case of pomegranate and sapota. Regarding cutting management two cuts proved to be significantly better than one cut and the difference was 5.4 and 7.6% in the first and second year, respectively (Table 1).

Table 1: Leaf length (cm) of sabai grass as influenced by cutting management and different horticultural plants

Treatments	1st year	2nd year	Pool mean of two years
Horticultural plants			
Drumstick	75.6	115.9	95.8
Pomegranate	84.0	131.5	107.7
Ber	81.3	119.7	100.5
Sapota	84.7	126.5	105.6
LSD* (p = 0.05)	2.5	3.9	4.5
Cutting management			
1 Cut	79.3	118.9	99.1
2 Cuts	83.6	127.9	105.7
LSD (p = 0.05)	NS	1.2	2.1

*LSD= Least Significant Difference

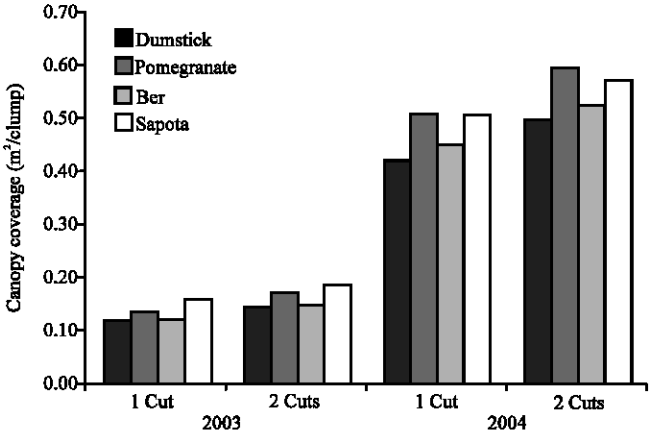

Fig. 1: Canopy coverage (m^2 per clump) of sabai grass as influenced by cutting management and different horticultural plants

Table 2: Number of tillers per clump of sabai grass as influenced by cutting management and different horticultural plants

Treatments	1st year	2nd year	Pool mean of two years
Horticultural Plants			
Drumstick	45.8	90.7	68.3
Pomegranate	51.6	105.9	78.8
Ber	47.7	98.6	73.1
Sapota	52.4	109.1	80.8
LSD* (p = 0.05)	1.03	4.16	2.39
Cutting management			
1 Cut	46.7	94.6	70.7
2 Cuts	52.1	107.5	79.8
LSD (p = 0.05)	2.33	7.21	3.38

*LSD= Least Significant Difference

It is clear from Fig. 1 that among the horticultural plants, lower canopy coverage was recorded in association with drumstick as compared to others. The maximum canopy coverage was found in association with sapota and it was statistically at par with pomegranate. Like leaf length, the canopy coverage per clump of sabai g rass was significantly influenced by cutting management in both the years.

As regards the treatment combinations sapota with two cuts management resulted in the highest canopy coverage which was followed by pomegranate with two cuts management. The lowest leaf length was recorded in case of drumstick under one cut management and the difference was 18% over pooled mean of two years.

The trend of effect of cutting management and association of four horticultural plants on the tiller number per clump of sabai grass was same as leaf length and canopy coverage (Table 2). Among the four horticultural plants (on an average) the highest tiller number was obtained in association with sapota and the lowest value was found in association with drumstick and the difference was 12.6 and 16.8% in the first and second year, respectively. On an average, two cuts treatment resulted in 10.7 and 13.4% higher tiller number per clump over one cut management in the first year and second year, respectively.

Dry leaf yield of sabai grass was significantly affected by cutting management and association with various horticultural plants (Table 3). Higher leaf yield was noted in two cuts management as compared to one cut management in both the years and on an average the difference was 29.6 and 33.4% in the first year and second year, respectively. As regards the association of horticultural plants,

Table 3: Dry leaf yield (kg ha^{-1}) of sabai grass as influenced by cutting management and different horticultural plants

	1st year			2nd year		
Horticultural plants (HP)	1 Cut	2 Cuts	Mean	1 Cut	2 Cuts	Mean
Drumstick	882.0	1245.0	1063.5	1816.1	2727.6	2271.8
Pomegranate	1052.5	1507.7	1280.1	2318.8	3491.9	2905.3
Ber	994.6	1416.7	1205.7	2016.9	3098.1	2557.5
Sapota	1092.2	1581.9	1337.0	2404.1	3533.2	2968.7
Mean	1005.3	1437.8		2139.0	3212.7	
LSD**	HP	CM*	HP×CM	HP	CM	HP×CM
(p = 0.05)	88.39	265.63	122.54	144.69	408.32	215.47

*CM = Cutting Management; **LSD = Least Significant Difference

poor leaf yield of sabai grass was recorded in association with ber and drumstick. Maximum yield was recorded in association with sapota, which was statistically at par with that of pomegranate. Among all the treatment combinations sapota with two cuts management recorded the highest leaf yield and the lowest leaf yield was recorded in case of drumstick under one cut management in both the years.

Discussion

Growth and yield of sabai grass was significantly affected by association with various horticultural plants and cutting management. The yield was higher in the second year as compared to first year due to initial slow rate of growth of the crop. Two cuts management recorded significantly higher yield as compared to one crop management in both the years. This might be due to better crop stand and vigorous re-growth after first cut in November under residual moisture in post monsoon season. Tripathy (1998) also reported higher sabai grass yield under two cuts management as compared to one cut management.

The growth and yield of sabai grass was inferior in association with ber and drumstick as compared to sapota and pomegranate. This may be due to the less-spread canopy structure of pomegranate and sapota, whereas the same in case of ber is horizontal and near to the ground causing smothering effect on the near by sabai grass plants. Drumsticks with higher canopy coverage suppress the growth of sabai grass. The canopy of drumstick trees allowed less sunlight penetration facilitating poor growth of sabai grass in comparison to ber (Qarro and De-Montard, 1989). The tree cover generally suppresses the growth and dry matter yield of grasses due to competition effects of various resources (Qarro and De-Montard, 1989) especially light. The adverse effect was more pronounced in the vicinity of the trees (Walker *et al*., 1986). The varied extent and amount of effect of trees on growth and yield of sabai grass could also be explained by the physical and physiological influences by the tree canopies (Bhatt *et al*., 1994). Almost comparable growth and yield was noted in association with sapota and pomegranate. This might be due to similarity in their canopy coverage in both the years.

From the present study it can be concluded that among the four associated horticultural plants sapota and pomegranate was proved to be most suitable, whether the worst performance of sabai grass regarding growth and yield was obtained in association with drumstick followed by ber. Regarding cutting management two cuts was proved to be advantageous with respect to yield as compared to one cut management. As all the plants are perennial in nature, research in this area for a longer time is necessary to obtain maximum benefit from the system without affecting their growth.

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