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Effect of Pre- and Post-emergence Herbicides on the Control of *Vicia sativa* in Rice-Fallow Blackgram (*Vigna mungo* L. Hepper)*

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ABSTRACT

A field experimemt was conducted during *rabi* 2009-10 at the Agricultural College Farm, Naira of Acharya N. G. Ranga Agricultural University to study the effect of different pre- and post-emergence herbicides on *Vicia sativa* control in rice-fallow blackgram. Density and dry weight of *Vicia sativa* as well as other broad leaf weeds were significantly reduced by hand weeding compared to other treatments and was on par with imazethapyr @ 200 g a.i ha^{-1} followed by @ 150 g a.i ha^{-1} and pendimethalin @ 1.0 kg a.i ha^{-1}. All other herbicides except, quizalofop-p-ethyl @ 50 and 75 g a.i ha^{-1} significantly reduced the density and dry weight of *Vicia sativa* and other broad leaf weeds compared to unweeded check. The maximum weed control efficiency was recorded with hand weeding, which was however, on par with imazethapyr @ 200 g a.i ha^{-1}. Imazethapyr at both the doses showed phytotoxicity on blackgram. At lower dose the crop recovered quickly while, at higher dose no such recovery was noticed. Hand weeding was significantly superior to other treatments in respect of yield. However, on considering economics, pendimethalin @ 1.0 kg a.i ha^{-1} was found to be a cost effective method.

Key words : Pre- and Post-emergence herbicides, Rice-fallow blackgram, *Vicia sativa*.

Cultivation of pulses in rice-fallows is a common practice in coastal areas of Andhra Pradesh and Tamil Nadu. In Andhra Pradesh, blackgram is cultivated in 2.69 lakh ha of rice-fallows, with a production of 1.80 lakh tonnes and productivity of 670 kg ha^{-1} (Plant Doctors Diary, 2010). Common vetch (*Vicia sativa* L.), locally called *Rangam minumu*, is one of the important weeds in rice-fallow blackgram spreading vigorously in recent years in the North Coastal Agro-climatic Zone of Andhra Pradesh. This weed not only competes for moisture and nutrients with blackgram but also adds its seed with blackgram, being similar in size and shape fetching lower market price of blackgram in addition to spreading to newer areas when used as seed (Jayalalitha and Rao, 2006). Due to its problematic nature and difficulties involved in controlling the weed effectively by mechanical means, it is felt essential to find out an appropriate herbicide, which could control the weed effectively. Since, no significant work has been carried out on this important location specific problem; the present investigation was taken up.

MATERIAL AND METHODS

A field experiment was conducted at the Agricultural College Farm, Naira of Acharya N. G. Ranga Agricultural University during *rabi* 2009-10. The experiment consists of twelve treatments, laid out in a Randomized Block Design with three replications. The soil of the experimental field was sandy clay loam in texture with pH 7.3 and was low in available nitrogen (179 kg ha^{-1}) and high in available phosphorus (54 kg ha^{-1}) and potassium (346 kg ha^{-1}). Sprouted seed of blackgram (Cv. LBG – 645) was broadcasted uniformly in the standing rice crop two days prior to harvest. The pre-emergence herbicides were applied by mixing the required quantity of herbicide in dry sand @ 50 kg ha^{-1} and were broadcasted uniformly at 7 DAS followed by water spray @ 500 L ha^{-1} inorder to provide sufficient moisture for herbicide absorption. The post-emergence herbicides were applied at 15 DAS using a spray volume of 500 L ha^{-1}. The crop did not receive any fertilizer and irrigation and was allowed to grow entirely on residual moisture and fertility. The preceeding rice crop received a fertilizer dose of 120 kg N, 60 kg P_2O_5 and 60 kg K_2O ha^{-1}. The phytotoxic effect of herbicides on blackgram was assessed by using a simple rating scale of 0 to 10 (equal to 0 to 100%) as suggested by Rao (2000).

RESULTS AND DISCUSSION

Effect of herbicides on weeds

The weed species, which infested the experimental plot, were *Vicia sativa, Cardiospermum halicacabum* L. *var luridum, Grangea maderaspatana, Chrozophora rottleri, Phyllanthus maderaspatensis* and *Xanthium strumarium* and all

Table 1. Density, dry weight and weed control efficiency of *Vicia sativa* in rice-fallow blackgram as affected by different treatments.

Treatments	* *Vicia sativa* density (No. m^{-2}) at		* *Vicia sativa* dry weight (kg ha^{-1}) at		Weed Control Efficiency (%) of *Vicia sativa* at	
	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS
T_1 : Pendimethalin @ 0.75 kg a.i ha^{-1} (PE)	13.8 (189.3)	16.0 (255.7)	7.7 (58.9)	16.3 (265.3)	57.3	53.8
T_2 : Pendimethalin @ 1.0 kg a.i ha^{-1} (PE)	13.5 (183.0)	15.1 (227.7)	7.2 (51.4)	15.6 (243.0)	60.7	56.0
T_3 : Alachlor @ 0.5 kg a.i ha^{-1} (PE)	14.2 (200.7)	16.3 (265.3)	8.0 (63.6)	16.8 (281.8)	54.6	51.7
T_4 : Alachlor @ 1.0 kg a.i ha^{-1} (PE)	14.0 (194.7)	15.6 (243.0)	7.4 (54.4)	15.9 (252.4)	60.6	54.8
T_5 : Oxyfluorfen @ 0.1 kg a.i ha^{-1} (PE)	14.5 (209.0)	16.9 (285.0)	8.3 (68.5)	17.5 (305.9)	51.6	46.6
T_6 : Oxyfluorfen @ 0.2 kg a.i ha^{-1} (PE)	14.3 (204.3)	16.6 (275.0)	8.2 (66.8)	17.1 (292.0)	52.7	50.4
T_7 : Imazethapyr @ 150 g a.i ha^{-1} (PoE)	13.4 (178.3)	14.5 (210.0)	7.1 (50.0)	15.4 (236.8)	68.7	63.0
T_8 : Imazethapyr @ 200 g a.i ha^{-1} (PoE)	10.9 (118.7)	11.8 (138.7)	5.1 (25.6)	12.0 (143.6)	91.8	83.7
T_9 : Quizalofop-p-ethyl @ 50 g a.i ha^{-1} (PoE)	16.7 (278.7)	19.6 (383.7)	10.9 (118.4)	21.6 (466.2)	24.8	24.8
T_{10}: Quizalofop-p-ethyl @ 75 g a.i ha^{-1} (PoE)	16.6 (274.3)	19.2 (368.0)	10.7 (114.0)	21.4 (457.6)	28.8	25.5
T_{11}: Unweeded check	17.3 (300.3)	19.8 (391.7)	11.6 (134.2)	22.2 (492.4)	-	-
T_{12}: Weed free check (HW at 15 and 30 DAS)	12.9 (166.0)	11.7 (136.3)	6.9 (47.2)	10.0 (99.6)	76.8	88.8
SEm±	0.53	0.88	0.47	1.05	3.15	2.85
CD (P=0.05)	1.6	2.6	1.4	3.1	9.2	8.4

* The data were subjected to square root transformation. Figures in parentheses are original values.

PE : Pre-emergence PoE : Post-emergence HW : Hand weeding DAS : Days after sowing

were broad leaf weeds. *Vicia sativa* was the dominant weed, which constituted around 70% of the total weed population.

The density and dry weight of *Vicia sativa* recorded at 30 DAS (Table 1) indicated that all the treatments significantly reduced the density and dry weight of *Vicia sativa* compared to unweeded check except, post-emergence application of quizalofop-p-ethyl @ 50 and 75 g a.i ha^{-1}. Post-emergence application of imazethapyr @ 200 g a.i ha^{-1} recorded significantly lower density and dry weight of *Vicia sativa* than rest of the treatments. Almost similar affect was observed at 60 DAS except, with imazethapyr @ 200 g a.i ha^{-1}, which was on par with hand weeding. Quizalofop-p-ethyl, at both the doses (50 and 75 g a.i ha^{-1}) was found ineffective in controlling *Vicia sativa* at both the stages of observation since it is effective only against grassy weeds. Higher dose of imazethapyr (200 g a.i ha^{-1}) application recorded significantly lower density and dry weight of *Vicia sativa* than lower dose (150 g a.i ha^{-1}) which might be due to its selective post-emergence activity in suppressing *Vicia sativa*. Among all the treatments, Hand weeding at 15 and

Table 2. Crop injury, crop stand, drymatter accumulation, seed yield and benefit cost ratio of rice-fallow blackgram as affected by different treatments.

Treatments	% Crop injury score			Crop stand (No. m^{-2}) at maturity	Crop drymatter accumulation (kg ha^{-1}) at harvest	Seed yield (kg ha^{-1})	Benefit Cost Ratio
	Days after spraying						
	7	14	21				
T_1 : Pendimethalin @ 0.75 kg a.i ha^{-1} (PE)	0	0	0	31.7	1959	751	2.38
T_2 : Pendimethalin @ 1.0 kg a.i ha^{-1} (PE)	0	0	0	31.7	2040	849	2.75
T_3 : Alachlor @ 0.5 kg a.i ha^{-1} (PE)	0	0	0	31.0	1917	742	2.45
T_4 : Alachlor @ 1.0 kg a.i ha^{-1} (PE)	0	0	0	32.0	2015	808	2.68
T_5 : Oxyfluorfen @ 0.1 kg a.i ha^{-1} (PE)	0	0	0	31.0	1771	727	2.28
T_6 : Oxyfluorfen @ 0.2 kg a.i ha^{-1} (PE)	0	0	0	28.7	1783	733	2.15
T_7 : Imazethapyr @ 150 g a.i ha^{-1} (PoE)	40	10	0	29.0	2084	881	2.60
T_8 : Imazethapyr @ 200 g a.i ha^{-1} (PoE)	60	60	60	24.3	1525	550	1.14
T_9 : Quizalofop-p-ethyl @ 50 g a.i ha^{-1} (PoE)	0	0	0	31.0	1578	653	1.84
T_{10} : Quizalofop-p-ethyl @ 75 g a.i ha^{-1} (PoE)	0	0	0	29.0	1628	667	1.78
T_{11} : Unweeded check	0	0	0	28.5	1329	493	1.40
T_{12} : Weed free check (HW at 15 and 30 DAS)	0	0	0	28.5	2516	1072	2.25
SEm±	-	-	-	1.32	117.39	64.59	-
CD (P=0.05)	-	-	-	3.9	344	189	-

PE : Pre-emergence PoE : Post-emergence HW : Hand weeding DAS : Days after sowing

30 DAS (T_{12}) had the highest weed control efficiency of *Vicia sativa*. Of the herbicide treatments, significantly the highest weed control efficiency was recorded with post-emergence application of imazethapyr @ 200 g a.i ha^{-1}. Quizalofop-p-ethyl at both the doses (50 and 75 g a.i ha^{-1}) had significantly lower weed control efficiency of *Vicia sativa* than rest of the treatments. The higher weed control efficiency in these treatments was due to lower drymatter accumulation compared to unweeded check. This might also be due to the effect of improved competitive ability of crop with advancement of age.

Effect on crop

Post-emergence application of imazethapyr @ 150 g a.i ha^{-1} caused crop injury to the extent of 40 per cent resulting in moderate stunting of seedling growth and discolouration of developing leaves with partial loss of crop stand (Table 2). However, these symptoms were slowly vanished at later period. Whereas, post-emergence application of imazethapyr @ 200 g a.i ha^{-1} caused crop injury to the extent of 60 per cent resulting in severe stunting and discolouration with significant stand loss. The symptoms remain unchanged even at 21 days after spraying. The phytotoxic effect of imazethapyr on blackgram was also reported by Gousia (2005) and Rao (2008). Among all the herbicides, post-emergence application of imazethapyr @ 200 g a.i ha^{-1} resulted in significantly lower crop stand than other treatments due to its severe phytotoxicity on blackgram. Whereas, imazethapyr @ 150 g a.i ha^{-1} had partial stand loss but it was on a par with rest of the treatments except, T_8. This was due to less phytotoxic effect of treatment T_7 on blackgram. Among the herbicides, the highest crop drymatter accumulation was recorded with imazethapyr @ 150 g a.i ha^{-1}, which was on par with the rest of the herbicides except, imazethapyr @ 200 g a.i ha^{-1}, quizalofop-p-ethyl @ 50 g a.i ha^{-1} and quizalofop-p-ethyl @ 75 g a.i ha^{-1} at harvest. Significantly the highest crop dry weight was recorded with hand weeding than rest of the treatments.

Among the various treatments tested, the maximum seed yield was recorded with hand weeding which was significantly superior to the rest of the treatments (Table 2). Among the herbicide treatments, except imazethapyr @ 200 g a.i ha^{-1}, quizalofop-p-ethyl @ 50 g a.i ha^{-1} and 75 g a.i ha^{-1}

all other treatments had significantly higher seed yield compared to unweeded check. Despite better weed control efficiency of imazethapyr @ 200 g a.i ha^{-1}, it could not be translated into higher seed yield probably due to its persistent phytotoxic effect on blackgram. Quizalofop-p-ethyl at both the doses had significantly lower yields due to its inefficiency in controlling weeds. The better growing conditions prevailed in hand weeding treatment significantly increased the seed yield of 117% over unweeded check (Table 2). Significantly the lowest yield of 493 kg ha^{-1} was recorded in unweeded check probably because of higher weed competition and unfavourable growth environment due to higher weed density and drymatter accumulation, which reduced crop drymatter and yield. The highest BCR (2.75) was recorded with pendimethalin @ 1.0 kg a.i ha^{-1}, which might be due to higher seed yield coupled with lower cost of chemical (Rs. 300 L^{-1}) followed by alachlor @ 1.0 kg a.i ha^{-1} (2.68) and imazethapyr @ 150 g a.i ha^{-1} (2.60). Though imazethapyr @ 150 g a.i ha^{-1} had the highest seed yield among herbicide treatments, it failed to give higher BCR due to high cost of chemical (Rs. 1400 L^{-1}). Imazethapyr @ 200 g a.i ha^{-1} had minimum BCR (1.14). This is due to reduced seed yield because of severe crop injury in addition to high cost of chemical.

From this study, it can be concluded that pre-emergence application of pendimethalin @ 1.0 kg a.i ha^{-1} is cost effective method of controlling *Vicia sativa* in rice-fallow blackgram.

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