The Bioscan 9(4): 1593-1596, 2014
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

INTEGRATED WEED MANAGEMENT IN BLACKGRAM (*VIGNA MUNGO* L.) AND ITS EFFECT ON SOIL MICROFLORA UNDER SANDY LOAM SOIL OF WEST BENGAL

RAJIB DAS*, B. C. PATRA, M. K. MANDAL[1] AND ANIMESH PATHAK[2]
Department of Agronomy, Bidhan Chandra Krishi Viswavidyalaya,
Mohanpur - 741 252, Nadia, West Bengal, INDIA
[2] Department of Seed Science and Technology,
Bidhan ChandraKrishi Viswavidyalaya,Mohanpur, Nadia - 741 252, West Bengal, INDIA
e-mail: rajibdasagro@gmail.com

KEYWORDS
Integrated
Weed dynamics
Weed control efficiency
Blackgram
Soil microflora

Received on :
21.09.2014

Accepted on :
17.12.2014

***Corresponding author**

ABSTRACT

The experiment was conducted in randomized block design (RBD) with 7 treatments in 3replications. Treatments comprised of T_1-Pendimethalin @ 1.5 lit/ha, T_2-Fluchloralin @ 1.5 lit/ha, T_3-Pendimethalin @ 1.5 lit/ha + hand weeding at 25 DAS, T_4-Fluchloralin @ 1.5 lit/ha + hand weeding at 25 DAS, T_5-Two hand weeding at 15 and 25 DAS,T_6-Weedy check. Result showed that T_5 recorded lowest weed population (84.1 no/m^2 and 55.5 no/m^2) and dry weight (13.23 and 10.57 g/m^2) which was significantly superior over rest of the treatments. Though weed control efficiency (85.53%) and seed yield (1.441 t/ha), stover yield (3.419 t/ha) were highest under treatment T_5but net return per rupee investment (2.2) was highest under T_3 as compared to other weed control treatments. There were no significant variations on the microbial population of the soil in the *rhizospere* region of the blackgram due to the application of testing herbicide.

INTRODUCTION

Blackgram is an important pulse crops in intensive cropping system of India due to its short growing duration but the average yield of blackgram is very low. Besides growing of this crop on marginal land, heavy weed infestation is the dominant reason for such a low yield of black gram (Rao *et al.*, 2010). In general, yield loss due to uncontrolled weed growth in black gram ranges from 27 to 100% (Singh and Singh, 2010). Blackgram is less competitive against many weeds during early stage of crop and the most sensitive period of weed competition is between 15 to 45 days after sowing. Various methods like cultural, mechanical, biological and chemicals are used for weed control (Fand *et al.*, 2013). The chemical weed control method is becoming popular among the farmers as they continue to realize the usefulness of herbicides, larger quantities would be applied to the soil. But the fate of these compounds in the soil is becoming increasingly important since they can be leached down, in which case groundwater is contaminated or if immobile, they would persist on the top soil (Ayansina *et al.,* 2003). These herbicides can then accumulate to toxic levels in the soil and become harmful to microorganisms, plants, and wildlife and even human (Chum *et al.,* 2010). Therefore, present research work was conducted with the objectives to study the integrated weed management in blackgram and its effect on soil microflora during *pre-kharif* season.

MATERIALS AND METHODS

Field studies were conducted during *pre-kharif* season of 2012 and 2013 at 'C' block research farm of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia and West Bengal. The soil of the experimental was sandy loam with(6.95 PH), available N 233 kg/ha, P_2O_5 24.53 kg/ha andK_2O 303.52 kg/ha. There were six treatments which replicates thrice.The experiment was laid down in randomized block design. blackgram variety 'PANT U 31' was shown on 15th March during 2012 and 20th March 2013 in row 30 cm apart, using 25 kg/ha seeds. Crop was fertilized 40 kg N, 30 kg P_2O_5 and 20 kg K_2O as basal dose. The N,P and K nutrients were applied through urea, diamonium phosphate (DAP) and muriate of potash, respectively. Weed density and weed dry weight were recorded at 25, 50 days after sowing with the help of 0.5 x 0.5m quadrate by throwing randomly at three places in each plot. Weeds were removed and counted species wise. Weed control efficiency was also calculated as suggested by Maity and Mukherjee (2011). Soil samples from the experimental plots were collected on different dates *viz.* initial (pretreatment), 5 days after application (DAA), 15 DAA, 30 DAA and at harvest of applying herbicides. The enumeration of the microbial population was done on agar plants containing appropriate media following serial dilution technique and pours plate method (Pramer and Schmidt, 1965).The data were subjected to statistical analysis by analysis of variance method (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effects on weed

The experimental field was dominated by natural infestation of broad leaf weed (BLW) like *Ageratum conyzoids, Boreria hispida, Commelina banghalensis* and grasses like *Echinochloa colona, Cynodon dactylon, Paspalum scrobiculatum, Digiteria sanguinalis* and sedges like *Cyperus rotundus*. Among the weed flora averaged over two years and various treatments, the maximum relative percentage was of *Ageratum conyzoids* (43.25%) followed by *Boreria hispida* (27.8%) and *Cynodon dactylon* (17.3%). The maximum weed density and weed dry weight was recorded in weedy check followed by fluchloralin @ 1.5 lit/ha are given in table 1. The lowest weed density was recorded in hand weeding twice followed by pendimethalin @ 1.5 lit/ha and one hand weeding at 25 DAS (Table 1). Weed dry weight reflects the growth potential of the weeds and is a better indicator of its competitive ability with the crop plants. Un-weeded check recorded the highest weed growth and weed biomass. In general, sequential treatments were found to be superior to individual application of herbicides because at the preliminary stage pre emergence herbicides prevent or kill the germinated weed seeds and hamper weed growth followed by hand weeding suppress weed growth and provide a favorable environment for crop (Rao *et al.*, 2010). Weed control efficiency of hand weeding twice and pendimethalin @ 1.5 lit/ha + one hand weeding at 25 DAS were 85.53%, 79.79%respectively over weedy check as hand weeding at 15 DAS effectively prevent or control early emerged weeds followed by hand weeding at 25 DAS control the later emerged weeds (Yadav *et al.*, 2004).

Effect on Crop

All growth characters like plant height, leaf area index (LAI), dry matter accumulation; nodule number and nodule dry weight and yield components like branch/plant, pods/plant, seeds/pod, and seed yield, stover yield recorded higher values in hand weeding twice and integrated weed management plots (Table 1and Table 2). Weed management practices had a significant impact on nodulation. Herbicide application had no deleterious effect on nodule number and their weight. More nodule and higher nodule dry weight was recorded when plants were subjected to hand weeding twice as better growth attributes and aerobic condition created by hand weeding, induced higher accumulation and translocation of photosynthates to different plant parts, which helped the plant to develop more nodules (Raman *et al.*, 2005). Crop parameters like branch/plant (6.9), pods/plant (40.7), seeds/pod (11.5) was found highest under twice hand weeded treatment (Table 2). The control plot recorded lowest branch/plant (4.8), pods/plant (29.8), seeds/pod (10.3). Seed yield (1.441 t ha^{-1}), stover yield (3.419 t ha^{-1}) were highest under twice hand weeded

Table 1: Effect of different weed management practices on weed density, weed dry weight, weed control efficiency, growth characters and nodulation of black gram (pooled data of two years)

Treatment	Weed density (No./m^2)		Weed dry weight (g/ m^2)		Weed control efficiency (%) at 25 DAS	Weed control efficiency (%) at 50 DAS	Leaf area index	Total dry matter (g/ m^2)	Nodules/ Plant	Nodules dry weight (mg/Plant)
	25 DAS	50 DAS	25 DAS	50 DAS						
T_1	12.2(148.3)	14.9 (221.4)	16.63	31.32	53.55	57.29	5.4	33.13	16.07	99.54
T_2	13.6(184.4)	15.8 (249.2)	17.45	34.23	51.26	53.33	5.1	30.23	15.54	86.53
T_3	10.8 (116.1)	9.2 (84.1)	14.01	14.82	60.87	79.79	6.1	32.59	16.77	108.54
T_4	11.8 (138.7)	9.9 (97.5)	15.23	17.34	57.46	76.36	5.8	30.83	16.61	101.58
T_5	9.1 (84.1)	7.5 (55.5)	13.23	10.57	63.04	85.53	6.8	37.54	17.37	116.07
T_6	16.8(285.1)	24.4(598.7)	35.8	73.34	0.00	0.00	4.1	19.83	13.47	74.17
SEm (±)	0.24	0.34	0.37	0.46	-	-	0.16	0.54	0.63	2.21
CD (P=0.05)	0.77	1.05	1.15	1.34	-	-	0.51	1.72	1.85	6.02

T_1- Pendimethalin @ 1.5 lit/ha, T_2- Fluchloralin @ 1.5 lit/ha, T_3- Pendimethalin @ 1.5 lit/ha + hand weeding at 25 DAS, T_4- Fluchloralin @ 1.5 lit/ha + hand weeding at 25 DAS, T_5- Two hand weeding at 15 and 25 DAS, T_6- Weedy check. * Figures given in parenthesis are original values.

Table 2: Effect of different weed management practices on plant height, branch/plant, yield attributes and economics of black gram (pooled data of two years)

Treatment	Plant height	Branch/plant	Pods/plant	Seeds/pod	Seed yield (t/ha)	Stover yield (t/ha)	Harvest index	NPR
T_1	61	5.9	37.6	11.1	1.243	2.819	44.09	1.8
T_2	61	5.6	35.7	10.6	1.142	2.708	42.17	1.7
T_3	63.1	6.6	39.7	11.7	1.349	3.319	40.64	2.2
T_4	65.4	6.2	37.8	11.2	1.34	2.917	45.94	2
T_5	64.6	6.9	40.7	11.5	1.441	3.419	42.15	2
T_6	55.8	4.8	29.8	10.3	0.883	2.502	35.29	1.3
SEm (±)	2.18	0.25	0.82	0.27	0.04	0.11	0.97	0.05
CD (P=0.05)	6.42	0.73	2.48	0.85	0.16	0.31	3.05	0.16

T_1- Pendimethalin @ 1.5 lit/ha, T_2- Fluchloralin @ 1.5 lit/ha, T_3- Pendimethalin @ 1.5 lit/ha + hand weeding at 25 DAS, T_4- Fluchloralin @ 1.5 lit/ha + hand weeding at 25 DAS, T_5- Two hand weeding at 15 and 25 DAS, T_6- Weedy check. NPR- Net return per rupee invested.

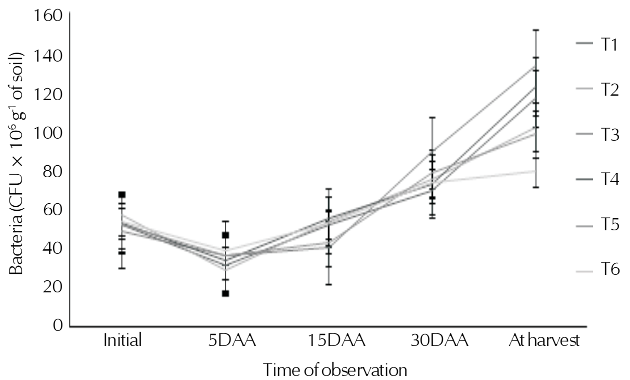


Figure 1: Influence of treatments on total bacteria (CFU x 10^6 g^{-1} of soil)

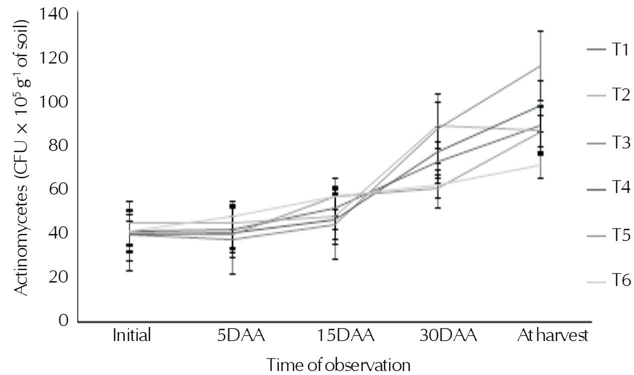
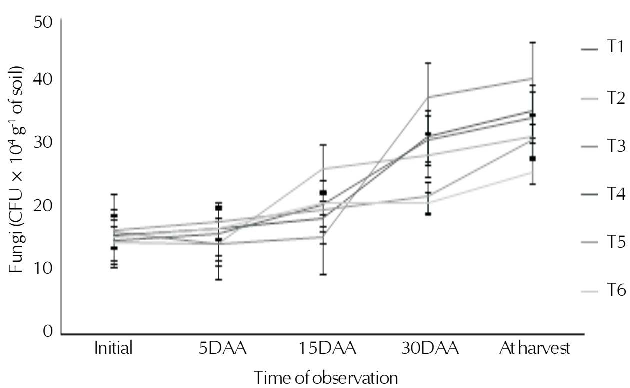


Figure 2: Influence of treatments on actinomycetes (CFU x 10^5 g^{-1} of soil).



*CFU- Colony forming unit.

Figure 3: Influence of treatments on fungi (CFU x 10^4 g-1 of soil).

plot. Pendimethalin @ 1.5 lit/ha + hand weeding at 25 DAS, Fluchloralin @ 1.5 lit/ha + hand weeding at 25 DAS were statistically at par with the hand weeding twice treatment in all respect of yield attributes. Twice hand weeded plot recorded 63.19% higher seed yield and 36.65% higher stover yield over weedy check (Table 2).This might be due to adequate weed control during the cropping period, which provided maximum moisture and nutrients for healthy plant growth and hence pod formation (Sultana *et al.*, 2009). However, harvest index was not significantly affected by weed control treatment. This was due to least competition fromweeds for the light, space, as well as above and below resources in weedy check. Weed infestation considerably reduces yield and crop must be maintained in such a way that crop-weed competition is minimum (Asaduzzaman *et al.*, 2010).

Microbial properties

The effects of integrated weed management on population of soil micro-flora *viz*. total bacteria, actinomycetes and fungi recorded at different time of observation (Initial, 5, 15, 30 DAA and harvest) are discussed below:

Total bacteria (10^6 cfu/g): Initially, there was no significant influence on the population of total bacteria in rhizosphere of blackgram. Population significantly varied between the treated and non treated plots after application of the herbicides and the population decreased up to 15 DAA. After 30 DAA, the population increased considerably in the herbicidal treated plots as compared to hand weeding and untreated control plots (Fig. 1). At harvest, herbicidal treatments recorded 24.57% to 68.64% higher population of total bacteria than control.

Actinomycetes (10^5cfu/g): Similar types of variations in actinomycetes population were recorded between the herbicide treated plots and the hand weeding and control plots after application of herbicides (Fig. 2). At harvest, herbicidal treatments recorded 21.32% to 63.98% higher population of actinomycetes than control. Similar findings were reported by Sapundjieva *et al.,* 2008.

Fungi (10^4 cfu/g): Up to 15 days after application of the herbicides, slight adverse effect on the population of fungi in rhizosphere region was observed. The data showed that population started to increase from 30 DAA. Further all the herbicide treated plots recorded higher fungi population than hand weeding and untreated control plots (Fig. 3). Herbicidal treatments recorded 19.47% to 57.10% higher population of fungi than control at harvest.

However, initially total bacteria, fungi and actinomycetes did not vary significantly in all the treatments but after herbicide application; they differ for a short period of time. Having the ability to degrade herbicides, microorganisms utilize them as a source of biogenic elements for their own physiological processes. As herbicides have toxic effects on microorganisms; they reduce their abundance, activity and consequently, the diversity of their communities before degradation. Immediately after application, the toxicity of herbicides is normally most severe as their concentration in soil is highest. With advancement of time, microorganisms degraded the herbicides and their concentration gradually reduced up to half-life. After that, carbon released from degraded organic herbicide leads to an increase of the soil microflora population (Bera and Ghosh, 2013).

Net return per rupee invested (NPR)

Highest NPR was noted in T_3 (2.2) owing to higher seed yield and comparatively lower cost under this treatment (Table 2) because pre-emergence herbicide application prevented seedling growth of grasses in the earlier stages followed by one hand weeding at 25 DAS gave a less or negligible competition to the crop .Whereas the lowest NPR was noted in T_6 (1.3). Though T_5 treatment recorded highest yield but it failed to obtain most profitable result with respect to NPR (2.0) due to higher labour wages and non-availability of labours at the critical crop-weed competition period. Similar findings was obtained by Verma *et al.,* 2013.

REFERENCES

Asaduzzaman, M., Sultana, S., Roy, T. S. and Masum, S. M. 2010. Weeding and plant spacing effects on the growth and yield of blackgram. *Bangladesh Research Publication J.* **4(1):** 62-68.

Ayansina, A. D. V., Ogunshe, A. A. O. and Fagade, O. E. 2003. Environment impact assessment and microbiologist. An overview. *In*: Proceedings of 11th Annual National Conference of Environment and Behaviour Association of Nigeria. pp. 26-27.

Bera, S. and Ghosh, R. K. 2013. Soil physico-chemical properties and microflora as influenced by bispyribac sodium 10% SC in transplanted *kharif* rice. *Rice Sci*. **20(5):** DOI: 10.1016/S1672-6308(13)60148-1.

Chum, M., Daizy, R., Singh, H. P. and Kohli, R. K. 2010. Comparative phytotoxicity of some benzoxazinoids on the early growth of selected weeds. *The Bioscan*. **5(4):** 537-540.

Fand, B., Sachin, S. and Gautam, R. D. 2013. Fortuitous biological control of insect pests andweeds: a critical review. *The Bioscan*. **8(1):** 01-10.

Halder, J. and Patra, A. K. 2007. Effect of chemical weed control methods on productivity of transplanted rice (*Oryza sativa*). *Indian J. Agron*. **52:** 111-113.

Maity, S. K. and Mukherjee, P. K. 2011. Effect of brown manuring on grain yield and nutrient use efficiency in dry direct seeded *Kharif*rice (*Oryza sativa* L.) *Indian J. Weed Science*. **43(1&2):** 61-66.

Pramer, D. and Schmidt, E. L. 1965. Experimental Soil Microbiology. *Minneapolis: Burgess Publ.*

Raman, R. and Krishnamoorthy, R. 2005. Nodulation and yield of mungbean (*Vigna radiate* L.) influenced by integrated weed management practices. *Legume Res*. **28:** 128-30.

Sapundjieva, K., Kalinova, S., Kartalska, Y.,Naydenov, M. 2008. Influence of pendimetalinherbicide upon soil microflora. *Pochvoznanie, Agrokhimiya I Ekologiya*. **42:** 49 55.

Sultana, S., Ulah, M. J., Karim, M. F. and Asaduzzaman, M. 2009. Response of mungbean to integrated nitrogen and weed management. *American-Eurasian J. Agronomy*. **2(2):** 104-08.

Verma, S., Singh, H. V. and Saxena, R. 2013. Relative performance of sesame (*Sesamum indicum*) under organic, inorganic and integrated nutrient management. *Indian J. Agricultural Sciences*. **83(3):** 143-149.

Yadav, S. S. 2004. Integrated weed management in sesame (*Sesamumindicum*L.) under rainfed conditions of Rajasthan. *Haryana J. Agronomy*. **20(1&2):** 120-121.