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Performance of Sabai Grass (*Eulaliopsis binata* (Retz.) C. E. Hubb) under Different Levels of Organic and Inorganic Fertilizers in Acid Soil

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Abstract: A field experiment was conducted in sandy loam acid lateritic soils to study the direct and residual effect of different levels of chemical fertilizers, farmyard manure and lime on growth and yield of sabai grass under rainfed condition. Three levels of chemical fertilizers viz., 0:0:0, 30:20:20 and 60:40:40 kg N:P:K ha^{-1}, respectively were tested as sole application and supplemented by FYM (50% N dose) but with and without lime application. The grass yield was increased with increasing level of chemical fertilizers, however, the difference was not discernible when the level was increased to maximum level. Higher grass yield was observed under integrated application of chemical fertilizers, farmyard manure and lime as compared to chemical fertilizers alone and the yield difference was to the extent of 18.7% under direct effect during wet season and to the extent of 54.6% under residual effect during dry season. Farmyard manure was more effective in improving the crop yield when applied with both chemical fertilizers and lime than with chemical fertilizers alone. Lime treated plots recorded 15.4% and 24.5% higher yield as compared to no lime application during wet and dry season respectively. Thus, combined application of soil amendment, organic manure and chemical fertilizers was beneficial in improving growth and yield of sabai grass in sandy loam acid lateritic soil.

Key words: *Eualaliopsis binata* · lime · farmyard manure · chemical fertilizers

INTRODUCTION

Sabai grass (*Eulaliopsis binata* (Retz.) C. E. Hubb), a perennial plant, belonging to the family Poaceae, is grown in many Asian countries like China, India [1], Pakistan [2], Nepal [3], Bhutan, Mayanmar, Thailand, Malaysia [4] and Phillipines. In India it is cultivated in the states of West Bengal, Bihar, Jharkhand, Orissa, Punjab, Haryana, Jammu and Kashmir, Himachal Pradesh, Madhya Pradesh and Uttar Pradesh [1]. Since its thin and long leaves possess high quality fiber, it is used as a major raw material for paper industries [2, 5]. For flexibility and strength properties, leaves are utilized for making ropes and other rope based utility items [1, 6]. At present Sabai grass has an important role in tribal economics of some regions of India [7]. In north eastern India sabai grass is mainly cultivated in acid lateritic soils. Low organic matter content [8], Fe, Mn and Al toxicity; deficiencies in available macronutrients as well as some micronutrients; reduced uptake of nutrients [9] and leaching loss of several nutrients are the problems of this soil. Moreover, being a perennial crop sabai grass utilizes lot of nutrients from the soil, thereby, reduces the productivity and fertility status of the soil [10]. So it is necessary to replenish the soil with suitable nutrient management practices, which will also increase the productivity. Combined application of organic manure and chemical fertilizers to crops was found to be effective in reducing the losses of C, N and P [11]. Therefore this soil can be made fertile by raising the soil pH through application of lime and use of organic sources along with chemical fertilizer. Since information are lacking on nutrient management of sabai grass [10], therefore the present investigation was conducted to study the direct and residual effect of lime, farmyard manure and chemical fertilizers on growth and yield of sabai grass under acid lateritic soil.

MATERIALS AND METHODS

Treatments: The experiment was conducted during 2003 at Experimental Farm, Rural Development Centre, Indian

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Table 1: Physical and chemical properties of experimental soil

Particulars	Value
Particle Size Distribution	
Sand (%)	61.25
Silt (%)	21.35
Clay (%)	17.40
Bulk density (mg/cu. m)	1.63
Soil reaction (pH)	5.25
Organic Carbon (g kg^{-1})	2.91
Total N (%)	0.42
Total P (%)	0.24
Total K (%)	0.59
Available N (g kg^{-1} of soil)	74.61
Available P (g kg^{-1} of soil)	5.24
Available K (g kg^{-1} of soil)	46.12

Institute of Technology, Kharagpur, West Bengal, India in red lateritic soil (Alfisol). The climate of this region is warm humid and the soil is sandy loam in texture. The physical and chemical properties of the test soil are presented in Table 1. Three doses chemical fertilizers (CF) viz., 0:0:0 (F_0), 30:20:20 (F_1) and 60:40:40 (F_2) kg of N:P:K ha^{-1}, respectively alone and supplemented by farmyard manure (FYM) (F_3 i.e., 50% N of F_1 dose supplemented by FYM and F_4 i.e., 50% N of F_2 dose supplemented by FYM) under with and without lime (L) were tested. All together ten treatments were arranged in a Factorial Randomized Block Design (FRBD) with three replications. The quantity of FYM applied to supply 50% N of CF. The balance 50% N and the difference in P and K from different levels of CF were met through chemical fertilizers. Lime was applied @ 2 t ha^{-1}. 10-12 slips per clump of sabai grass were planted in first week of July with the onset of monsoon at a spacing of 100 cm and 50 cm between rows and plants respectively. Two harvest of sabai grass was taken, first in November and second in March.

Chemical analysis of soil: For soil chemical analysis, samples were collected before starting of experiments from 20 cm soil depth at random from different locations. The samples were air-dried in shade for 48 h, ground in a pestle and mortar and passed through a 2 mm sieve. Estimation of the pH, organic carbon and available N, P and K contents of the soil were done using a glass electrode, Walkley and Black method, Kjeldahl distillation, NH_4F extraction and NH_4OAc extraction methods, respectively [12].

Statistical analysis: The recorded data were analyzed with the help of analysis of variance (ANOVA) for Factorial Randomized Block Design (FRBD). Least significant differences (L.S.D) were conducted at a 5% level of probability, where significance was indicated by F-test [13].

RESULTS AND DISCUSSION

Direct effect of nutrient sources on growth and yield of sabai grass during wet season: Different fertilization sources significantly influenced the growth parameters like leaf length, canopy diameter and dry matter production and green leaf yield of sabai grass (Tables 2 and 3) during wet season. The yield of sabai grass increased with increasing level of CF, however, the increment was marginal at maximum level of CF in the wet season. Combined application of CF along with FYM improved the grass yield to the extent of 13.4% over sole application of CF. As FYM is the source of all macro and micronutrients it increased the uptake of all the nutrients and thereby ultimately increased yield of sabai grass [6]. Application of lime further increased the yield over no lime treatment and on an average the difference was 15.4%. The increase in soil pH due to application of lime raised the soil pH and increased the availability of most of the plant nutrients particularly N, P, K, Ca and Mg as well as micronutrients [14], which promoted higher grass yield. Better availability of the nutrients thereby increased the nutrient uptake. The higher nutrient uptake under combined application of lime, FYM and CF was responsible for higher yield of sabai grass [6].

Residual effect of nutrient sources on growth and yield of sabai grass during dry season: In the dry season under residual fertility better growth in terms of leaf length, canopy diameter and dry matter accumulation and higher yield of sabai grass was recorded with integrated application of CF, FYM and lime as compared to absolute control and only CF (Tables 2 and 3). The increment was to the extent of 54.6%. Unlike wet season, no remarkable difference in the sabai grass yield was observed under residual fertility of different levels of CF in the dry season. The annual rainfall of this region is about 1300-1400 mm and 80% of rain occurs during June to September, therefore, leaching loss of readily available nutrients of CF from well drained sandy loam upland soil during wet season might had been responsible for very less to no residual effect of CF in the dry season. Under residual fertility the effect of FYM was more apparent in the plots where higher level of FYM was applied in the wet season.

Table 2: Effect of different fertilization sources on leaf length (cm) and canopy diameter (cm) of sabai grass during wet and dry season

Fertilization sources (F)	Leaf length (cm)			Canopy diameter (cm)		
Wet season	L_0	L_1	Mean	L_0	L_1	Mean
F_0	66.00	74.67	70.33	31.50	34.67	33.09
F_1	76.00	83.67	79.83	38.30	43.67	40.98
F_2	78.67	85.00	81.83	41.43	45.97	43.70
F_3	77.33	86.33	81.83	40.00	46.33	43.17
F_4	80.77	88.27	84.52	44.03	49.00	46.52
Mean	75.75	83.59		39.05	43.93	
S.Em±	F	L	F x L	F	L	F x L
	2.23	1.41	3.16	1.63	1.03	2.31
L.S.D (P=0.05)	4.69	2.97	6.64	3.43	2.17	4.85
	L_0	L_1	Mean	L_0	L_1	Mean
F_0	34.67	38.67	36.67	15.00	18.67	16.83
F_1	37.00	41.00	39.00	26.80	30.67	28.73
F_2	38.33	43.67	41.00	26.93	31.96	29.45
F_3	41.00	46.00	43.50	30.50	34.60	32.55
F_4	44.33	51.00	47.67	32.90	36.90	34.90
Mean	39.07	44.07		26.43	30.56	
S.Em±	F	L	F x L	F	L	F x L
	1.00	0.63	1.42	1.63	1.03	2.31
L.S.D (P=0.05)	2.11	1.33	2.98	3.43	2.17	4.85

Note: F_0 = No CF; F_1 = CF @ 30:20:20 kg N:P:K ha^{-1}; F_2 = CF @ 60:40:40 kg N:P:K ha^{-1}; F_3 = 50% N of F_1 dose supplemented by FYM; F_4 = 50% N of F_2 dose supplemented by FYM; L_0 = No lime; L_1 = Lime @ 2 t ha^{-1}; L.S.D = Least significant difference; S.Em = Standard error of mean

Table 3: Effect of different fertilization sources on dry matter production (g $clump^{-1}$) and green leaf yield (kg ha^{-1}) of sabai grass during wet and dry season

Fertilization sources (F)	Dry matter (g $clump^{-1}$)			Green leaf yield (kg ha^{-1})		
Wet season	L_0	L_1	Mean	L_0	L_1	Mean
F_0	32.68	35.63	34.15	948.48	1018.73	983.61
F_1	58.12	65.11	61.62	1623.56	1866.53	1745.04
F_2	62.05	69.70	65.87	1779.95	2003.13	1891.54
F_3	62.76	72.64	67.70	1840.70	2214.81	2027.75
F_4	68.86	79.06	73.96	1965.43	2314.45	2139.94
Mean	56.89	64.43		1631.62	1883.53	
S.Em±	F	L	F x L	F	L	F x L
	4.17	2.64	5.90	77.18	36.77	82.22
L.S.D (P=0.05)	8.76	5.54	12.39	162.15	77.26	172.75
Dry season	L_0	L_1	Mean	L_0	L_1	Mean
F_0	22.00	26.67	24.33	614.33	756.86	685.60
F_1	26.33	29.93	28.13	724.53	852.92	788.73
F_2	26.84	32.60	29.72	760.25	935.05	847.65
F_3	33.00	41.00	37.00	950.30	1197.10	1073.70
F_4	39.33	48.67	44.00	1116.03	1445.57	1280.80
Mean	29.50	35.77		833.09	1037.50	
S.Em±	F	L	F x L	F	L	F x L
	2.65	1.67	3.74	36.89	23.33	52.17
L.S.D (P=0.05)	5.56	3.52	7.86	77.50	49.02	109.61

Note: F_0 = No CF; F_1 = CF @ 30:20:20 kg N:P:K ha^{-1}; F_2 = CF @ 60:40:40 kg N:P:K ha^{-1}; F_3 = 50% N of F_1 dose supplemented by FYM; F_4 = 50% N of F_2 dose supplemented by FYM; L_0 = No lime; L_1 = Lime @ 2 t ha^{-1}; LSD = Least significant difference; S.Em = Standard error of mean

This benefit was might be due to a reduced loss of applied nutrients and slow release of nutrients as influenced by the decomposition process of FYM. Such a possibility had also been noted by Singh *et al.* [15]. The degree of residual fertility varied according to the dose of fertilization sources used in the wet season. The higher quantity of FYM led to improvement of soil physical properties [16] and this might have resulted in increased yield of sabai grass in the dry season. Moreover, application of lime along with organic sources accelerated the mineralization of the organic materials and enhanced the availability of essential nutrients to the crop [17], which ultimately led to better growth and biomass production of sabai grass under residual fertility also. On an average, lime treated plots recorded 24.5% higher yield as compared to no lime treatment under residual fertility.

CONCLUSIONS

Moderate dose of chemical fertilizer was effective in improving the yield of sabai grass to an optimum level as compared to no fertilizers or higher dose. Combined application of lime, organic manure and chemical fertilizers have been found to be much effective in increasing yield of sabai grass as compared to continuous use of only chemical fertilizers. It can reasonably be stated that as a soil amendment lime can be successfully applied to acid lateritic soils to improve its productivity.

REFERENCES

1. Gupta, B.N., 2006. Non-Wood Forest Products in Asia, India. Available from: http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/X5334E/x5334e07.htm.
2. Sial, M.I., 2006, Non-Wood Forest Products in Asia, Pakistan. Available from: http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/X5334E/x5334e07.htm.
3. Khatri, D.P., 2006. Non-Wood Forest Products in Asia, Nepal. Available from: http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/X5334E/x5334e07.htm.
4. Yong, P.L., 2006. Non-Wood Forest Products in Asia, Malaysia. Available in: http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/X5334E/x5334e07.htm.
5. Barik, K.C., 1998. Performance of sabaigrass (*Eulaliopsis binata*) germplasm. Indian J. Agric. Sci., 68: 326-327.
6. Basu Manisha, Das Sanjib and S.C. Mahapatra, 2006. Effect of integrated nutrient management on sabai grass-groundnut intercropping system under ateritic soils of south West Bengal. Environ. and Ecol., 24S 9: 190-192.
7. Anonymous, 2002. Country case study paper India. The Regional Workshop on Indigenous Practices of Sustainable Land and Resource Management in Asian Highlands Thailand, December 2-5, Available from: http://www.ilo.org/public/english/region/asro/newdelhi/download/indiappr.pdf.
8. Mahapatra, I.C., K.N. Singh, K.G. Pillai and S.R. Bapat, 1985. Rice soils and their management. Indian J. Agron., 30: 1-41.
9. Beckie, H.J. and H. Ukrainetz, 1996. Lime-amended acid soil has elevated pH 30 years later. Can. J. Soil Sci., 76: 59-61.
10. Tripathy, S.K., 1998. Effetc of cutting management and nitrogen fertilization on yield and economics of sabai grass (*Eulaliopsis binata*). In: Proc. National Sem. on "Strategy for maximization of forage production by 2000 AD", May 5-7, 1998, India, pp: 113-116.
11. Agbenin, J.O. and J.T. Goladi, 1997. Carbon, nitrogen and phosphorous dynamics under continuous cultivation as influenced by farmyard manure and inorganic fertilizers in the Savanna of northern Nigeria. Agric. Ecosyst. Environ., 63: 17-24.
12. Jackson, M.L., 1973. Soil Chemistry Analysis, 2nd Ed. Prentice Hall of India Pvt. Ltd, New Delhi.
13. Gomez, K.A. and A.A. Gomez, 1984. Statistical Procedures for Agricultural Research. John Wiley and Sons, Singapore.
14. Sims, J.T., B.L. Vasilas and M. Ghodrati, 1995. Evaluation of fly ash as a soil amendment for the Atlantic coastal plane: II. Soil chemical properties and crop growth. Water, Air and Soil Pollut., 81: 363-372.
15. Singh, K.N., B. Prasad and S.K. Sinha, 2001. Effect of integrated nutrient management on a Typic Haplaquant on yield and nutrient availability in a rice-wheat cropping system. Aust. J. Agric. Res., 52: 855-858.
16. Bhadoria, P.B.S. and Y.S. Prakash, 2003. Relative influence of organic manures in combination with chemical fertilizer in improving rice productivity of laetritic soil. J. Sustainable Agric., 23: 77-87.
17. Panda, N., 1998. Problems and prospects of efficient use of fertilizers in acid soils of India. Fert. News., 43: 39-50.