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copiesBIO-EFFICACY OF SAND MIX APPLICATION OF PRE-EMERGENCE HERBICIDES ALONE AND IN SEQUENCE WITH IMAZETHAPYR ON WEED CONTROL IN RELAY CROP OF BLACKGRAM

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ABSTRACT

A field experiment was conducted during winter seasons of 2007-08 and 2008-09 to study the bio-efficacy of sand mix application of pre emergence herbicides, pendimethalin 1000 g ha^{-1}, pretilachlor 500 g ha^{-1}, oxyfluorfen 120 g ha^{-1}, imazethapyr 63 g ha^{-1} alone and in sequence with post emergence application of imazethapyr 50 g ha^{-1} on weed control in black gram grown as relay crop. Results indicated that sequential treatments were found to be superior to individual applications. Among the sequential treatments, pre emergence sand mix application of pendimethalin 1000 g ha^{-1} followed by imazethapyr 50 g ha^{-1} at 20 days after sowing (DAS) significantly reduced weed growth and recorded the highest seed yield (1113 kg ha^{-1}), net monetary returns (Rs.2255 ha^{-1}) and B:C ratio (1.33) and was at par with other sequential treatment, oxyfluorfen 120 g ha^{-1} followed by imazethapyr 50 g ha^{-1} and also with hand weeding at 15 and 30 DAS. Uncontrolled weed growth caused 61 percent reduction in seed yield of blackgram.

Key Words: Sand mix application, pre emergence herbicide, relay crop.

INTRODUCTION

Cultivation of black gram as a relay crop in rice fallows is a common practice in coastal districts of Andhra Pradesh, India, wherein sprouted seeds of black gram are broadcasted in standing crop of rice 2 to3 days before its harvest. The black gram sown in this system survives entirely on residual moisture and fertility only. As there is no field preparation, weed growth particularly of *Echinochloa* spp. is severe and effectively competitive with the crop for residual moisture, nutrients and reduces the black gram yield to the extent of 75 percent (Rao and Rao, 2003; Rao, 2008).

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The continuous use of post emergence grassy herbicides (ACCase inhibitors) resulted in shifting of weed flora towards broad leaf weeds (BLW) with the dominance of *Grangea maderaspatana* in relay crop of black gram. The broad spectrum herbicide imazethapyr causes slight injury to relay crop of black gram, thus farmers are reluctant to use this herbicide Therefore, in the present investigation an attempt has been made to find out the efficacy of applying pre emergence herbicides along with post emergence herbicide imazethapyr alone and in sequence, as normal method of pre emergence application is not viable in the existing system.

MATERIALS AND METHODS

A field experiment was conducted during winter seasons of 2007-08 and 2008-09 at Water Management Pilot area at Modukur Village of Guntur District, Andhra Pradesh, India. The soil texture of the experimental field was clay having lower available nitrogen, medium available phosphorus and higher available potassium with soil pH of 7.8. The experiment consisting of ten treatments (Table-1) was laid out in randomized complete block design with three replications.

The sprouted seeds of black gram (cv. LBG 645) were broadcasted uniformly two days before harvest of rice crop. Immediately after removal of paddy sheaves (one week after harvest) the pre emergence herbicides were thoroughly mixed in dry sand at 50 kg ha^{-1} and broadcasted uniformly over the field and then water was sprayed by using a spray volume of 500 L ha^{-1} in order to create normal pre emergence situation.

The post emergence herbicide was sprayed at 20 DAS using a spray volume of 500 L ha^{-1}. The crop survived entirely on the residual moisture and fertility only. Density of different weed groups and total weed dry weight were recorded at various stages with the help of a quadrate and then converted to m^{-2} and the data on weed parameters were subjected to square root transformation (x + 0.5) before statistical analysis (Panse and Sukhatme, 1978).

RESULTS AND DISCUSSION

Effect on weeds

The experimental field was dominated by natural infestation of BLW like *Grangea maderaspatana*, *Gnaphalium polycaulon*, *Nasturtium indicum, Chrozophora rottleri, Cardanthera uliginosa, Xanthium strumarium* and grasses like *Echinochloa colona, Dinebra retroflexa, Leptochloa chinensis.*

All the weed control treatments significantly reduced the density of grasses, BLW and total weed dry weight over unweeded check at all stages of observation (Tables-1 & 2). Among the

treatments, pre emergence sand mix application of pendimethalin 1.0 kg followed by sequential application of imazethapyr 50 g ha^{-1} at 20 DAS recorded higher weed control efficiency (WCE) of 70 % at 60DAS and was at par with other sequential treatments and also with hand weeding at 15 and 30 DAS. Similar trend was observed at harvest also. Unweeded check recorded the highest weed growth. In general, sequential treatments were found to be superior to individual application of herbicides.

Effect on crop

Sand mix application of pre emergence herbicide oxyfluorfen 120 g ha^{-1} and pretilachlor 500 g ha^{-1} and post emergence application of imazethapyr 50 g ha^{-1} resulted in slight injury to black gram for about a week and then the crop resumed to normal condition. All the weed control treatments significantly influenced the yield and yield attributes over unweeded check (Table-3).

Among the treatments, pre emergence sand mix application of pendimethalin 1.0 kg ha^{-1} followed by imazethapyr 50 g ha^{-1} at 20 DAS recorded significantly the highest seed yield (1000 kg ha^{-1}) over all other treatments, except with the treatments, oxyfluorfen 120 g ha^{-1} followed by imazethapyr (50 g ha^{-1}) and hand weeding at 15 and 30 DAS (1201 kg ha^{-1}).

The increased yield in these treatments might be due to effective control of weeds in early stage by pre emergence sand mix application and late emerged weeds by post emergence application of imazethapyr, which resulted in reduced weed growth and increased crop growth and yield components. The results are akin to those reported by Rao and Murthy (2004) and Begum and Rao (2006). The uncontrolled weed growth resulted in 61 % yield reduction.

Economics

The highest net monetary return (Rs.22,255 ha^{-1}) and benefit cost ratio of 1.33 was obtained with pre emergence sand mix application of pendimethalin 1000 g ha^{-1} fb. imazethapyr 50 g ha^{-1} at 20 DAS (Table-3). This was closely followed by pre sand mix application of pretilachlor 500 g ha^{-1} followed by imazethapyr 50 g ha^{-1} with net monetary return of Rs.18,270 and benefit cost ratio of 1.13 which may be due to higher WCE and lower cost of treatment.

From the results it can be concluded that pre emergence sand mix application of pendimethalin 1.0 kg ha^{-1} followed by imazethpyr 50 g ha^{-1} at 20 DAS appears to be effective, economically and a good substitute for hand weeding in rice fallow black gram, when grown as relay crop.

Table-1. Effect of different treatments on density of different weed groups in black gram (pooled data).

Treatments	Dose (g ha^{-1})	Time of application (DAS)	Weed density (plants m^{-2}) at 30 DAS				Weed density (plants m^{-2}) at 60 DAS			
			Grasses	BLW	WCE (%)		Grasses	BLW	WCE (%)	
					Grasses	BLW			Grasses	BLW
T1- Unweeded check	-	-	14.5 (216.7)	18.6 (274.7)	-	-	13.7 (196.0)	18.9 (410.7)	-	-
T2- Hand weeding	-	15&30	6.0 (44.0)	12.8 (180.7)	59	32	3.8 (16.0)	4.5 (24.0)	72	76
T3- Pendimethalin	1000	10 (SMA)	4.7 (26.7)	10.5 (123.3)	68	44	7.0 (58.7)	9.0 (121.3)	49	52
T4- Oxyfluorfen	120	10 (SMA)	7.2 (42.0)	9.5 (93.3)	50	49	7.4 (61.3)	9.4 (132.0)	46	50
T5- Pretilachor	500	10 (SMA)	8.1 (66.0)	12.9 (172.7)	44	31	9.6 (98.7)	11.9 (172.0)	30	37
T6- Imazethapyr	68	10 (SMA)	8.7 (79.3)	11.5 (137.3)	40	41	10.3 (110.7)	13.2 (194.7)	25	30
T7- Imazethapyr	50	20 (SMA)	5.4 (37.3)	9.7 (97.3)	63	48	8.0 (68.0)	10.3 (128.0)	42	44
T8- T3 fb. T7	1000 fb. 50	10(SMA) fb.20	3.6 (15.0)	5.4 (34.7)	75	71	4.1 (20.0)	5.2 (35.3)	70	72
T9- T4 fb. T7	120 fb. 50	10(SMA) fb.20	4.5 (70.7)	5.1 (32.0)	69	73	4.8 (30.7)	5.6 (39.3)	65	70
T10- T5 fb. T7	500 fb. 50	10(SMA) fb.20	4.5 (49.3)	6.1 (42.0)	69	67	6.4 (38.0)	6.4 (47.7)	53	66
CD at 5%			**2.1**	**2.3**			**1.9**	**2.6**		

Note SMA: Sand mix application, DAS: Days after sowing. Data transformed to $\sqrt{x+0.5}$ transformation. Figures in parentheses are original values

Table-2. Effect of different treatments on density of different weed groups and total weed dry weight in blackgram (pooled data).

Treatments	Dose (g ha^{-1})	Time of application (DAS)	Weed density (plants m^{-2}) at Harvest				Total weed dry weight (g m^{-2}) at		WCE (%) at	
			Grasses	BLW	WCE (%)		60 DAS	Harvest	60 DAS	Harvest
					Grasses	BLW				
T1- Unweeded check	-	-	12.5 (161.3)	19.4 (383.3)	-	-	7.6 (62.9)	11.6 (140.4)	-	-
T2- Hand weeding	-	15&30	5.3 (29.3)	5.4 (34.0)	58	72	2.0 (4.5)	4.5 (21.6)	74	61
T3- Pendimethalin	1000	10 (SMA)	7.8 (63.3)	10.0 (114.7)	38	49	4.3 (18.8)	6.4 (46.0)	43	45
T4- Oxyfluorfen	120	10 (SMA)	7.9 (64.0)	9.8 (109.3)	37	50	4.6 (20.7)	6.6 (44.8)	40	43
T5- Pretilachor	500	10 (SMA)	8.6 (80.3)	12.9 (185.3)	31	34	5.3 (27.9)	7.5 (57.7)	30	35
T6- Imazethapyr	68	10 (SMA)	8.2 (75.3)	12.7 (168.7)	34	35	4.7 (22.6)	7.6 (60.2)	38	34
T7- Imazethapyr	50	20 (SMA)	8.3 (71.3)	11.0 (126.0)	34	43	3.8 (14.0)	6.5 (43.3)	50	44
T8- T3 fb. T7	1000 fb.50	10 (SMA) fb.20	4.6 (26.8)	7.2 (57.3)	63	63	2.8 (7.4)	4.8 (23.1)	63	59
T9- T4 fb. T7	120 fb.50	10(SMA) fb.20	4.9 (34.7)	7.6 (64.0)	61	61	3.1 (8.8)	5.1 (25.8)	59	56
T10- T5 fb. T7	500 fb.50	10(SMA) fb.20	5.6 (39.0)	7.9 (69.3)	55	59	3.4 (10.9)	5.3 (27.78)	55	54
CD at 5%			1.8	1.8			0.8	1.2		

Note; SMA: Sand mix application DAS: Days after sowing. Data transformed to $\sqrt{x+0.5}$ transformation. Figures in parentheses are original values.

Table-3. Effect of different treatments on yield and yield components of black gram (pooled data).

Treatments	Dose (g ha^{-1})	Time of application (DAS)	Crop injury score (%) days after application		Crop dry weight (g m^{-2}) at		No. of Pods $Plant^{-1}$	No. of seeds pod^{-1}	100 seed weight (g)	Seed yield (kg ha^{-1})	Net return (Rs ha^{-1})	BCR (Rs)
			7	14	60 DAS	Harvest						
T1- Unweeded check	-	-			90.0	201.1	11.3	5.5	4.55	464	1240	0.08
T2- Hand weeding	-	15&30			117.1	435.6	27.0	6.8	5.55	1201	24,035	1.33
T3- Pendimethalin	1000	10 (SMA)			126.7	319.6	17.9	6.2	5.17	840	13,300	0.83
T4- Oxyfluorfen	120	10 (SMA)	7.5	0	119.1	330.1	17.8	6.2	5.14	880	14,884	0.94
T5- Pretilachor	500	10 (SMA)	10	0	114.0	273.2	16.7	6.0	4.90	688	8,580	0.55
T6- Imazethapyr	68	10 (SMA)			117.1	274.8	16.7	6.1	5.19	669	7,307	0.45
T7- Imazethapyr	50	20 (SMA)			120.9	302.2	17.6	6.2	5.10	728	9,580	0.60
T8- T3 fb. T7	1000 fb. 50	10 (SMA) fb. 20			165.8	406.8	25.4	6.6	5.36	1113	22,255	1.33
T9- T4 fb. T7	120 fb. 50	10 (SMA) fb. 20	5	0	155.3	367.3	22.9	6.4	5.12	1000	18,484	1.12
T10- T5 fb. T7	500 fb. 50	10 (SMA) fb. 20	10	0	149.3	368.4	23.0	6.6	4.98	982	18,484	1.12
CD at 5%					18.6	46.4	2.9	0.36	0.41	115.0		

Fb. = Followed by

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