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RESPONSE OF GUINEA GRASS (*PANICUM MAXIMUM* JACQ.)-LEGUMES INTERCROPPING TO WEED CONTROL

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SUMMARY

A field experiment was conducted during 2006-11 on sandy loam soil at Central Research Farm of Indian Grassland and Fodder Research Institute, Jhansi to find out the response of Guinea grass-legumes intercropping to weed control in semi-arid rainfed conditions. Intercropping of *Stylosanthes seabrana* with Guinea grass produced significantly higher total green and dry forage yields (25.10 and 6.68 t/ha) than *Clitoria ternatea* (19.10 and 5.41 t/ha), *Macroptillium atropurpureum* (20.17 and 5.60 t/ha) and *S. hamata* (23.36 and 6.29 t/ha). Intercropping of *S. seabrana* with Guinea grass also resulted in significantly higher total crude protein yield (582.0 kg/ha) as compared to *C. ternatea* (457.7 kg/ha) and *M. atropurpureum* (474.9 kg/ha). In weed management practices, hand weeding 35 days after sowing in 1st year and 25 days after onset of monsoon rain from 2nd year onwards recorded significantly higher green forage, dry forage and crude protein yields of both Guinea grass (16.48 and 5.02 t/ha and 344.0 kg/ha) and legumes (9.05 and 2.0 t/ha and 271.8 kg/ha) than weedy check, pre-emergence application of pendimethalin @ 0.75 kg a.i./ha and weeding with weeder-cum-mulcher. Intercropping of *S. seabrana* with Guinea grass also resulted in significant improvement in organic carbon (0.48%) and available nitrogen (228 kg/ha) than *C. ternatea* and *M. atropurpureum.* Available nitrogen (226.2 kg/ha), phosphorus (9.91 kg/ha) and potash (195.8 kg/ha) also significantly increased in hand weeding plots than weedy check (211.3, 9.05 and 179.1 kg/ha).

Key words : *Clitoria ternatea*, forage yield and quality, intercropping, *Macroptillium atropurpureum, Panicum maximum*, soil nutrients status, *Stylosanthes hamata*, *S. seabrana*, weed control

In India, livestock rearing is one of the main occupations of the farmers in arid and semi-arid regions. Livestock population is increasing every year and there is ever increasing demand for quality forage. The major part of livestock feed is met either from crop by-products (rice straw/wheat bhusa/millet stover) or from the less nutritive grasses leading to low animal productivity. Feeding of livestock with high priced concentrates is not possible for all the farmers due to their poor economic conditions. It is, therefore, important that community lands, village grazing lands and marginal lands owned by the farmers should be put under pasture for forage from both the economic and resource conservation point of view (Yadav and Rajora, 1995). This approach would greatly reduce the hazards of soil erosion and mitigate the adverse effect of drought on animal population. In this context, Guinea grass (*Panicum maximum* Jacq.) and perennial forage legumes (*Stylosanthes seabrana, S. hamata, Macroptillium atropurpureum* and *Clitoria ternatea*) are most suitable species for higher quality forage production in semi-arid regions under rainfed conditions. However, when legumes grown with grasses their establishment and growth are often poor because of faster growth of weeds and their smothering effect during early stage of legumes growth. In view of these points, the present experiment was undertaken to find out the response of Guinea grass-legumes intercropping to weed control in semi-arid rainfed conditions.

MATERIALS AND METHODS

A field experiment was conducted during 2006-11 at Central Research Farm ($25^0 27'$ N latitude, $78^0 37'$ E longitude and 275 m above mean sea level) of Indian Grassland and Fodder Research Institute, Jhansi to find out the response of Guinea grass-legumes intercropping to weed control in semi-arid rainfed conditions. The soil of the experimental field was sandy loam, low in organic carbon (0.46 and 0.50) and available nitrogen (207.75 and 227.38 kg/ha) and medium in available phosphorus (10.20 and 10.70 kg/ha) and potash (149.36 and 163.30 kg/ha) in initial and last years, respectively. The total rainfall received was 553.8, 1267.1, 544.9 and 684.1 mm in 38, 52, 33 and 32 rainy days during 2007, 2008, 2009 and 2010, respectively. There were 16 treatment combinations replicated thrice in randomized block design. The treatment comprised four legumes (*S. hamata, S. seabrana*, *C. ternatea* and *M. atropurpureum*) and four weed management practices (weedy check, hand weeding–35 days after sowing in first year and 25 days after onset of monsoon rain from 2nd year onwards, weeding with weeder-cum-mulcher–35 days after sowing in first year and 25 days after onset of monsoon rain from 2nd year onwards and pre-emergence application of pendimethalin @ 0.75 kg a. i/ha in first year and just after one day of onset of monsoon rain from 2nd year onwards). The seedlings of Guinea grass were transplanted in the month of July 1 m apart and in between two rows of grasses-legumes were sown. Dry matter content was estimated by drying 500 g plant sample of each treatment and replication in hot-air oven at 70^0C, which led to computation of dry matter yield. The crude protein content of the fresh samples was estimated by the procedure of AOAC (1995).

RESULTS AND DISCUSSION

Effect of Legumes Intercropping with Guinea Grass

Intercropping of *S. seabrana* with Guinea grass produced significantly higher total green and dry forage yields (25.10 and 6.68 t/ha) than *C. ternatea* (19.10 and 5.41 t/ha), *M. atropurpureum* (20.17 and 5.60 t/ha) and *S. hamata* (23.36 and 6.29 t/ha). This was due to better survival and growth of *S. seabrana* over the years as compared to *S. hamata*, *M. atropurpureum* and *C. ternatea*. Edye *et al*. (1998) reported that *S. seabrana* was consistently superior to other *Stylosanthes* species in seedling and perennial plant density and yield particularly in the third year of the experiment and Basak *et al.* (2003) also reported that *S. seabrana* had the best overall yield performance out of 20 cultivars of *Stylosanthes* species were evaluated for their growth and yield performance. In total dry forage yields per cent contribution of *S. hamata, S. seabrana, M. atropurpureum* and *C. ternatea* was 30.52, 36.23, 23.39 and 20.15, respectively. Clem *et al*. (2001) found that *S. seabrana* was best adapted for use in permanent pastures as compared to various other legumes.

Crude protein yield (582.0 kg/ha) also increased significantly when Guinea grass intercropped with *S. seabrana* than intercropping with *C. ternatea* (457.7 kg/ha) and *M. atropurpureum* (474.9 kg/ha). This was due to higher dry matter yield obtained by intercropping of *S. seabrana* with Guinea grass than *M. atropurpureum* and *C. ternatea*. Intercropping of *S. seabrana* with Guinea grass also recorded significantly less number of weeds (48.18/m^2) and lower weed dry weight (82.45 g/m^2) as compared to *C. ternatea* (number of weeds 60.49/m^2 and weed dry weight 96.36 g/m^2). This was due to better survival and growth of *S. seabrana* over the years and their suppressing effect on weeds. Intercropping of *S. seabrana* with Guinea grass recorded maximum organic carbon (0.48%) and available nitrogen (228.0 kg/ha) in soil. While available phosphorus (9.75 kg/ha) and potash (194.8 kg/ha) were highest in plots where *C. ternatea* was intercropped with Guinea grass.

Effect of Weed Control

In weed management practices, hand weeding 35 days after sowing in 1st year and 25 days after onset of monsoon rain from 2nd year onwards recorded significantly higher green and dry forage yields of both Guinea grass (16.48 and 5.02 t/ha) and legumes (9.05 and 2.0 t/ha) than weedy check, pre-emergence application of pendimethalin @ 0.75 kg a. i./ha and weeding with weeder-cum-mulcher (Table 1). Higher yield was also obtained in maize-legume intercropping system by hand weeding treatment compared to weedy check (Chalka and Nepalia, 2005). Liu and Revell (2002) indicated that after removal of weeds, the legume component had the ability to grow better than weedy check. Crude protein yield (615.8 kg/ha) also increased significantly when hand weeding was done at 35 days after sowing in 1st year and 25 days after onset of monsoon rain from 2nd year onwards than weedy check, pre-emergence application of pendimethalin @ 0.75 kg a. i./ha and weeding with weeder-cum-mulcher (Table 2). Moyer *et al*. (2003) also reported that removal of weeds resulted in higher protein yield than weed infested plots.

TABLE 1

Effect of legumes and weed management practices on green and dry forage yields of Guinea grass based pasture (Mean of four years)

Treatment	Green forage yield (t/ha)			Dry forage yield (t/ha)		
	Guinea grass	Legumes	Total	Guinea grass	Legumes	Total
Guinea+Legumes						
G+*S. hamata*	14.64	8.72	23.36	4.37	1.92	6.29
G+*S. seabrana*	14.25	10.85	25.10	4.26	2.42	6.68
G+*M. atropurpureum*	14.02	6.15	20.17	4.29	1.31	5.60
G+*C. ternatea*	14.05	5.05	19.10	4.32	1.09	5.41
S. Em±	0.40	0.18	0.49	0.11	0.04	0.15
C. D (P=0.05)	NS	0.53	1.41	NS	0.12	0.42
Weed control						
Weedy check	12.36	6.57	18.93	3.76	1.43	5.18
Pendimethalin 0.75 kg a.i./ha	13.47	7.22	20.69	4.08	1.58	5.66
Weeder-cum-mulcher	14.40	7.78	22.18	4.39	1.72	6.11
Hand weeding	16.48	9.05	25.53	5.02	2.00	7.02
S. Em±	0.40	0.18	0.49	0.11	0.04	0.15
C. D. (P=0.05)	1.14	0.53	1.41	0.31	0.12	0.42

NS–Not Significant.

TABLE 2

Effect of legumes and weed management practices on crude protein yield, number of weeds and weed dry weight in Guinea grass based pasture (Mean of four years)

Treatment	Crude protein yield (kg/ha)			No. of weeds/m^2	Weed DW (g/m^2)
	Guinea grass	Legumes	Total		
Guinea+Legumes					
G+*S. hamata*	296.6	250.4	547.0	50.97	85.91
G+*S. seabrana*	289.0	293.0	582.0	48.18	82.45
G+*M. atropurpureum*	288.7	186.2	474.9	53.01	90.47
G+*C. ternatea*	289.3	168.4	457.7	60.49	96.36
S. Em±	9.6	6.8	16.8	2.18	3.98
C. D. (P=0.05)	NS	19.5	48.5	6.28	11.45
Weed control					
Weedy check	249.5	188.2	437.7	69.49	117.68
Pendimethalin 0.75 kg a.i./ha	275.1	201.3	476.4	59.96	101.13
Weeder-cum-mulcher	295.0	236.8	531.8	51.26	87.12
Hand weeding	344.0	271.8	615.8	31.81	49.56
S. Em±	9.6	6.8	16.8	2.18	3.98
C. D. (P=0.05)	27.5	19.5	48.5	6.28	11.45

NS–Not Significant.

Hand weeding also resulted in significantly less number of weeds (31.81/m^2) and lower weed dry weight (49.56 g/m^2) than weedy check, pre-emergence application of pendimethalin @ 0.75 kg a. i./ha and weeding with weeder-cum-mulcher (Table 2). Decrease in weed count and weed dry weight by hand weeding was also reported by Sharma and Gill (2005). The common weeds found and removed from the experimental field were *Cynotis* sp., *Commelina benghalensis, Leucas aspera, Cassia tora, Phyllanthus niruri, Borreria hispida, Fimbristylis diphylla, Parthenium hysterophorus, Celosia argentea, Ipomea pestigridis, Digera arvensis, Tridax procumbence, Sida acuta, Cyperus rotundus, Coculus* sp., *Miremia emarginata, Miremia triandra* and *Borreria stricta.* Among weed management practices, hand weeding recorded maximum available nitrogen (226.2 kg/ha), phosphorus (9.91 kg/ha) and potash (195.8 kg/ha). While organic carbon (0.51%) was highest in weedy check plots.

TABLE 3
Effect of legumes intercropping and weed management practices on soil organic carbon and available nutrients of soil of Guinea grass based pasture (Mean of four years)

Treatment	Organic carbon (%)	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)
Guinea+Legumes				
Guinea+S. hamata	0.46	222.8	9.26	183.3
Guinea+S. seabrana	0.48	228.0	9.22	179.6
Guinea+M. atropurpureum	0.44	213.9	9.58	189.1
Guinea+C. ternatea	0.42	208.9	9.75	194.8
S. Em±	0.01	4.8	0.18	3.7
C. D. (P=0.05)	0.02	13.86	0.52	10.68
Weed control				
Weedy check	0.51	211.3	9.05	179.1
Pendimethalin 0.75 kg a. i./ha	0.45	215.9	9.09	183.5
Weeder-cum-mulcher	0.44	220.2	9.76	188.4
Hand weeding	0.41	226.2	9.91	195.8
S. Em±	0.01	4.8	0.18	3.7
C. D. (P=0.05)	0.02	13.86	0.52	10.68

CONCLUSION

Based on the results it can be concluded that intercropping of Guinea grass with *S. seabrana* along with hand weeding 35 days after sowing in first year and 25 days after onset of monsoon rain from 2nd year onwards in sandy loam soil was found adequate for higher productivity and quality of forage and improvement in soil nutrients status under semi-arid rainfed conditions. In legumes, *S. seabrana* had better ability to compete with weeds and performed well in association with Guinea grass under semi-arid rainfed conditions.

REFERENCES

AOAC. 1995 : *Official Methods of Analysis,16th edn*. Association of Official Analytical Chemists, Arlington, VA, USA. pp. 69-88.

Basak, N. S., M. K. Nanda, and A. K. Mukherjee. 2003 : Performance of *Stylosanthes* cultivars in the new alluvial zone of West Bengal. *Forage Res*., **28** : 223-227.

Chalka, M. L., and V. Nepalia, 2005 : Production potential and economics of maize (*Zea mays*) intercropped with legumes as influenced by weed control. *Indian J. Agron.*, **50** : 119-122.

Clem, R. L., N. J. Brandon, M. J. Conway, C. R. Esdale, and R. M. Jones, 2001 : Early stage evaluation of tropical legumes on clay soil at three sites in central and southern inland Queensland. *Trop. Agric. Tech. Memorandum*, **7** : 25.

Edye, L. A., T. J. Hall, R. L. Clem, T. W. G. Graham, W. B. Messer, and R. H. Rebgetz. 1998 : Sward evaluation of eleven "*Stylosanthes seabrana*" accessions and *S. scabra* cv. Seca at five sub-tropical sites. *Trop. Grasslands*, **32** : 234-251.

Liu, Anyou, and C. Revell. 2002 : Effect of early application of bromoxynil on the population dynamics of a regenerating pasture species mixture. In : 13th Australian Weeds Conference : Weeds "threats now and forever", Perth, Western Australia, 8-13 Sept. (Edited by Jacob, H. S., Dodd, J. and Moore J. H.).

Moyer, J. R., S. N. Acharya, Z. Mir, and R. C. Doram, 2003 : Weed management in irrigated fenugreek grown for forage in rotation with other annual crops. *Canadian J. Plant Sci.*, **83** : 181-188.

Sharma, K. C., and S. C. Gill, 2005 : Effect of integrated weed management in lucerne (*Medicago sativa*) in arid region of Rajaisthan. In : *Abstr.* National Symposium on Advances in Forage Research and Sustainable Animal Production held at CCSHAU, Hisar, August 29-30. p. 65.

Yadav, M. S., and M. P. Rajora, 1995 : In : *New Vistas in Forage Production*, C. R. Hazra, and Bimal Misri (eds.). All India Coordinated Research Project on Forage Crops. Indian Grassland and Fodder Research Institute, Jhansi (U. P.), India. pp. 97-112.