



## Management of weeds in direct-seeded rice

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### ABSTRACT

A field experiment was conducted during the *Kharif* season of 2012 to 2014 for three years at Agricultural Research Station, Vadgaon Maval, Pune, Maharashtra to find out the efficacy of different chemical and mechanical weed control methods and its economics in direct-seeded rice. From the pooled data it was observed that the pre-emergence application of oxyfluorfen 0.150 kg/ha and post-emergence application metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha as weed control measure in direct-seeded rice gave the highest net returns (₹ 57,063/ha) with higher B:C ratio (2.3) having lower weed index (2.96) and higher weed control efficiency (91.08 %).

**Key words:** Direct-seeded rice, Economics, Herbicide, Management, Weeds, Yield

Rice (*Oryza sativa* L.) is a major food grain crop of the world and more than half of the population subsists on it. India is the second largest rice producing country in the world. The method of direct seeding escapes the transplanting and puddling operations which is an attractive and sustainable alternative to traditional transplanting of rice. Direct-dry seeding offers faster and easier planting, reduced labour, earlier crop maturity by 7–10 days, and higher tolerance of water deficit, (Balasubramanian and Hill 2002). A major impediment in the successful cultivation of direct-seeded rice (DSR) in tropical countries is heavy infestation of weeds which often range from 50-91% (Paradkar *et al.* 1997) due to simultaneous emergence of weeds and crop and less availability of efficient selective herbicides for control of weeds during initial stages of crop weed competition. However, weeds are the main biological constraints to the production of DSR (Rao *et al.* 2007, Chauhan and Johnson 2010), which may cause 60-80% reduction in grain yield of rice. Hence, present study was carried out to evaluate the efficacy of different chemical and mechanical weed control methods and its economics in direct-seeded rice.

### MATERIALS AND METHODS

A field experiment was carried out during *Kharif* 2012, 2013 and 2014 for three years at Agricultural Research Station, Vadgaon Maval, Pune, Maharashtra. The experiment consisted of ten treatments comprising of unweeded check, weed free and weed control methods, *viz.* pre-emergence application of pendimethalin (1.0 kg/ha), oxyfluorfen (0.150 kg/ha), metsulfuron-methyl + chlorimuron-ethyl (0.004 kg/ha, 25 DAS), pendimethalin (1.0 kg/

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ha) *fb* metsulfuron-methyl + chlorimuron-ethyl (0.004 kg/ha, 25 DAS), oxyfluorfen (0.150 kg/ha) *fb* metsulfuron-methyl + chlorimuron-ethyl (0.004 kg/ha, 25 DAS), pendimethalin (1.0 kg/ha) *fb* 1 hoeing (25-30 DAS) *fb* 1 HW (40-45 DAS), oxyfluorfen (0.150 kg/ha) *fb* 1 hoeing (25-30 DAS) *fb* 1 HW (40-45 DAS), metsulfuron-methyl + chlorimuron-ethyl (0.004 kg/ha, 25 DAS) *fb* 1 HW (40-45 DAS). The experiment was laid out in randomized block design with three replications. The rice variety '*Phule Samruddhi*' was sown at 22.5 cm distance during *Kharif* 2012-2014. All the herbicides were sprayed by using water 500 L/ha with the help of sprayer fitted with flat fan nozzle. The weed samples taken out as per treatment were oven dried for about one week and dry weight was recorded. All the other recommended package of practices except weed control was followed to raise the direct dry seeded crop.

### RESULTS AND DISCUSSION

#### Effect on weeds

Dominant weed flora consisted of monocots as *Echinochloa colona* and *Cynodon dactylon* among grasses; *Cyperus iria* and *Cyperus difformis* among sedges and *Eclipta alba*, *Portulaca oleracea*, *Celosia argentea* and *Ludwigia parviflora* among.

Various weed parameters like lowest weight of dry matter of weed (g/m<sup>2</sup>), weed control efficiency (%) and lower weed index were significantly influenced by different treatment under studies. Significantly lowest weight of dry matter of weed and weed index with highest weed control efficiency were recorded in the weed-free treatment (Table 1 and 2). The second best treatment was pre-

**Table 1. Weight of dry matter of weed (g/m<sup>2</sup>), weed control efficiency (%) and mean weed index of paddy as affected by different treatments for the year 2012-2014 and pooled mean**

Treatment	Weight of dry matter of weed (g/m <sup>2</sup> )				Weed control efficiency (%)				Weed index			
	2012	2013	2014	Pooled	2012	2013	2014	Pooled	2012	2013	2014	Pooled
Pendimethalin PE 1.0 kg/ha	182.1	167.5	126.6	158.8	38.5	34.7	40.9	38.0	41.1	44.5	40.4	42.0
Oxyfluorfen PE 0.150 kg/ha	155.9	149.7	113.0	139.6	47.3	41.5	47.1	45.3	38.5	40.5	38.3	39.1
Metsulfuron-methyl + chlorimuron-ethyl POE 0.004 kg/ha	161.6	147.0	111.0	139.9	45.4	42.5	48.0	45.3	35.6	33.9	34.8	34.8
Pendimethalin PE 1.0 kg/ha + POE application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha	67.1	61.1	34.7	54.3	77.1	75.7	83.7	78.8	7.1	15.6	18.0	13.5
Oxyfluorfen PE 0.150 kg/ha + POE application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha	27.4	25.0	15.9	22.8	90.6	90.1	92.5	91.1	2.0	4.3	2.6	3.0
Pendimethalin PE 1.0 kg/ha + one hoeing (25 to 30 DAS) + one hand weeding (40 to 45 DAS)	146.0	132.9	91.1	123.3	50.5	47.7	57.3	51.9	23.5	30.4	29.6	27.8
Oxyfluorfen PE 0.150 kg/ha + one hoeing (25 to 30 DAS) + one hand weeding (40 to 45 DAS)	121.2	110.3	87.7	106.4	59.0	56.8	58.7	58.1	20.5	24.8	26.0	23.8
POE application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha + one hand weeding (40 to 45 DAS)	126.0	121.0	91.33	112.8	57.3	52.5	57.1	55.6	26.4	27.2	28.9	27.5
Unweeded check	296.9	257.5	215.5	256.6	00.0	0.0	0.0	0.0	74.7	73.1	60.3	69.4
Weed-free	0.00	0.00	0.00	0.00	100.0	100.0	100.0	100.0	00.0	0.0	0.0	0.0
LSD (P=0.05)	25.9	25.9	17.5	20.8	8.3	9.5	7.1	7.6				

PE – Pre-emergence, POE –Post-emergence

**Table 2. Mean grain and straw yield (t/ha) of paddy for the year 2012-2014 and pooled mean**

Treatment	Grain yield (t/ha)				Straw yield (t/ha)			
	2012	2013	2014	Pooled	2012	2013	2014	Pooled
Pendimethalin PE 1.0 kg/ha	3.11	3.29	3.48	3.29	3.63	3.77	3.88	3.76
Oxyfluorfen PE 0.150 kg/ha	3.26	3.53	3.61	3.46	3.80	4.06	4.02	3.96
Metsulfuron-methyl + chlorimuron-ethyl POE 0.004 kg/ha	3.41	3.92	3.82	3.72	3.98	4.49	4.25	4.24
Pendimethalin PE 1.0 kg/ha + POE application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha	4.92	5.00	4.80	4.91	5.74	5.75	5.38	5.63
Oxyfluorfen PE 0.150 kg/ha + POE application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha	5.20	5.69	5.71	5.53	6.07	6.61	6.45	6.38
Pendimethalin PE 1.0 kg /ha + one hoeing (25 to 30 DAS) + one hand weeding (40 to 45 DAS)	4.06	4.13	4.12	4.10	4.73	4.69	4.58	4.67
Oxyfluorfen PE 0.150 kg/ha + one hoeing (25 to 30 DAS) + one hand weeding (40 to 45 DAS)	4.22	4.47	4.34	4.34	4.92	5.12	4.82	4.95
POE application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha + one hand weeding (40 to 45 DAS)	3.92	4.35	4.16	4.14	4.57	4.99	4.61	4.73
Unweeded check	1.34	1.60	2.33	1.76	1.56	1.80	2.56	1.98
Weed free	5.31	5.95	5.86	5.71	6.20	6.84	6.63	6.55
LSD (P=0.05)	5.43	6.63	7.25	6.02	6.29	7.33	8.13	6.77

PE – Pre-emergence, POE –Post-emergence

emergence application of oxyfluorfen 0.150 kg/ha and post-emergence application of metsulfuron-methyl 10% + chlorimuron-ethyl 0.004 kg/ha having lowest weight of dry matter of weed (22.77 g/m<sup>2</sup>) with higher weed control efficiency (91.08%) and lower weed index (2.96). The highest weed biomass was recorded in unweeded check. Result were in close conformity with Singh *et al.* (2014)

### Effect on crop

Pooled data, revealed that the mean grain and straw yield (t/ha) of paddy were affected significantly by different treatments (Table 3). It was observed that the significant highest grain and straw yield of paddy (5.71 t/ha and 6.55 t/ha, respectively) were obtained in the weed free treatment. It was at par with

**Table 3. Economics of paddy as affected by different treatments for the year 2012-2014 and pooled mean**

Treatment	Net returns (x10 <sup>3</sup> /ha)				B:C ratio			
	2012	2013	2014	Pooled	2012	2013	2014	Pooled
Pendimethalin PE 1.0 kg/ha	13.29	16.25	18.85	16.13	1.2	1.4	1.4	1.3
Oxyfluorfen PE 0.150 kg/ha	15.73	20.43	21.46	19.21	1.4	1.5	1.4	1.4
Metsulfuron-methyl + chlorimuron-ethyl POE 0.004 kg/ha	18.75	27.69	27.34	24.59	1.4	1.7	1.6	1.6
Pendimethalin PE 1.0 kg/ha + POE application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha	45.12	46.42	44.09	45.21	2.1	2.1	1.9	2.0
Oxyfluorfen PE 0.150 kg/ha + POE application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha	50.07	58.81	62.31	57.06	2.2	2.4	2.2	2.3
Pendimethalin PE 1.0 kg /ha + one hoeing (25 to 30 DAS) + one hand weeding (40 to 45 DAS)	27.17	28.21	27.47	27.62	1.6	1.6	1.5	1.6
Oxyfluorfen PE 0.150 kg/ha + one hoeing (25 to 30 DAS) + one hand weeding (40 to 45 DAS)	29.91	34.21	32.09	32.07	1.7	1.7	1.6	1.7
POE application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha + one hand weeding (40 to 45 DAS)	25.86	33.26	32.14	30.42	1.6	1.7	1.6	1.6
Unweeded check	17.83	-13.41	-1.21	-10.82	0.6	0.7	1.0	0.8
Weed free	47.21	58.37	57.59	54.39	1.9	2.2	2.0	2.0
LSD (P=0.05)	9.73	11.76	14.37	11.16				

PE – Pre-emergence, POE –Post-emergence

pre-emergence application of oxyfluorfen 0.150 kg/ha and post-emergence application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg /ha having grain yield (5.53 t/ha) and straw yield (6.38 t/ha). Similar result were in close conformity of Abraham *et al.* (2014)

### Economics

Pooled data (Table 3), revealed that weed free treatment recorded significantly highest gross returns (₹ 1,05,931/ha). However, it was at par with the treatment pre-emergence application of oxyfluorfen 0.150 kg/ha and post-emergence application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha (₹ 1,02,753/ha).

The significantly highest net returns (₹ 57,063/ha) was obtained in the treatment of pre emergence application of oxyfluorfen 0.150 kg/ha and post-emergence application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha which was at par with the weed free treatment (₹ 54390/ha).

The highest B: C ratio (2.3) was observed in pre-emergence application of oxyfluorfen 0.150 kg/ha and post-emergence application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg /ha (Table 3).

The gram was dibbled immediately after harvest of experimental paddy plot to observe the effect of different treatments on succeeding crop. The various herbicides applied to the paddy crop did not affect the germination of the succeeding crop gram.

It was concluded that in drilled paddy for effective management of weeds, pre-emergence application of oxyfluorfen 0.150 kg/ha and post-emergence application of metsulfuron-methyl + chlorimuron-ethyl 0.004 kg/ha at 25 days after sowing in 500 liters of water proved effective and economical.

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