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Performance of *Stylosanthes* cultivars in gangetic plains of West Bengal under different levels of phosphorus and cutting

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ABSTRACT

The field experiment was conducted during two consecutive years (2001-02 and 2002-03) at C. R. Farm, B. C. K. V., West Bengal under upland situation to evaluate the performance of two *Stylosanthes* cultivars under three levels of phosphorus and three levels of cutting. *Stylosanthes seabrana* 2534 proved to be superior with respect to growth parameters, green forage and dry matter yield over *S. seabrana* 104710. Increment of phosphorus and cutting levels significantly increased green forage and dry matter yield. The cultivar *S. seabrana* 2534 with application of 60 kg P_2O_5 ha^{-1} and 3 cutting levels gave the best result in terms of economics.

Key words : *Stylosanthes*, cutting, phosphorus, forage yield, economics

With rapidly shrinking area, which can be afforded for growing feed and fodder, it has become mandatory to put in use 167 million ha wastelands through suitable pasture legumes for the fodder purpose (Agarwal *et al.*, 2000). Among various pasture legumes tried for introduction, different species of *Stylosanthes* have shown wide preference to various types of climatic and edaphic conditions in many countries of the world (Khara *et al*., 1990). But, the crop *Stylosanthes* is not among the commonly cultivated forage crops under West Bengal situation. The package of practices of the crop is not yet standardized on the basis of different agro ecological situation of West Bengal. Very little work has been done so far on the effect of fertilization and cutting management on herbage production in stylo. Therefore a field experiment was conducted to evaluate the green herbage production potential of *Stylosanthes* under different management practices.

MATERIALS AND METHODS

The field experiment was conducted during 2001-02 and 2002-03 at Central Research Farm, Bidhan Chandra Krishi Viswavidyalaya, Gayeshpur, West Bengal (latitude-23.5^o N, longitude-89^o E, altitude 9.75 m above mean sea level). The soil of the experimental site was typical Gangetic Alluvium (Entisol), sandy loam in texture with a pH of 6.1, low in total nitrogen (0.021%), organic carbon (0.23%) and available phosphorus (15.84 kg P_2O_5 ha^{-1}) and rich in available potash (142.0kg K_2O ha^{-1}).

Eighteen treatment combinations were tested in a factorial randomized block design with three replications. The treatments comprised three cutting management practices (one cut at 31 weeks, two cuts at 10 and 31 weeks and three cuts at 10, 17 and 31 weeks after sowing); two cultivars (*Stylosanthes seabrana* 2534 and *Stylosanthes seabrana* 104710) and three levels of phosphorus (0, 60 and 120 kg P_2O_5 ha^{-1}). A uniform dose of 20 kg N ha^{-1} through urea and 40 kg K_2O ha^{-1} through muriate of potash was applied as basal to all the plots. P fertilizer through single super phosphate was applied according to different treatments as basal. The experiment was conducted each year in separate contiguous plots under rainfed condition. The seeds treated with sulphuric acid were sown @ 3 kg ha^{-1} on 24th and 25th July, in 2001 and 2002 respectively. Each plot was divided into 2 portions for destructive samplings and for recording biometrical observations and the other part for estimation of yield. At 21 days after sowing the crop was thinned to maintain the plant population at 20-25 m^{-1} row length. Plant height and the number of branches were recorded from fixed 50 cm long rows. The crop was harvested according to the treatments at 15 cm above ground level. The economics was worked out on the basis of prevalent market rates of input and output.

Table 1 : Plant height and number of branches per plant of *Stylosanthes* cultivars at different growth stages as influenced by phosphorus and cutting levels (mean of two years)

Treatment	Plant height (cm)			No. of branches/plant		
	119 DAS	168 DAS	217 DAS	119 DAS	168 DAS	217 DAS
Cultivars						
S. seabrana 2534 (V_1)	65.11	61.88	65.86	8.29	34.30	48.16
S. seabrana 104710 (V_2)	63.51	60.27	64.05	6.17	22.08	32.28
CD (P=0.05)	NS	NS	NS	0.97	2.08	2.86
Phosphorus levels (kg ha^{-1})						
0 (P_0)	84.34	85.68	88.39	8.90	41.01	46.00
60 (P_1)	54.02	60.69	63.92	6.42	30.16	41.87
120 (P_2)	54.57	36.86	42.59	6.37	13.40	32.80
CD (P=0.05)	3.90	2.84	3.21	1.19	2.55	3.51
Cutting levels						
One (C_1)	58.59	54.83	58.72	6.52	19.83	27.69
Two (C_2)	63.96	60.56	68.83	7.53	29.78	43.64
Three (C_3)	70.38	63.84	72.34	7.63	34.96	49.33
CD (P=0.05)	3.90	2.84	3.21	NS	2.55	3.51

Table 2 : Economic analysis of *Stylosanthes* cultivation under different cutting and phosphorus levels (mean of two years).

Treatment	Green forage yield (t ha^{-1})	Gross return (Rs. ha^{-1})	Additional Return (Rs. ha^{-1})	Common cost of cultivation (Rs. ha^{-1})	Additional cost due to treatments (Rs. ha^{-1})	Marginal return-cost ratio
***S. seabrana* 2534**						
Phosphorus x Cutting levels						
P_0C_1	8.19	9828.00	-	4359.36	-	-
P_0C_2	8.77	10524.00	696.00	4359.36	625.00	1.11
P_0C_3	8.37	10044.00	216.00	4359.36	1250.00	0.17
P_1C_1	9.22	11064.00	1236.00	4359.36	1687.00	0.73
P_1C_2	11.09	13308.00	3480.00	4359.36	2312.50	1.50
P_1C_3	12.39	14868.00	5040.00	4359.36	2937.50	1.72
P_2C_1	10.18	12216.00	2388.00	4359.36	3375.00	0.71
P_2C_2	11.80	14160.00	4332.00	4359.36	4000.00	1.08
P_2C_3	13.57	16284.00	6456.00	4359.36	4625.00	1.40
***S. seabrana* 104710**						
Phosphorus x cutting levels						
P_0C_1	4.96	5952.00	-	4359.36	-	-
P_0C_2	4.95	5940.00	-12.00	4359.36	625.00	- 0.02
P_0C_3	5.85	7020.00	1068.00	4359.36	1250.00	0.85
P_1C_1	6.81	8172.00	2220.00	4359.36	1687.00	1.32
P_1C_2	6.95	8340.00	2388.00	4359.36	2312.50	1.03
P_1C_3	7.90	9480.00	3528.00	4359.36	2937.50	1.20
P_2C_1	7.52	9024.00	3072.00	4359.36	3375.00	0.91
P_2C_2	7.39	8868.00	2916.00	4359.36	4000.00	0.73
P_2C_3	9.25	11100.00	5148.00	4359.36	4625.00	1.11

Selling price of green forage = Rs. 120 q^{-1}, Cost of P fertilizer = Rs. 4.50 kg^{-1} SSP
Labour charge = Rs. 62.50 man^{-1} unit

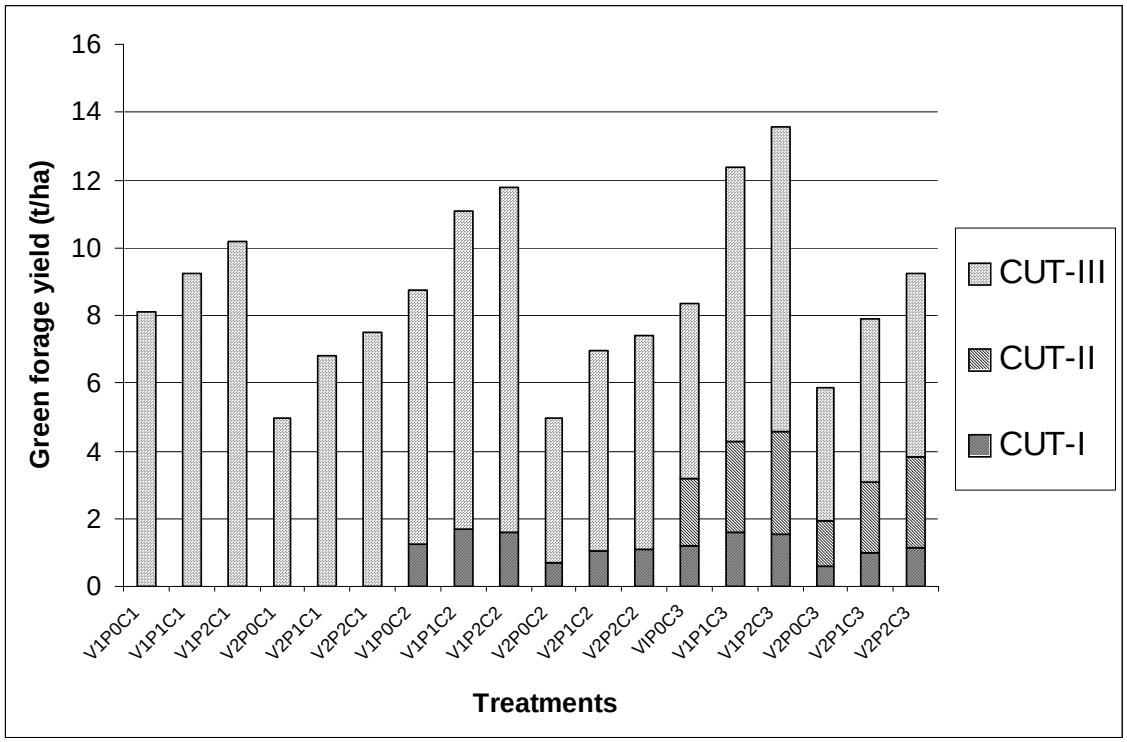

Fig. 1 : Green forage yield (t ha^{-1}) of *Stylosanthes* cultivars from individual cuts.

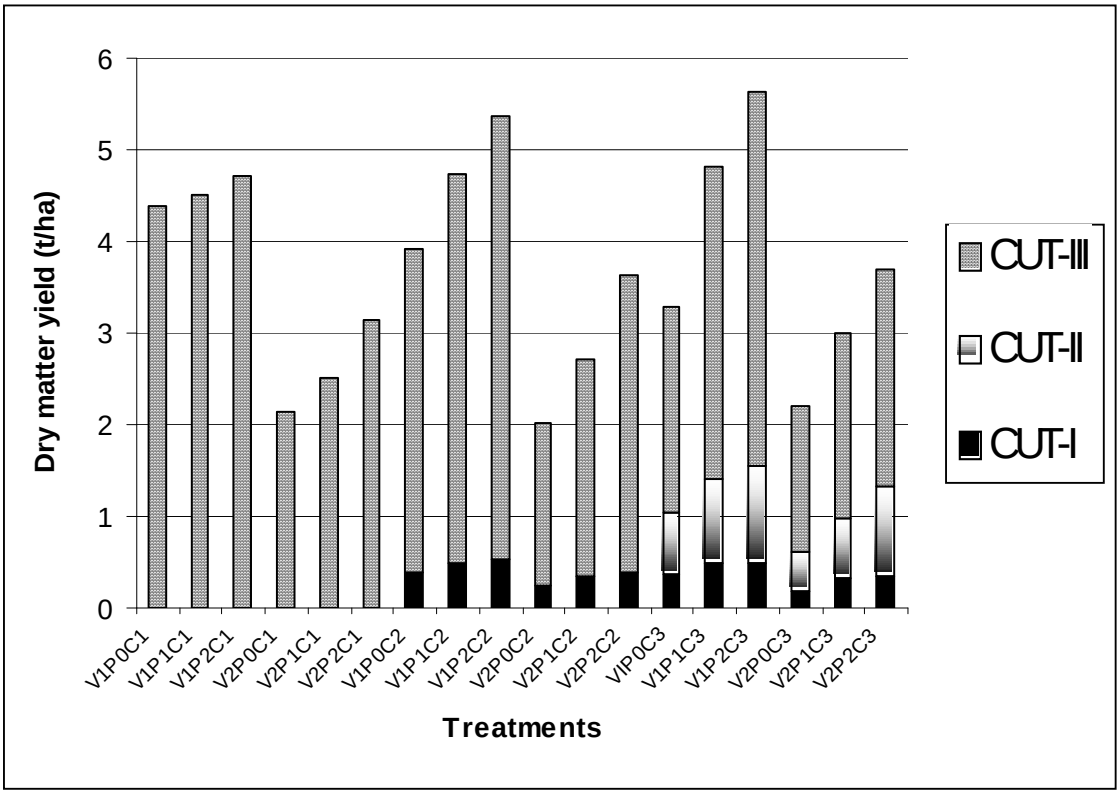

Fig. 2 : Dry matter yield (t ha^{-1}) of *Stylosanthes* cultivars from individual cuts.

RESULTS AND DISCUSSION

Growth parameters

Although the cultivars did not show any noticeable difference but phosphorus application was found to have significant bearing on plant height at different growth stages. Tomar (1992) also reported that plant height of different Stylo cultivars increased with increasing rates of phosphorus application. There was no remarkable increase in plant height between 119 and 168 DAS, owing to low temperature prevailing during this period. The treatments where cutting was being done (C_2 and C_3) the plant height were interrupted to show comparatively low value. At the time of third cutting at 217 DAS, the plant height was significant with respect to cutting as well as phosphorus levels.

The two cultivars differed significantly with respect to number of branches per plant at all the dates of observation. Cutting and phosphorus levels also had significant effect in both the cultivars. At 119 and 168 DAS, single cut treatment had significantly higher number of branches over 2 cut treatment. 3 cut treatment recorded the lowest value due to the intermediate cutting before winter and subsequent poor regeneration at lower temperature. At 217 DAS, the same trend was also observed but there was a quick recovery by 3 cut treatment.

Green forage yield

In the first cut, the cultivar S. seabrana 104710 responded better to higher dose of phosphorus application whereas S. seabrana 2534 gave higher yield only at 60 kg P_2O_5 ha^{-1}. In the 2nd cut, both the cultivars recorded higher green forage yield under 120 kg P_2O_5 ha^{-1} as compared to lower doses. In 3rd cut, which was done in all the treatments, maximum yield was observed in cultivar S. seabrana 2534 with 2 cuts and application of 120 kg P_2O_5 ha^{-1} (10.23 t ha^{-1}). Basak et al. (2003) also made similar observations regarding green forage yield.

Dry matter yield

In first cut, maximum dry matter yield was recorded in S. seabrana 2534 with 2 cutting levels and application of 120 kg P_2O_5 ha^{-1} (0.53 t ha^{-1}) and in 2nd cut, that of same phosphorus levels in 3 cuts in the same cultivar (1.06 t ha^{-1}). In 3rd cut, highest yield was obtained in S. seabrana 2534 with 2 cuts and 120 kg P_2O_5 ha^{-1} (4.84 t ha^{-1}) closely followed by that of same cultivar under single cut and 120 kg P_2O_5 ha^{-1} (4.71 t ha^{-1}). Similar range of dry matter yield was also observed by Rai and Patil (1985) and Maiti and Jan (1981).

Economics

Through gross return was maximum in both the cultivars at higher phosphorus level (120 kg P_2O_5 ha^{-1}) the additional cost involved with higher phosphorus application was proved to be uneconomic. On the other hand 3 cuttings in the growing period was more economic than lesser number of cuttings. Among all the treatments, *S. seabrana* 2534 with application of 60 kg P_2O_5 ha^{-1} and 3 cutting levels showed the highest marginal return-cost ratio (1.72) proving its economic advantage over others.

Thus growing of *Stylosanthes seabrana* 2534 with 60 kg P_2O_5 ha^{-1} and 3 cutting levels holds promise for higher and economical forage yield under Gangetic plains of West Bengal.

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