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Effect of Diffferent Herbicides on Weed Growth and Grain Yield of Direct Seeded Rice under Rainfed Condition

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ABSTRACT

An experiment was conducted on weed control in direct seeded rice under rainfed condition at college farm, college of agriculture, Rajendranagar, Hyderabad, during kharif, 2010. The soil of the experimental site was sandy clay loam in texture with a pH of 7.8, low in available nitrogen, high in available phosphorus and medium in available potassium. The results revealed that early post-emergence application of Cyhalofop-buty + (chlorimuron-ethyl+ mestulfuron-methyl) @ 90+20 g ha^{-1} applied at 20-30 DAS resulted in lower weed density and weed dry matter production, thus gave higher weed control efficiency (82.13%). The same treatment recorded higher grain yield (3820 kg ha^{-1}) and found at par with two hand weedings treatment (at 20 and 40 DAS). The highest B: C ratio of 2.44 was found with Cyhalofop-buty + (chlorimuron-ethyl+mestulfuron-methyl).

Key words: *Rainfed, Rice, Yield, Herbicides*

INTRODUCTION

In India, rice is cultivated round the year in one or the other part of the country in diverse ecologies spread over 44.8 M ha with production of 99.1 M tons ha^{-1} and productivity of 2.2 t ha^{-1}. In Andhra Pradesh the area under rice is about 4.3 M ha^{-1}with production of 14.2 M tons ha^{-1} and productivity of 3.2 tonns ha^{-1}. It is estimated that by 2020 at least 170 to 180 MT (115 to 120 MT milled rice) of rice is to be produced in India (4.03 t ha^{-1}) to maintain the present level of self sufficiency[1], which means, the productivity should go up by another one tonne from the current productivity. With many constraints, producing more rice from the same land to feed additional population is a great challenge. In all rice growing countries, there is an acute shortage of human labour due to diversion of labour to non agricultural sectors.

At present due to acute shortage of labour chemical weed control is gaining movementum and of late several promissing herbicides are made available in the market which are of pre-emergence and early post-emergence in nature. The combination formulations are also available with higher efficacy.

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Such kind of combination of herbicides were found to be effective in controlling a wide range of weed species in rice[2]. It was also found that some herbicidies are cost effective and gave better results. Chemical weed control is therefore one suitable alternative under this circumstance and is a necessity for intensive agriculture.

MATERIALS AND METHODS

Field experiment was conducted at the college farm, ANGRAU Rajendranagar, Hyderabad during *kharif* season of 2010-11. To find the best weed control practice in direct seeded rice. The farm is located at an altitude of 542.6 m above mean sea level with geographical bearing of 78° 21' E longitude and 17° 19' N latitude. The soil of the experimental field was sandy clay loam in texture with in moderate drainage. Composite soil samples were collected prior to the experiment and analyzed for various physical and chemical characteristics. The soil was low in available nitrogen (230 kg ha^{-1}), high in available phosphorus (28 kg ha^{-1}) and medium in available potassium (86 kg ha^{-1}), contents. The pH was 7.8 of the soil. The field experiment was comprises of eleven treatments of weed management practices T_1–(Pyrzosulfuron-ethyl @ 25 g ha^{-1}), T_2-(Pretilachlor-S @ 750 g ha^{-1}), T_3-(Cyhalofop-butyl @ 90 g ha^{-1}), T_4–(Fenoxaprop-p-ethyl @ 60 g ha^{-1}), T_5–[Cyhalofop-buty+ (chlorimuron-ethyl+mestulfuron-methyl) @ 90+20 g ha^{-1}], T_6–[Fenoxaprop-p-ethyl + (chlorimuron-ethyl+mestulfuron-methyl) @ 60+20 g ha^{-1}], T_7-(Bispyribac sodium @ 25 g ha^{-1}), T_8–(Fenoxaprop-p-ethyl + Ethoxysulfuron @ 60+15 g ha^{-1}), T_9-(Oxyfluorfen followedby 2,4-D @ 300 fb 0.5 g ha^{-1}), T_{10}–(Two Hand weedings at 20 and 40 DAS) and T11 - Weedy check. The experiment was laid out in a randomized block design with three replications.

Medium duration rice variety MTU-1010 was used in the present experiment the good quality seeds were sown @ 100 kg ha^{-1}, by adopting a spacing of 15 x 10 cm. The crop was sown on 5th August 2010. One light irrigation was given immediately after sowing for proper germination and establishment. Biometric observations were recorded both on weed and crop at different stages. For the purpose of recording data on weed and crop, one square meter area in each net plot was randomly demarkated.

RESULTS AND DISCUSSION

The weed flora associated with experimental crop consisted of grasses *viz; Echinochloa colona, Echinochloa crusgalli, Cynadon dactylon, Digitaria sangunalis,* sedges *viz; Cyperus rotundus, Cyperus difformis* and broad leaf weeds *viz; Phyllanthus niruri, Physalis minima, Alternanthra sessillis, Commelina bengalensis, Digera arvensis, Celosia argentina, Parthinium hysterophorus, Cleom viscose* and *Eclipta alba.* Among these, broad leaf weeds are dominant weeds followed by sedges and grasses in dry seeded rainfed rice.

Effect on weeds and their control

All the weed control treatments significantly reduced the weed density, weed dry matter production and increased the weed control efficiency over weedy check (Table.1, 2 and 3). T_5–[Cyhalofopbuty+ (chlorimuron-ethyl+mestulfuron-methyl) @ 90+20 g ha^{-1}] applied at 20-30 DAS recorded lower weed population and weed dry matter production resulting in the higher weed control efficiency (82.13%) and lower weed index (4.18). However, application of T_6–[Fenoxaprop-p-ethyl + (chlorimuron-ethyl+mestulfuron-methyl) @ 60+20 g ha^{-1}] was also at par with T_5. Weed control efficiency of farmers practice (i.e. two hand weeding at 20 and 40 DAS) was also similar with T_5. In general, metsulfuron-methyl + chlorimuron-ethyl was more effective against broad leaf weeds than grassy weeds. Mukherjee and Singh, and Singh and Tewari[3, 4] also reported similar findings. *Echinochola colona* was controlled effectively with the application of Cyhalofop-butyl. Similar results were observed by Choubey *et al,*[5].

Effect on crop performance and yield

The higher grain yield of 3820 kg ha^{-1} was recorded by T_5–[Cyhalofop-buty + (chlorimuron-ethyl+mestulfuron-methyl) @ 90+20 g ha^{-1}] and stood at par with T_{10} –(Two Hand Weedings at 20 and 40 DAS) (4873 kg ha^{-1}). Significantly lower grain yield of 1244 kg ha^{-1} was with T_{11} - Weedy check. The grain yield increased by T_{10} and T_5 was 220.4 and 207.0% over weedy check respectively. These results are in accordance with findings of Saini[6] and Mukherjee and Singh[7].

The efficacy of treatment T_5 was because Cyhalofop-buty controlled grassy weeds and Almix (chlorimuron-ethyl+mestulfuron-methyl) controlled both sedges and broad leaf weeds simultaneously and resulted in lower weed density and minimum dry matter accumulation by the weeds. These results are in accordance with the findings of Saini[8] and Gopinath and Kundu[9]. This was mainly due to bio-efficacy of herbicidal mixture of Cyhalofop-buty + (chlorimuron-ethyl+mestulfuron-methyl) and Fenoxaprop-p-ethyl + (chlorimuron-ethyl+ mestulfuron-methyl) in controlling wide range of weed species (grasses, sedges and broad leaf weeds). Cyhalofop-butyl is an inhibitor of acetyl coenzyme–A carboxylase, apivotal enzyme in plant fatty acid biosynthesis and Almix (chlorimuron-ethyl+mestulfuron-methyl) controlled the weeds by inhibiting acetolactatesynthase (ALS), a key enzyme in the biosynthesis of the branched chain amino acids isoleucine, leucine, and valine. The same results were reported by Saini *et al.*[10]; Singh *et al.*[11].

Table 1: Effect of weed control treatments on weed density (no.m^{-2}), weed dry matter (g m^{-2}) and weed control efficiency (%) at different stages of dry-seeded rainfed rice

T No.	Treatments	Time of application (DAS)	Dose (g ha^{-1})	Weed density (no.m^{-2})		Weed dry matter (g m^{-2})		Weed control efficiency (%)	
				20 DAS	60 DAS	20 DAS	60 DAS	20 DAS	60 DAS
T_1	Pyrzosulfuron-ethyl	3-7	25	6.33	12.67	8.2	37.9	44.96	56.59
T_2	Pretilachlor-S	0-5	750	6.33	10.33	8.9	40.4	40.26	53.72
T_3	Cyhalofop-butyl	25	90	15.33	10.00	14.8	39.7	0.91	54.49
T_4	Fenoxaprop-ethyl	30	60	14.66	12.33	14.9	43.2	0.45	50.52
T_5	Cyhalofop-butyl + (Chlorimuron-ethyl + Mestulfuron-methyl)	25-30	90+20	15.33	9.66	14.5	15.6	2.68	82.13
T_6	Fenoxaprop-ethyl +(Chlorimuron-ethyl + Mestulfuron-methyl)	25-30	60+20	14.66	10.33	14.5	19.0	2.68	78.24
T_7	Bispyribac sodium	20	25	15.33	9.34	14.6	28.1	2.01	67.81
T_8	Fenoxaprop-ethyl + Ethoxysulfuron	25-30	60+15	15.33	11.66	14.8	23.4	0.65	73.20
T_9	Oxyfluorfen + 2,4-D	0-5 fb 30	300 fb 0.5	7.66	8.33	9.5	25.6	36.39	70.68
T_{10}	Two Hand Weedings	20 and 40		15.33	6.00	14.8	13.9	0.47	84.08
T_{11}	Weedy check	_		15.66	26.00	14.9	87.3	0.0	0.0
	S.Em(+_)			0.41	1.29	0.27	2.5		
	C.D (p=0.05)			1.24	3.84	0.82	7.7		

Table 2: Effect of weed control treatments on weed index (WI), grain yield (kg ha^{-1}) and B: C ratio of dry-seeded rainfed rice

T No.	Treatments	Time of application (DAS)	Dose (g ha^{-1})	Weed index (WI)	Grain yield (kg ha^{-1})	B:C Ratio
T_1	Pyrzosulfuron-ethyl	3-7	25	27.11	2906.00	2.08
T_2	Pretilachlor-S	0-5	750	27.58	2887.00	1.93
T_3	Cyhalofop-butyl	25	90	49.53	2012.00	1.36
T_4	Fenoxaprop-ethyl	30	60	50.06	1987.00	1.42
T_5	Cyhalofop-butyl + (Chlorimuron-ethyl + Mestulfuron-methyl)	25-30	90+20	4.18	3820.00	2.44
T_6	Fenoxaprop-ethyl +(Chlorimuron-ethyl + Mestulfuron-methyl)	25-30	60+20	14.07	3426.00	2.33
T_7	Bispyribac sodium	20	25	15.04	3387.00	2.24
T_8	Fenoxaprop-ethyl + Ethoxysulfuron	25-30	60+15	13.11	3464.00	2.33
T_9	Oxyfluorfen + 2,4-D	0-5 fb 30	300 fb 0.5	14.37	3414.000	2.38
T_{10}	Two Hand Weedings	20 and 40		0.00	3987.00	2.08
T_{11}	Weedy check	_		68.79	1244.00	0.96
	S.Em(+_)			-	107.32	-
	C.D (p=0.05)			-	318.83	-

CONCLUSION

Among the weed control treatments, the chemical treatment *i.e.* Cyhalofop-butyl+ (Chlorimuron-ethyl+Metsulfuron-methyl) @ 90+20 g ha^{-1} was found effective in controlling different weeds and recorded higher WCE of 82.13% in direct seeded rainfed rice.The early post-emergence herbicides were found effective as compared to pre-emergence herbicides for better growth of rice and higher grain yield. Among the early post-emergence herbicides, application of Cyhalofop-butyl + (Chlorimuron-ethyl+ Metsulfuron-methyl) @ 90+20 g ha^{-1} recorded at par grain yield with that of hand weeding treatment (at 20 and 40 DAS).Cyhalofop-butyl + (Chlorimuron-ethyl+Metsulfuron-methyl) @ 90+20 g ha^{-1}] was found economically beneficial weed control practice and recorded maximum BCR (2.22) over two hand weedings treatment (2.08).

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