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Response of Drum Seeded Rice to Different Pre - and Post-Emergence Herbicides

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ABSTRACT

A field experiment was conducted during *kharif*, 2012 at S.V. Agricultural College Farm, Tirupati to identify the effective and economic weed management practices for the control of weeds in drum seeded rice. Among the sequential application of pre- and post-emergence herbicides including mechanical weeding with two row power weeder, pre-emergence application of oxadiargyl 75 g *a.i* ha^{-1} at 7 DAS followed by azimsulfuron 30 g *a.i* ha^{-1} applied at 40 DAS resulted in the highest growth parameters *viz.,* plant height, number of tillers m^{-2}, leaf area index and dry matter production and the highest grain yield (5.75 t ha^{-1}) including maximum benfit : cost ratio (3.30) due to effective control of weeds throughout crop growing period.

Key words : Drum seeded rice, Herbicides, Weed Management, Yield.

Rice (*Oryza sativa* L.) is an important food crop of India contributing 45 per cent of the total food grain production. Among the different methods of crop establishment techniques of rice in our country, transplanting has been the major method of establishment, but, it requires more labour and cumbersome practice due to nursery raising. Wet seeding holds special significance in the present day rice production systems with regard to saving of water, time, labour, energy and enhanced productivity and profitability of rice cultivation. Shifting from transplanting to wet seeding has resulted in change in relative abundance of weed species and competition offered by the weeds is severe due to emergence of weeds and rice seed lings simultaneously at a time. Heavy weed infestation in direct seeded rice reduces the grain yield upto 53 per cent (Hussain *et al*., 2008). Hand weeding is the most effective method for the control of weeds, but it is not possible due to scarcity and increased cost of labour. Mechanical weeding with manually operated weeder is drudgery and escape the weeds present in between the plant rows. Hence, usage of herbicides offers scope for effective and economical control of weeds from very beginning of the crop and increased the competition edge to crop than weeds. Pre-emergence herbicides alone *viz.,* butachlor, pretilachlor and anilofos may not be sufficient to control the weeds in drum seeded rice due to severe weed infestation. In cognizance of the above, the present study was undertaken to test the relative efficacy of sequential application of pre- and post-emergence herbicides, along with mechanical weeding with two row power weeder in drum seeded rice.

MATERIAL AND METHODS

A field investigation was carried out during *kharif* 2012 at S.V. Agricultural College Farm, Acharya N.G. Ranga Agricultural University, Tirupati, Andhra Pradesh to evaluate the response of drum seeded rice to different pre- and post-emergence herbicides. The soil of the experiment field was sandy loam in texture, low in available nitrogen (215 kg ha^{-1}) phosphorus (23.5 kg ha^{-1}) and organic carbon (0.43%), medium in potassium (250 kg ha^{-1}), neutral in reaction (pH 6.9) and EC of 0.18 ds m^{-1}. The field experiment was laid out in Randomized Block Design with ten treatments and replicated thrice. The experiment consisted of pre-emergence application of pretilachlor @ 500 g *a.i* ha^{-1} (T_1), pre-emergence application of oxadiargyl @ 75 g *a.i* ha^{-1} (T_2), pre-emergence application of pretilachlor @ 500 g *a.i* ha^{-1} + mechanical weeding with power weeder at 40 DAS (T_3), pre-emergence application of oxadiargyl @ 75 g *a.i* ha^{-1} + mechanical weeding with power weeder at

40 DAS (T_4), pre-emergence application of pretilachlor @ 500 g *a.i* ha^{-1} + azimsulfuron @ 30 g *a.i* ha^{-1} at 40 DAS (T_5), pre-emergence application of oxadiargyl @ 75 g *a.i* ha^{-1} + azimsulfuron @ 30 g *a.i* ha^{-1} at 40 DAS (T_6), pre-emergence application of pretilachlor @ 500 g *a.i* ha^{-1} + bispyribac-sodium @ 30 g *a.i* ha^{-1} at 40 DAS (T_7) and pre-emergence application of oxadiargyl @ 75 g *a.i* ha^{-1} + bispyribac-sodium @ 30 g *a.i* ha^{-1} at 40 DAS (T_8) besides two hand weeding at 20 and 40 DAS (T_9) and unweeded check (T_{10}). The required quantities of pre-emergence herbicides (pretilachlor and oxadiargyl) were mixed with fine sand @ 50 kg ha^{-1} and then broadcasted at 7 DAS and post-emergence herbicides (bispyribac-sodium and azimsulfuron) were applied uniformly at 40 DAS *i.e* 3-4 leaf stage of the weeds by using spray fluid @ 500 L ha^{-1} with the help of knap sack sprayer. Mechanical weeding with two row power weeder was carried out at 40 DAS as per the treatments. A uniform fertilizer dose of 120-60-60 N, P_2O_5 and K_2O kg ha^{-1} was applied. One third dose of nitrogen and entire phosphorus and potassium were applied as basal and remaining nitrogen was top dressed in two equal splits at active tillering and panicle initiation stage. Rice variety Somasila was used as test variety. Sowing of sprouted seeds was done with the help of drum seeder on perfectly leveled puddled soil. The data on weed density and dry weight at harvest were subjected to square root ($\sqrt{x+0.5}$) transformation to normalize their distribution. Growth parameters *viz.,* plant height, number. of tillers m^{-2} and dry matter production were recorded as per the standard procedure and economics of the drum seeded rice cultivation was worked out.

RESULTS AND DISCUSSION

Effect on weed

The dominant weed flora associated with experimental field were *Cyperus differmis* (L.), *Cyperus iria* (L.), *Cyperus rotundus* (L.), *Echinochloa colonum* (L.), *Eclipta alba* (L.) Hassk and *Ammania baccifera* (L.). Hand weeding twice at 20 and 40 DAS recorded the lowest density and dry weight of weeds. The next best weed management practice was the pre-emergence application of oxadairgyl @ 75 g *a.i* ha^{-1} followed by azimsulfuron @ 30 g *a.i* ha^{-1} applied at 40 DAS showed better performance in minimizing the density and dry weight of weeds (Table-1) and it was comparable with pre-emergence application of oxadairgyl @ 75 g *a.i* ha^{-1} followed by bispyribac-sodium 30 g *a.i* ha^{-1} applied at 40 DAS. This might be due to effective control of weeds by pre-emergence application of oxadiargyl @ 75 g *a.i* ha^{-1} as it inhibits the protoporphyrinogen oxidase enzyme in target plants (Dickmann *et al.,* 1997) than pretilachlor at early stages. Further, post-emergence application of azimsulfuron @ 30 g *a.i* ha^{-1} might have controlled the predominant weed flora *i.e* sedges more effectively than bispyribac-sodium at later stages (Ferrero *et al*., 2002). Mechanical weeding with two row power weeder was found to be ineffective in controlling weeds as many of the weeds present in intra rows of the crop and pre-emergence application of pretilachlor @ 500 g *a.i* ha^{-1} or oxadiargyl @ 75 g *a.i* ha^{-1} alone were ineffective in controlling weeds throughout the crop period.

Effect on crop growth

Among the weed management practices tried, pre-emergence application of oxadiargyl 75 g *a.i* ha^{-1} followed by azimsulfuron @ 30 g *a.i* ha^{-1} applied at 40 DAS resulted in the highest values of growth parameters *viz.,* plant height, leaf area index, number of total tillers m^{-2} and drymatter production, which were however, comparable with two hand weedings at 20 and 40 DAS. This might be due to nearly weed free environment that facilitated the better availability of nutrients and moisture for crop growth and development (Pratap Singh *et al*., 2009). Pre-emergence application of oxadiargyl or pretilachlor alone or supplemented with mechanical weeding with two row power weeder were not effective in producing higher values of growth parameters. The lowest values of the above said growth parameters were associated with unweeded check, which were significantly lower than with rest of the weed management practices due to severe weed infestation.

Yield

Grain and straw yield was significantly influenced by different weed management practices in drum seeded rice. The highest grain and straw

Table 1. Weed density and dry weight and growth parameters of drum seeded rice as influenced by different weed management practices.

Treatment	Dose (g *a.i* ha^{-1})	Time of application (DAS)	Weed density (No. m^{-2})	Weed dry weight (g m^{-2})	Plant height (cm)	Leaf area index	Tillers (No. m^{-2})	Dry matter production (kg ha^{-1})
Pretilachlor	500	7	78.66 (8.88)	56.19 (7.52)	85.1	5.18	340	9240
Oxadiargyl	75	7	75.00 (8.68)	53.98 (7.38)	86.6	5.23	347	9410
Pretilachlor *fb* power weeder	500	7+40	36.00 (6.03)	30.50 (5.56)	90.2	5.67	358	10104
Oxadiargyl *fb* power weeder	75	7+40	34.33 (5.90)	29.59 (5.48)	90.7	5.72	362	10291
Pretilachlor *fb* azimsulfuron	500+30	7+40	18.66 (4.37)	20.72 (4.60)	95.4	6.28	381	10615
Oxadiargyl *fb* azimsulfuron	75+30	7+40	16.33 (4.09)	18.80 (4.39)	104.6	6.92	414	11634
Pretilachlor *fb* bispyribac-sodium	500+30	7+40	19.00 (4.41)	20.90 (4.62)	95.1	6.25	374	10538
Oxadiargyl *fb* bispyribac-sodium	75+30	7+40	16.66 (4.14)	19.09 (4.42)	95.8	6.3	383	10721
HW twice	-	20+40	7.33 (2.79)	12.00 (3.53)	104.1	6.86	408	11514
Unweeded check			271.00 (16.46)	225 (15.01)	75.3	4.56	280	8674
CD (p=0.05)			0.200	0.160	0.8	0.06	10	207

Figures in parenthesis indicates square root transformed ($\sqrt{X+0.5}$) values. *fb*: followed by.

yield as well as harvest index were recorded with pre-emergence application of oxadairgyl @ 75 g *a.i* ha^{-1} followed by azimsulfuron @ 30 g *a.i* ha^{-1} applied at 40 DAS, and was at par with two hand weedings at 20 and 40 DAS. This might be due to lesser competition offered by weeds for growth resources during the entire crop growth period which lead to increased yield components and there by increased the grain yield. These results are in conformity with those of Singh *et al.,* (2010). The decrease in grain and straw yield of drum seeded rice due to heavy weed infestation in unweeded check was 51and 46 per cent, in respectively compared to the best weed management practice *i.e* pre-emergence application of oxadairgyl 75 g *a.i* ha^{-1} followed by azimsulfuron 30 g *a.i* ha^{-1} applied at 40 DAS.

Economics

The highest net returns (₹68,766) and benefit-cost ratio (3.30) were realized with pre-emergence application of oxadiargyl @ 75 g *a.i* ha^{-1} followed by azimsulfuron @ 30 g *a.i* ha^{-1} applied at 40 DAS. This might be due to effective control of all the categories of weeds by these herbicides that lead to increased grain and straw yield and reduced cost of weeding compared to other weed management practices. These results are in accordance with those of Dharminder *et al.* (2012). The next best weed management practice in drum seeded rice to obtain higher benfit : cost ratio was the pre-emergence application of oxadiargyl @ 75 g *a.i* ha^{-1} followed by bispyribac-sodium @ 30 g *a.i* ha^{-1} applied at 40 DAS and it was at par with two hand weedings at 20 and 40

Table 2. Yield and economics of drum seeded rice as influenced by different weed management practices.

Treatment	Dose (g *a.i* ha^{-1})	Time of application (DAS)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Cost of cultivation (₹ ha^{-1})	Net returns (₹ ha^{-1})	Benefit : Cost ratio
Pretilachlor	500	7	3810	5500	26500	39974	2.50
Oxadiargyl	75	7	3928	5580	26639	41803	2.53
Pretilachlor *fb* power weeder	500	7+40	4500	5891	27164	50830	2.89
Oxadiargyl *fb* power weeder	75	7+40	4601	5946	27303	52273	2.91
Pretilachlor *fb* azimsulfuron	500+30	7+40	5180	6208	29686	59416	3.00
Oxadiargyl *fb* azimsulfuron	75+30	7+40	5754	6513	29825	68766	3.30
Pretilachlor *fb* bispyribac-sodium	500+30	7+40	5100	6195	28870	58939	3.01
Oxadiargyl *fb* bispyribac-sodium	75+30	6+40	5200	6214	29009	60419	3.08
HW twice	-	20+40	5706	6500	31900	65910	3.06
Unweeded check			2820	4458	25900	23692	1.91
CD (p=0.05)			139	94	-	2900	0.04

DAS. Among the weed management practices tried. Pre-emergence application of oxadiargyl or pretilachlor alone recorded lower benefit: cost ratio followed by these herbicides supplemented with mechanical weeding with two row power weeder at 40 DAS. This might be due to ineffective control of weeds lead to reduced grain and straw yields.

Conclusion

It can be concluded that pre-emergence application of oxadairgyl @ 75 g *a.i* ha^{-1} followed by azimsulfuron @ 30 g *a.i* ha^{-1} applied at 40 DAS resulted in the broad spectrum weed control with the highest grain yield and net returns with drum seeded rice.

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