International Journal of Agriculture, Environment & Biotechnology
Citation: IJAEB: 7(4): 805-810 December 2014
DOI Number: 10.5958/2230-732X.2014.01390.4

AGRONOMY

Screening of Weed Competitive Cultivars of Summer Green-gram in Lateritic Soil of West Bengal

B. Duary[1], M. Das[1], K. Charan Teja[1] and M. K. Bhowmick[2]

[1]Institute of Agriculture, Visva-Bharati, Sriniketan, Birbhum, West Bengal, India
[2]Rice Research Station (Govt. of W.B.), Chinsurah (R.S.), Hooghly, West Bengal, India

Corresponding author: bduary@yahoo.co.in

Paper No. 271 Received: 17 October, 2014 Accepted: 16 November, 2014 Published: 18 December, 2014

Abstract

A field experiment was conducted in two consecutive summer seasons of 2008 and 2009 at the Institute of Agriculture, Visva-Bharati, Sriniketan, West Bengal to screen out the weed competitive Green-gram cultivars. Experimental plots were infested with grassy, broadleaved and sedge weeds. *Digitaria sanguinalis* among grasses, *Croton bonplandianum* among broad leaved and *Cyperus rotundus* among sedges were most predominant throughout crop season. Losses in seed yield of green-gram due to weed infestation ranged from 7 to 37%. Among the cultivars, the plots of 'WBM 34-1-1', 'WBM 04-5' and 'PDM 54' registered lower number as well as dry weight of grasses, broadleaved, sedges and total weeds at 45 days after sowing (DAS) under both weedy and one hand weeding situations. These cultivars also recorded higher values of yield attributes and seed yields. Yield components *viz.* number of pods/plant, seeds/pod, test weight as well as seed yield were significantly reduced in weedy situation, compared with one hand weeding at 30 DAS in all the cultivars excepting 'PDM 54' and 'WBM 04-5', where no significant reduction due to weed competition was recorded, indicating higher weed competitive abilities of both the cultivars. The cultivars 'WBM 34-1-1', 'WBM 04-5' and 'PDM 54' appeared to be promising towards suppressing weeds and producing higher seed yields in lateritic soil of West Bengal.

Highlights

- Competitive crop cultivars are an important cost-effective tool for the management of weeds causing yield reduction to the extent of 7-37% in summer greengram.
- 'PDM 54', 'WBM 04-5' and 'WBM 34-1-1' were identified as promising weed competitive greengram cultivars.

Keywords: Greengram, weed competitive cultivars, summer season, yield reduction

In India, the food grain production has increased from 82 million tonnes (mt) in 1961-62 to 257 mt in 2011-12 (Ayyappan, 2012). The country holds the pride of being world's largest producer of pulses, contributing 17-18 mt to the global pulse basket. There was a record production of 18.09 mt in an area of 26.28 million hectares (m ha) during 2010-11 (Ali *et al*., 2012). But it is still short of the present consumption level. As a result of which the country is forced to import pulses to the tune of 2.0-2.5 mt. Pulses have a unique property of maintaining and restoring soil fertility through biological nitrogen fixation as well as improving physical properties of soil by virtue of their deep root system (Neelam *et al*. 2014). Among them, green-gram [*Vigna radiata* (L.) Wilczek] is an important short duration grain legume having wide adaptability and low input requirement. Even the crop is well suited to a large number of cropping systems and constitutes an important source of high quality protein in the cereal-based

diets of many people in Asia (Kaur and Sharma, 2013). In India, it is grown in 2.76 m ha in almost all the states with an average productivity of only 317 kg/ha. One of the reasons for such a low productivity is its casual cultivation on marginal lands without caring for weed management. Weed competition may result upto about 53% yield reduction in green-gram (Kundu *et al.*, 2011). Considering the diversity of weed problem, no single method of weed control can reach the desired level of efficiency under all situations. As an important component of integrated weed management, increasing crop cultivar competitiveness may be an attractive low-cost weed management strategy, which is easy to deliver to the farmers. But in India, much work has not yet been done on screening of weed competitive crop cultivars in general and particularly in pulses. There are some green-gram cultivars which have dense foliage, making them able to compete with weeds and to prevent yield reduction at minimum extent. Besides, there are some cultivars which may have allelopathic effect on weeds with which they can compete with weeds and do not allow them to grow much in their vicinity. In this perspective, the present experiment was carried out in lateritic belt of West Bengal to screen out the weed competitive green-gram cultivars during summer season.

Materials and Methods

A field experiment was conducted in two consecutive summer seasons of 2008 and 2009 at Agricultural Farm, Institute of Agriculture, Visva-Bharati, Sriniketan, Birbhum, West Bengal, situated at 23°39/ N latitude and 87°42/ E longitude with an altitude of 58.9 m above mean sea level. The experimental site was situated in sub-humid sub-tropical lateritic belt of the state. Mean maximum temperature ranged from 31.98 to 37.33°C during crop season (March-May) while mean minimum temperature varied from 18.21to 25.56°C. The prevailing climatic condition in the season was more or less congenial for the growth and development of green-gram. The relative humidity during crop growing period varied from 81.86 to 95.00%, while the long term average of relative humidity varied from 55.75 to 71.14%. It was observed that the average relative humidity in the crop season was quite higher than the long term average. The soil of the experimental plot was loamy sand in texture, acidic in soil reaction with low level of organic carbon and available nitrogen, but medium level of available P_2O_5 and K_2O. Weed competitiveness of six green-gram cultivars was evaluated under two different situations– one under weedy and another with hand weeding (HW) at 30 days after sowing (DAS). Altogether there were twelve different treatment combinations *viz*. 'B 1' ('Sonali') - weedy, 'B 105' ('Panna') - weedy, 'PDM 84-139' ('Samrat') - weedy, 'WBM 34-1-1' ('Bireshwar') - weedy, 'PDM 54' - weedy, 'WBM 04-5' ('Sukumar') - weedy, 'B 1' ('Sonali') - one HW, 'B 105' ('Panna') - one HW, 'PDM 84-139' ('Samrat') - one HW, 'WBM 34-1-1' ('Bireshwar') - one HW, 'PDM 54' - one HW, 'WBM 04-5' ('Sukumar') - one HW. These treatments were assigned in a randomized block design with three replications. The crop was fertilized with a basal dose of 20 kg N, 40 kg P_2O_5 and 40 kg K_2O/ha. Seeds of different cultivars were sown in lines at a row spacing of 25 cm and plant spacing of 10 cm with a seeding depth of 5-6 cm. As per the requirement of the crop, two irrigations were applied, considering the occurrence of rainfall. The crop was irrigated by border strip method. Population of different categories of weeds at 15, 30 and 45 DAS was recorded by placing the quadrat of 50 cm × 50 cm at pre-determined locations in the sampling area. The values were converted to number/m^2. Grasses, broadleaved and sedges were counted separately and their sum was used to obtain total weed population. The weed samples for dry weight were collected from the area used for weed count on the same dates (15, 30 and 45 DAS).

Results and Discussion

Weed Flora

The experimental plots were infested with sixteen different weed species under three categories and nine families. *Digitaria sanguinalis, Cynodon dactylon, Dactyloctenium aegyptium, Echinochloa colona*, self-sown rice (grasses); *Cyperus rotundus, C. iria, C.*

differmis (sedges); and *Croton bonplandianum, Physalis minima, Cleome viscosa, Amaranthus spinosus, Solanum nigrum, Euphorbia hirta, Heliotropium indicum* and *Ludwigia parviflora* (broadleaved) were recorded. *Croton bonplandianum* among broadleaved, *Digitaria sanguinalis* among grasses and *Cyperus rotundus* among sedges were most predominant weeds throughout the crop season.

Effect on Weeds

Weed density in green gram field *i.e.* number of grasses, sedges, broadleaved and total weeds/m^2 differed significantly with different cultivars under weedy as well as hand weeded plots. Grassy weed population at 45 DAS was significantly minimum in the plots of 'PDM 54' under weedy as well as with hand weeding, which was followed by 'WBM 04-5' (Table 1). It clearly indicated the grassy weed suppressing ability of these cultivars. The cultivar 'PDM 84-139' under weedy situation registered significantly the highest number of grassy weeds and of total weeds which was statistically at par with that of 'B 105' and 'B 1' under weedy situation. Similar results were observed in case of sedge and broadleaved population. When one hand weeding was applied at 30 DAS, weed density at 45 DAS did not vary significantly among the cultivars. Weed dry weight also varied significantly with different treatments. The lowest dry weight of grasses, sedges, broadleaved and total weeds under weedy situation was recorded in the plots of 'PDM 54', followed by 'WBM 04-5' and 'WBM 34-1-1'. The highest dry weight of total weeds and grasses was observed under 'PDM 84-139', which was statistically at par with 'B 1' under weedy situation. No significant difference was observed at 45 DAS in respect to dry weight of grasses, sedges, broadleaved and total weeds among different cultivars when hand weeding was applied at 30 DAS.

Table 1. Weed density and weed dry weight at 45 DAS as influenced by different treatments (Pooled data)

Treatments	Weed density (No./m^2)				Weed dry weight (g/m^2)			
	Grass	Sedge	BLW	Total	Grass	Sedge	BLW	Total
B 1 - weedy	75.34	23.47	86.67	185.48	122.28	7.62	41.33	171.23
B 105 - weedy	76.80	32.00	77.60	186.40	131.74	10.35	75.15	217.23
PDM 84-139 - weedy	85.74	23.47	77.34	186.55	186.26	5.14	46.82	238.22
WBM 34-1-1 - weedy	64.40	24.00	68.54	156.94	82.47	4.77	24.95	112.19
PDM 54 - weedy	60.40	13.47	53.87	127.74	58.90	3.40	11.64	73.94
WBM 04-5 - weedy	74.80	14.40	61.60	150.80	82.47	6.41	22.17	111.05
B 1 - HW	12.80	5.60	11.47	29.87	3.52	1.35	2.04	6.91
B 105 - HW	9.20	5.60	9.87	24.67	1.57	1.32	1.35	4.24
PDM 84-139 - HW	10.80	4.27	9.60	24.67	3.45	1.29	2.15	6.88
WBM 34-1-1 - HW	9.07	6.14	10.67	25.88	2.27	1.24	3.08	6.59
PDM 54 - HW	10.40	5.60	9.60	25.60	4.07	1.27	1.69	7.02
WBM 04-5 - HW	8.94	2.40	8.27	19.61	3.38	1.13	1.65	6.15
LSD (0.05)	5.27	2.46	5.36	8.83	10.51	0.56	3.15	11.95

(BLW) Broadleaved weed, (DAS) Days after sowing, (HW) Hand weeding at 30 DAS

The cultivars 'PDM 54', 'WBM 34-1-1' and 'WBM 04-5' not only kept the grasses, broadleaved, sedges as well as total weed population in lower level than that of other cultivars, but also lowered down the dry weight of weeds. This clearly indicated that these three cultivars had more weed suppressing ability than the others in summer season. Similar findings were also reported by Mishra *et al*. (2004).

Effect on Productivity

The pod length, yield components (number of pods/plant, number of seeds/ pod, test weight), seed yield and stover yield of green-gram varied significantly among the treatments. The cultivar 'WBM 34-1-1'registered significantly the highest pod length and test weight when grown with one hand weeding at 30 DAS, which was statistically at par with that of 'B 105' with one HW at 30 DAS. The cultivars 'B 105', 'PDM 54', 'WBM 04-5' and 'WBM 34-1-1'with one HW registered the higher number of pods/plant and seeds/pod. Number of pods/plant, seeds/pod and test weight were significantly reduced in weedy situation, compared with one HW at 30 DAS, in all the cultivars excepting 'PDM 54' and 'WBM 04-5', where no significant reduction due to weed competition was recorded, indicating the higher weed competitive ability of both the cultivars (Table.2). The crop cultivars under weedy situation faced weed competition for nutrients, light, water and space throughout the crop growth period, resulting in lower values of growth and yield attributes and ultimately the yield. The results were in agreement with the findings of Moorthy and Dubey (2004).

The reduction in the values of yield attributes like number of pods/plant, seeds/pod, test weight and seed yield in weedy plots over one HW was the lowest with cultivar 'PDM 54', followed by 'WBM 04-5' as evident in Table 3. The yield improvement by one HW was higher in cultivars 'PDM 84-139' (36.57%) and 'B 1' (34.22%) as compared to weedy

Table 2. Length of pod, yield attributes and yields of greengram as influenced by different treatments (Pooled data)

Treatments	Pod length (cm)	Plant population (No./m^2)	Pods/plant	Seeds / pod	Test weight (g)	Seed yield (Kg/ha)	Stover yield (Kg/ha)
B 1 - weedy	5.96	35	10.20	8.20	21.34	628	1284
B 105 - weedy	7.13	33	7.80	9.50	35.97	886	1795
PDM 84-139 - weedy	6.14	35	8.50	7.50	27.69	633	1412
WBM 34-1-1 - weedy	7.12	35	7.00	8.60	54.27	1143	1975
PDM 54 - weedy	7.32	36	8.60	9.20	28.12	804	2086
WBM 04-5 - weedy	6.95	34	9.80	8.00	35.42	944	1585
B 1 - HW	6.55	36	12.40	8.70	22.69	834	1428
B 105 - HW	7.88	35	10.20	10.20	38.33	1347	2029
PDM 84-139 - HW	6.72	35	11.13	8.70	30.47	998	1719
WBM 34-1-1 - HW	8.23	36	8.50	8.80	57.72	1491	2183
PDM 54 - HW	7.75	35	9.20	9.30	29.32	866	2235
WBM 04-5 - HW	7.23	35	10.53	8.10	36.93	1039	1708
LSD (0.05)	0.45	NS	1.93	1.63	2.37	131.1	218.9

(BLW) Broadleaved weed, (HW) Hand weeding at 30 DAS, (NS) Not significant

Table 3. Per cent reduction of yield attributes under weedy situation over hand weeding in greengram (Pooled data)

Cultivars	Pods/plant	Seeds/pod	Test weight	Seed yield
B 1	17.74	5.75	5.96	24.70
B 105	23.53	6.86	6.16	34.22
PDM 84-139	23.65	13.79	9.10	36.57
WBM 34-1-1	17.65	2.27	5.98	23.34
PDM 54	6.52	1.08	4.09	7.16
WBM 04-5	6.96	1.23	4.10	9.14

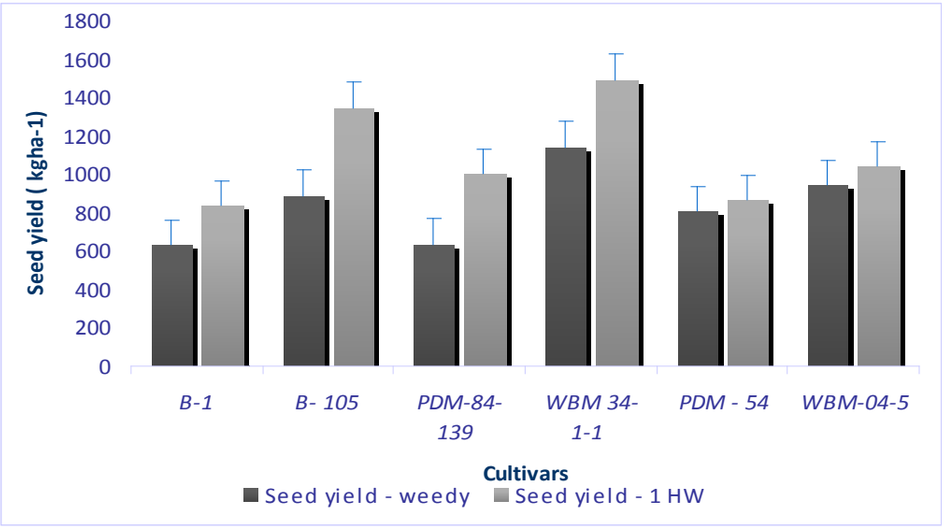

Figure 1. Seed yields of greengram cultivars under weedy and hand weeded plots

situation, whereas it was lower in 'PDM 54' (7.16%) and 'WBM 04-5'(9.14%), indicating better weed competitive ability of these two cultivars (Table 3; Figure 1). The cultivar 'WBM 34-1-1'recorded significantly the highest seed yield among all the cultivars tested under both hand weeding and weedy situations, followed by 'WBM 04-5', 'B 105' and 'PDM 54' (Table 2). The cultivars 'B 1' and 'PDM 84-139' under weedy situation registered lower seed yields. Similar results were also observed in case of stover yield. The results were in conformity with the findings of Mishra *et al.* (2004) and Moorthy and Dubey (2004).

Conclusion

The study indicated that yield reduction due to weed competition in green-gram ranged from 7.16% in 'PDM 54' to 36.57% in 'PDM 84-139'. The cultivars 'PDM 54', 'WBM 04-5' and 'WBM 34-1-1' kept the broadleaved, grasses, sedges as well as total weed population at lower levels and registered higher seed yields than the others. This clearly showed that these three cultivars might possess more weed suppressing ability in summer season. Being more competitive with weeds, the cultivars 'PDM 54', 'WBM 04-5' and 'WBM 34-1-1' may be recommended for cultivation in lateritic belt of West Bengal.

References

Ali, M., N. Kumar and P. K. Ghosh. 2012. Milestones on agronomic research in pulses in India. *Indian Journal of Agronomy* **57** (3rd IAC special issue): 52-57.

Ayyappan, S. 2012. Indian Agriculture- the way forward. *In:* Souvenir of Third International Agronomy Congress on

Agriculture Diversification, Climate Change Management and Livelihoods, Organised by ISA and ICAR, New Delhi, Nov, 26-30, 2012. p. i.

Kaur, N. and Sharma, P. 2013. Exploitation of rhizobacteria for functional traits in mungbean. *International Journal of Agriculture, Environment and Biotechnology* **6** (4): 533-543.

Kundu, R., Bera, P. S., Brahmachari K. and Mallick, R. 2011. Integrated weed management in summer greengram (*Vigna radiata (L.) Wilczek*) under gangetic alluvial soil of West Bengal. *Journal of Botanical Society Bengal* **65**(1): 35-43.

Mishra, J. S., Singh, V. P., Moorthy B. T. S. and Yaduraju, N. T. 2004. Weed suppressing ability of pea cultivars. *Indian Journal of Weed Science* **36** (3 and 4): 282-284.

Moorthy, B. T. S. and Dubey, R. P. 2004. Performance of chickpea cultivars under sub-optimal and optimal weed management conditions. *Indian Journal of Weed Science* **36** (3 and 4): 274-275.

Neelam, K. P. S. Kushwaha and Upadhyay V. 2014. Screening of urdbean germplasm for resistance against Rhizoctonia solani Kühn causing web blight disease. *International Journal of Agriculture, Environment and Biotechnology* **7**(2): 293-298.