Research Article

EFFECT OF PRECEDING RICE HERBICIDE RESIDUE ON WEED, GROWTH AND YIELD OF SUMMER BLACKGRAM IN RICE-BHENDI-BLACKGRAM SEQUENCE

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ABSTRACT

Field experiment was carried out at Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai during summer season, 2017. To find out preceding rice herbicide residual effect on weed, growth, yield of summer blackgram rice-bhendi-blackgram sequence. Grasses were the dominant weed species throughout crop season followed by sedges and broad leaved weeds at 20 DAS, whereas except grasses other weeds were vice versa at 60 DAS. Residual effect of preceding rice crop herbicide residue and their weed control treatments exerted significant differences in grasses, sedges and broad leave weeds density and weed dry weight of blackgram at 20 DAS. Weed free check was recorded significantly higher LAI of 3.90 which was comparable with butachlor at 1.25 kg/ha on 3 DAT *fb* hand weeding on 40 DAT + hand weeding twice at 20 and 40 DAS.The highest seed yield (8.42q/ha) recorded under weed free check. Among the weed control treatments, residual effect of butachlor at 1.25 kg/ha on 3 DAT *fb* hand weeding on 40 DAT + hand weeding twice at 20 and 40 DAS registered higher seed and haulm yield of 32.1, 28.2% and 54.2, 53.2% respectively.

INTRODUCTION

Blackgram (*Vigna mungo* L. Hepper) is rich source of protein, carbohydrate, fat of 25, 60, 1.3 per cent respectively. India has sizable vegetarian population in their daily diet. In globally, India is the largest producer and consumer of pulse. It produced 13%of total pulses area and 10% of total pulse production in India as well as 25% in global production (Kaushik *et al.*, 2014). The productivity of blackgram decline day by day owing to poor establishment of crop and severe weed infestation. Weeds compete with crops for nutrients, water space which leads to considerable loss of blackgram productivity. Crop yield reduction of blackgram may extended up to 46 to 60 per cent due to weed incidence and their density. Weeds management consists of cultural, mechanical and chemical besides manual methods. However, hand weeding is considered as one of the best methods to control of emerged weeds throughout the crop growing period, owing to laborious, time consuming and cost it is not being practiced by farmers. Rice fallow system, pre-plant herbicide application is difficult owing to without land preparation and time bond application of herbicide (Sasikala *et al.*, 2014).An effective herbicide should control weeds with reasonable doses selectively non-toxic to crops, remain in the area where applied, persist throughout the growing season taking care of frequently germinating weeds and then leaving no residue at the end of the season permitting subsequent crop in the sequence. Better understanding of weed flora and influence of soil and crop factors on life cycle of weed helps to control weeds through improved method of encapsulated slow release formulations. In the view of above points, the present study was carried out to study the effect of preceding rice herbicide residue crops on weed, growth and yield of summer blackgram rice-bhendi-blackgram sequence.

MATERIALS AND METHODS

A field experiment was carried out at Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai during Summer season, 2017. To find out preceding rice herbicide residual effect crops on weed, growth, yield of summer blackgram in rice-bhendi-blackgram sequence. The soil of the experimental plots was sandy clay loam with a pH of 6.9 and EC of 0.30 dS/min texture with medium organic carbon (0.30%) status, low

available nitrogen (254.0 kg/ha), medium in available phosphorus (20.1 kg/ha) and medium in available potassium (189.9 kg/ha). The experimental site is geographically situated in the Western agro-climatic zone of Tamil Nadu at 78˚54′ and 92˚39′ East longitude at an altitude of 147 m above MSL respectively. Rice experiment was laid out in randomized block design with eight treatments with three replications. Similar design and treatments were used without any disturbance in lay out for subsequent bhendi and blackgram. The details of eight weed control treatments imposed to previous rice – bhendi crop were T_1-oxadiargyl loaded in biochar applied at 3 DAT, T_2-oxadiargyl loaded in zeolite applied at 3 DAT, T_3-encapsulated oxadiargyl with starch applied at 3 DAT,T_4-encapsulated oxadiargyl with water soluble polymer applied at 3 DAT, T_5-oxadiargyl at 100 g/ha applied at 3 DAT,T_6-butachlor at 1.25 kg/ha on 3 DAT *fb* hand weeding (HW) on 40 DAT in rice + hand weeding twice at 20 and 40 DAS, T_7-weed free check and T_8-weedy check.After harvest, previous crops residues were removed from the field and applied glyphosate at 1.0 kg/ha. After a week, blackgram variety of *VBN (Bg)-8*was sown20 kg/ha seed rate with 30 cm x 10 cm spacing. Irrigated immediately after sowing and life irrigation was given three days after sowing and subsequent irrigations were given as and when required.The crop was fertilized with the recommended dose of 25:50:25 kg NPK /ha as source of urea, diammonium phosphate and muriate of potash. The entire dose of NPK was applied as basal.Gap filling and thinning was done at 10 DAS and leaving a single healthy plant/hill. Need based plant protection measures were given whenever pest incidences are more than economic threshold level. Relative density (Relative density) of individual predominant weed species and group wise weeds were calculated by the method suggested by (Kim and Moody, 1983).

$$\text{RD (\%)} = \frac{\text{No. of weeds of individual species}}{\text{Total no. of weeds}} \times 100$$

The data pertaining to weeds were transformed to square root of $\sqrt{x+2}$ and analyzed as suggested by Gomez and Gomez (2010).

Table 1. Effect of preceding rice herbicide residue on absolute and relative density of weeds at 20 and 60 DAS in summer blackgram

Weed species	20 DAS		60 DAS	
	AD (no./m^2)	RD (%)	AD (no./m^2)	RD (%)
Grasses				
Echinochloa colonum	46.67	30.57	68.67	21.66
Leptochloa chinensis	15.33	10.04	28.33	8.94
Panicum flavidum	13.00	8.52	22.33	7.04
Cynodon dactylon	8.67	5.68	19.00	5.99
Total grasses	**83.67**	**54.80**	**138.33**	**43.64**
Sedge				
Cyperus rotundus	28.67	18.78	45.67	14.41
Fimbristylis miliacea	15.33	10.04	23.00	7.26
Cyperus difformis	7.33	4.80	10.33	3.26
Total sedges	**51.33**	**33.62**	**79.00**	**24.92**
Broad leaved weeds(BLW)				
Eclipta alba	5.67	3.71	25.33	7.99
Trianthema portulacastrum	3.33	2.18	9.33	2.94
Ammannia baccifera	4.67	3.06	15.00	4.73
Convolvulus arvensis	1.33	0.87	13.67	4.31
Phyllanthusmaderaspatensis	1.67	1.09	8.67	2.74
Phyllanthus niruri	1.00	0.66	11.67	3.68
Boerhavia diffusa	0.00	0.00	8.67	2.74
Cleome viscosa	0.00	0.00	7.33	2.31
Total BLW	**17.67**	**11.57**	**99.67**	31.44
Total weed density	**152.67**	**100.00**	**317.00**	**100.00**

RESULTS AND DISCUSSION

Weed dynamics

The predominant weeds were noticed in experimental field *viz.,* graminaceous weeds were *Echinochloa colonum, Leptochloa chinensis, Panicum flavidum, Cynodon dactylon* and along with *Cyperus rotundus, Cyperus difformis, Fimbristylis miliacea.* Seven families of broad leaved weeds were present in the experiment field of which *Eclipta alba, Trianthema portulacastrum, Ammannia baccifera, Convolvulus arvensis, Phyllanthus maderaspatensis, Phyllanthus niruri, Boerhavia diffusa* and *Cleome viscosa* were the major weeds observed in blackgram.

Absolute density and relative density of weed

The absolute density (no./m^2) and relative density (per cent) of individual weeds presented in Table 1. In general, grasses were the dominant weed species throughout crop season followed by sedges and broad leaved weeds at 20 DAS, whereas except grasses other weeds density were vice versa at 60 DAS. The relative density of individual weed species showed that the grasses *Echinochloa colonum* was the predominant weed species registered a relative density of 30.57per cent with the absolute density of 46.67/m^2 at 20 DAS. This was followed by sedges (51.33/m^2) among the sedges *Cyperus rotundus* was the prime grassy weed species found higher proportion in weed flora with a higher relative density of 18.78 and 14.41 per cent with absolute density of 28.67 and 45.67/m^2 at 20 and 60 DAS respectively. Grassy weeds were predominant occurrence of weed flora in blackgram might be owing to their wider environmental adaptation of weeds and richness of resource availability during entire crop growth season which showed that consistently removal of nutrient for their profuse weed growth. The similarly wide spectrum of weeds reported by Punia *et al.* (2017)in blackgram Bommayasamy *et al.* (2018) in bhendi field.

Table 2. Effect of preceding rice herbicide residue on grass, sedges, BLW weeds density (no./m2) and weeds dry weight (g/m2) at 20 DAS in summer blackgram

Treatments	Weed density (no. m^{-2})			Weed dry weight (g/m^2)		
	Grass	Sedges	BLW	Grass	Sedges	BLW
T_1-Oxadiargyl loaded with biochar on 3 DAT	4.86 (21.67)	3.91 (13.33)	2.71 (5.33)	2.66 (5.06)	2.60 (4.74)	1.79 (1.19)
T_2-Oxadiargyl loaded with zeolite on 3 DAT	5.83 (32.00)	4.86 (21.67)	3.11 (7.67)	2.81 (5.90)	3.10 (7.61)	1.92 (1.67)
T_3-Oxadiargyl encapsulated with starch on 3 DAT	4.97 (22.67)	4.43 (17.67)	2.77 (5.67)	2.73 (5.45)	2.68 (5.17)	1.85 (1.44)
T_4-Oxadiargyl encapsulated with water soluble polymer on 3 DAT	6.10 (35.33)	5.65 (30.00)	3.27 (8.67)	2.86 (6.17)	3.11 (7.68)	2.10 (2.40)
T_5-Oxadiargyl at 100 g ha^{-1} on 3 DAT	6.35 (38.33)	6.53 (40.67)	4.32 (16.67)	3.20 (8.22)	3.35 (9.24)	2.39 (3.75)
T_6-Butachlor at 1.25 kg ha^{-1} on 3 DAT *fb* hand weeding on 40 DAT + hand weeding twice at 20 and 40 DAS	3.79 (12.33)	3.00 (7.00)	2.45 (4.00)	2.22 (2.93)	2.47 (4.15)	1.78 (1.18)
T_7 -Weed free check	1.41 (0.00)	1.41 (0.00)	1.41 (0.00)	1.41 (0.00)	1.41 (0.00)	1.41 (0.00)
T_8 –Weedy check	9.24 (83.67)	7.30 (51.33)	4.43 (17.67)	4.38 (17.25)	4.68 (19.93)	3.42 (9.77)
SE.d	0.22	0.14	0.14	0.29	0.15	0.16
CD (P=0.05)	0.47	0.30	0.29	0.62	0.32	0.35

Effect on weeds

Weed density and weed dry weight

Residual effect of preceding rice herbicide residue and their weed control treatments exerted significant differences in grasses, sedges and broad leave weeds density and weed dry weight of blackgram at 20 DAS (Table 2). Weed free check showed superiority in among the weed control treatmentsfollowed by residual effect of butachlor at 1.25 kg ha^{-1} on 3 DAT *fb* hand weeding on 40 DAT in rice + hand weeding twice at 20 and 40 DAS in blackgram registered lower grass weed density of 12.33 /m^2. Similar trend was registered in sedges density at 20 DAS. The next order best treatment was residual effect of oxadiargyl loaded with biochar on 3 DAT which was comparable with residual effect of oxadiargyl loaded with zeolite on 3 DAT. Whereas, in BLW density, the least density of 4.00/m^2

recorded under residual effect of butachlor at 1.25 kg ha^{-1} on 3 DAT *fb* hand weeding on 40 DAT + hand weeding twice at 20 and 40 DAS which at par with residual effect of oxadiargyl loaded with biochar on 3 DAT. The highest weed density of grasses, sedges, BLW of 83.67, 51.33, 17.67 m^2 recorded in weedy check. The lowest weed dry weight of grasses, sedges and BLW recorded in weed free check at 20 DAS.Among the weed control treatments, the lowest grasses dry weight of 2.93,5.06,5.45g/m^2recorded under residual effect of butachlor at 1.25 kg ha^{-1} on 3 DAT *fb* hand weeding on 40 DAT in rice + hand weeding twice at 20 and 40 DAS which was on par with residual effect of oxadiargyl loaded with biochar on 3 DAT and oxadiargyl encapsulated with starch on 3 DAT. The similar trend was observed sedges and BLW dry weight. It might be owing to application of glyphosate prior to sowing of blackgram significant reduced grasses, sedges and broad leaved weeds density and dry weight. Similar results were reported by Singh *et al.* (2002) under zero tillage. The highest weed dry weight grasses, sedges, BLW of 17.25,19.93,9.77 g/m^2 recorded under weedy check.

Table 3. Effect of preceding rice herbicide residue crops on leaf area index, crop growth rate, root characters of summer blackgram

Treatments	Growth attributes			
	LAI at 25 DAS	**CGR (g/m^2/d) at 25 to 50 DAS**	**Root length (cm) at 25 DAS**	**Root dry weight (kg/ha) at 25 DAS**
T_1-Oxadiargyl loaded with biochar on 3 DAT	3.37	1.09	12.7	44.4
T_2-Oxadiargyl loaded with zeolite on 3 DAT	2.90	0.82	12.5	36.7
T_3-Oxadiargyl encapsulated with starch on 3 DAT	3.16	0.90	12.6	38.0
T_4-Oxadiargyl encapsulated with water soluble polymer on 3 DAT	2.72	0.92	11.7	34.4
T_5-Oxadiargyl at 100 g/ha on 3 DAT	2.55	0.85	10.2	27.8
T_6- Butachlor at 1.25 kg/ha on 3 DAT *fb* hand weeding on 40 DAT + hand weeding twice at 20 and 40 DAS	3.76	1.25	15.9	44.4
T_7 -Weed free check	3.83	1.16	18.1	51.1
T_8 –Weedy check	2.13	0.82	10.0	24.4
SE.d	0.19	0.17	0.94	2.3
CD (P=0.05)	0.40	NS	2.01	5.0

Effect on crops

Effect on growth attributes

The difference in LAI, root character such as root length and root dry weight between herbicide residual effect of preceding rice crop and their weed control treatments was significant at all the stages (Table 3).Weed free check was recorded significantly higher LAI of 3.90 which was comparable with butachlor at 1.25 kg/ha on 3 DAT *fb* hand weeding on 40 DAT + hand weeding twice at 20 and 40 DAS. It was followed by residual effect of oxadiargyl loaded with biochar on 3 DAT. This might be due to least competition for above and below ground resources. The least LAI was registered by weedy check (T_8).Herbicide residual effect of preceding rice crops and their weed control treatments does not exert significant difference in crop growth rate at 25 DAS. With regards to weed control treatments, the lengthier root of 18.1 cm and root dry weight of 51.1 kg/ha were recorded under weed free check at 25 DAS. It was followed by butachlor at 1.25 kg/ha on 3 DAT *fb* hand weeding on 40 DAT + hand weeding twice at 20 and 40 DAS and oxadiargyl loaded with biochar on 3 DAT.The least root length and root dry weight of 10.0 cm and 24.2 kg/ha were observed under weedy check. This might be due to significant reduction of grasses, sedges and broad leaved weeds achieved by glyphosate application and subsequent vigorous crop growth under uniform dibbling of seeds for maintaining required plant population per unit area. Similar findings were reported by Singh *et al.* (2002) under zero tilled conditions.

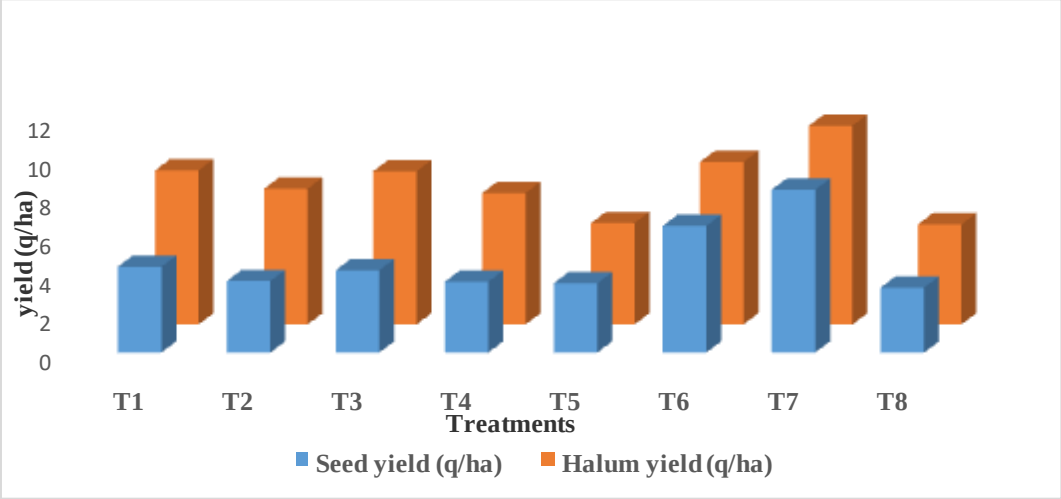

Fig. 1. Effect of preceding rice herbicide residue on seed yield and Haulm yield (q/ha) of summer blackgram

Effect on seed and haulm yield

Significant difference among herbicide residual effect of preceding rice and their weed control treatments were evidenced with increased seedand haulm yield of blackgram (Fig. 1).The highest seed yield (8.42q/ha) recorded under weed free check. Among the weed control treatments, butachlor at 1.25 kg ha^{-1} on 3 DAT *fb* hand weeding on 40 DATin rice+ hand weeding twice at 20 and 40 DAS succeeding crops registered higher seedand haulm yield of 32.1, 28.2% and 54.2, 53.2% respectively. The next order best treatments were residual effect of oxadiargyl loaded with biochar on 3 DAT, oxadiargyl encapsulated with starch on 3 DAT and oxadiargyl loaded with zeolite on 3 DAT.This might be due to effective control of weeds in previous crops which reduced weed seed bank and gave higher seed and haulm yield of blackgram. These treatments were on par with one another. The similar results are reported by Mansoori *et al*. (2015). The lowest seed and haulm yield of 3.36 and 5.17 q/ha respectively recorded under weedy check.

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