



Optimization of suitable weed management practices for aerobic rice

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Nowadays water is the most critical input in agriculture and future estimate revealed that scarcity of water will become more severe as the share of water to other sector will increase. And all of us know that rice crop water requirement is very high particularly for puddling for transplanting of rice. Therefore new cultivation system *i.e.* aerobic rice should be tested as it requires very less amount of water to reduce future water scarcity problem. The reality is that rice production needs to produce more rice with less water *i.e.* more crop per drop. In aerobic rice, crop is subjected to greater weed competition than transplanted rice. Weeds are one of the major constraints to aerobic rice production systems, as dry tillage, alternate wetting and drying condition are conducive to germination, growth of weeds causing grain yield losses of 50-90 % (Mishra and Singh 2007). This constraint also causes in the way of wider adoption of aerobic rice as weeds and rice seeds germinate at the same time causing serious crop-weed competition.

In recent years, some attempts have been made for developing suitable weed management strategies for rice which are economically viable and practically feasible for general adoption by the average farmers in India. Chemical or mechanical methods of weed management in isolation have also been found effective in many situations of upland rice but these chemical have to be tested especially for aerobic condition. Now, it is the need of hour to find out suitable weed management practice for effective weed management in aerobic rice for increasing crop yield and water use efficiency and to make aerobic rice cultivation more viable. Considering the above facts, a field experiment was conducted to evaluate the efficacy of different weed management practices in managing weeds of aerobic rice.

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A field experiment was carried out at the Agricultural Research Farm, Rajendra Agricultural University, Pusa, Samastipur, Bihar (India), during *Kharif* season of 2012. Geographically, Pusa is located in semi-arid and sub-tropical region at 25° 59' N latitude, 85°40' E longitude and at an altitude of 52.1 m above mean sea level. The soil of the experimental field was clay loam in texture. It was moderately fertile being low in organic carbon (0.32%), available nitrogen (249 kg N/ha), phosphorus (16.86 kg P₂O₅/ha) and potassium (120 kg K₂O/ha). The soil was alkaline in reaction (pH 8.4). Rice variety "*Rajendra Suwasani*" was taken as a test crop with recommended dose of fertilizer (RDF) 130-68-58 kg N-P₂O₅-K₂O/ha. The experiment was conducted with 14 weed management treatments *viz.* pretilachlor at 750 g/ha at 1 days after sowing (DAS), pyrazusulfuron at 25 g/ha at 5 DAS; bispyribac sodium at 25 g/ha at 20 DAS; pretilachlor at 750 g/ha at 1 DAS followed by (*fb*) bispyribac sodium at 25 g/ha at 20 DAS; pyrazusulfuron at 25 g/ha at 5 DAS *fb* bispyribac sodium at 25 g/ha at 20 DAS; pretilachlor at 750 g/ha at 1 DAS *fb* one hand weeding at 20 DAS; *sesbania* co-culture at 40 kg/ha *fb* 2,4-D at 800 g/ha at 20 DAS; *sesbania* co-culture at 40 kg/ha *fb* bispyribac sodium at 25 g/ha at 20 DAS; *sesbania* co-culture at 40 kg/ha + pretilachlor at 750 g/ha at 1 DAS *fb* 2,4-D at 800 g/ha at 20 DAS; azimsulfuron at 35 g/ha at 20 DAS; pretilachlor at 750 g/ha at 1 DAS *fb* azimsulfuron at 35 g/ha at 20 DAS; two hand weeding at 15 and 30 DAS; two hand weeding at 20 and 40 DAS; weedy check in RBD replicated thrice. A quadrat of size 0.50 m² was placed in the sampling area of each plot and weeds falling within the frames of quadrat were counted and recorded. These weeds were removed, washed free of soil and oven dried at 70 °C for 72 hours and the weed biomass was recorded. Weed index was calculated by the formula proposed by Gill and Kumar (1969). Since the data on weed density and weed biomass showed high variation, the data were subjected to square root transformation.

Weed growth

The weed management practices significantly influenced the weed density and weed dry weight at different stages of aerobic rice (Table 1). Weed density and weed dry weight were registered significantly lowest under two hand weeding at 20 and 40 DAS at all crop growth stages due to effective management of the first flush of weeds during 20 DAS and second flush of weeds during 40 DAS. This result was similar to that of the experimental findings of Yadav *et al.* (2007).

Weed control efficiency and weed control index

Weed control efficiency varied with different weed management practices in aerobic rice. At 30 DAS, weed control efficiency ranged from 48.24% in bispyribac sodium at 25 g/ha at 20 DAS to 88.02% in hand weeding twice at 20 and 40 DAS (Table 2) indicating the superiority of hand weeding twice at 20 and 40 DAS during critical period of crop weed competition. This finding is in conformity with Walia *et al.* (2008).

All the weed management treatments substantially reduced the competition by weeds for various resources resulting in lower weed control index. Two hand weeding at 20 and 40 DAS recorded the least weed control index (0.00) followed by two hand weeding at 15 and 30 DAS (4.33) and pretilachlor at 750 g/ha at 1 DAS *fb* azimsulfuron at 35 g/ha at 20 DAS (4.66).

Grain and straw yield

Amongst weed management treatments, maximum grain and straw yield were recorded in treatment where hand weeding was done twice either 20 and 40 DAS or 15 and 30 DAS maintained its superiority over rest of the treatments and it was followed by those treatments where pre-emergence application of herbicide followed by post-emergence herbicide. Hand weeding twice at 20 and 40 DAS recorded maximum grain yield of 3.95 t/ha which was 56 % higher over weedy check (1.73 t/ha). Among the various combination of herbicides, application of pretilachlor at 750 g/ha at 1 DAS *fb*

Table 1. Effect of different weed management treatments on weed growth in aerobic rice

Treatment	Weed density (no./m ²)			Weed dry Weight (g/m ²)		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
Pretilachlor at 750 g/ha at 1 DAS	136.0 (11.7)	152.7 (12.4)	94.3 (9.8)	13.9 (3.8)	43.5 (6.7)	23.0 (4.9)
Pyrazosulfuron at 25 g/ha at 5 DAS	122.0 (11.1)	149.7 (12.3)	92.3 (9.6)	12.3 (3.6)	37.3 (6.2)	23.0 (4.9)
Bispyribac-sodium at 25 g/ha at 20 DAS	151.0 (12.3)	168.3 (13.0)	105.7 (10.3)	14.9 (4.0)	47.3 (6.9)	27.3 (5.3)
Pretilachlor at 750 g/ha at 1 DAS <i>fb</i> bispyribac sodium at 25 g/ha at 20 DAS	59.0 (7.7)	94.3 (9.8)	68.3 (8.3)	5.2 (2.5)	20.3 (4.6)	14.7 (3.9)
Pyrazosulfuron at 25 g/ha at 5 DAS <i>fb</i> bispyribac sodium at 25 g/ha at 20 DAS	52.5 (7.3)	66.0 (8.2)	47.0 (6.9)	4.1 (2.2)	14.6 (3.9)	10.7 (3.4)
Pretilachlor at 750 g/ha at 1 DAS <i>fb</i> one hand weeding at 20 DAS	54.3 (7.4)	86.3 (9.3)	51.3 (7.2)	4.8 (2.4)	18.5 (4.4)	12.7 (3.7)
<i>Sesbania</i> co-culture at 40 kg/ha <i>fb</i> 2,4-D at 800 g/ha at 20 DAS	98.7 (10.0)	135.3 (11.7)	85.3 (9.3)	9.3 (3.2)	34.4 (5.9)	18.2 (4.3)
<i>Sesbania</i> co-culture at 40 kg/ha <i>fb</i> bispyribac sodium at 25 g/ha at 20 DAS	80.0 (9.0)	127.0 (11.3)	81.0 (9.0)	8.4 (3.1)	28.4 (5.4)	17.2 (4.2)
<i>Sesbania</i> co-culture at 40 kg/ha + pretilachlor at 750 g/ha at 1 DAS <i>fb</i> 2,4-D at 800 g/ha at 20 DAS	119.3 (11.0)	146.7 (12.1)	86.7 (9.4)	10.8 (3.4)	36.1 (6.1)	20.2 (4.6)
Azimsulfuron at 35 g/ha at 20 DAS	66.3 (8.2)	106.7 (10.4)	70.7 (8.5)	7.6 (2.9)	23.5 (4.9)	16.6 (4.2)
Pretilachlor at 750 g/ha at 1 DAS <i>fb</i> azimsulfuron at 35 g/ha at 20 DAS	51.3 (7.2)	62.3 (7.9)	43.3 (6.6)	3.7 (2.2)	12.9 (3.7)	9.9 (3.3)
Two hand weeding at 15 and 30 DAS	48.7 (7.0)	58.3 (7.7)	38.7 (6.3)	3.4 (2.1)	9.7 (3.3)	7.1 (2.8)
Two hand weeding at 20 and 40 DAS	35.0 (6.0)	38.3 (6.3)	34.3 (5.9)	2.2 (1.7)	7.1 (2.8)	6.3 (2.7)
Weedy check	136.0 (11.7)	414.4 (20.4)	419.7 (20.5)	28.7 (5.4)	124.3 (11.2)	143.0 (12.0)
LSD (P=0.05)	0.47	0.46	0.39	0.12	0.23	0.21

Figures in parentheses indicate original values

Table 2. Weed control efficiency, weed control index and yield of aerobic rice as influenced by different weed management

Treatment	Weed control efficiency (%)			Weed control index (%)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index (%)
	30 DAS	60 DAS	90 DAS				
Pretilachlor at 750 g/ha at 1 DAS	53.4	63.0	77.5	32.3	2.67	3.74	41.7
Pyrazusulfuron at 25 g/ha at 5 DAS	58.4	63.9	77.8	30.8	2.73	3.82	41.7
Bispyribac sodium at 25 g/ha at 20 DAS	48.2	59.2	74.6	37.7	2.46	3.47	41.5
Pretilachlor at 750 g/ha at 1 DAS <i>fb</i> bispyribac sodium at 25 g/ha at 20 DAS	79.8	77.2	83.6	8.4	3.62	4.91	42.2
Pyrazusulfuron at 25 g/ha at 5 DAS <i>fb</i> bispyribac sodium at 25 g/ha at 20 DAS	82.0	84.0	88.7	6.6	3.69	5.05	42.2
Pretilachlor at 750 g/ha at 1 DAS <i>fb</i> one hand weeding at 20 DAS	81.4	79.1	87.7	6.9	3.67	5.03	42.2
<i>Sesbania</i> co-culture at 40 kg/ha <i>fb</i> 2,4-D at 800 g/ha at 20 DAS	66.3	67.3	79.6	15.3	3.34	4.61	42.0
<i>Sesbania</i> co-culture at 40 kg/ha <i>fb</i> bispyribac sodium at 25 g/ha at 20 DAS	72.6	69.2	80.6	13.2	3.42	4.69	42.2
<i>Sesbania</i> co-culture at 40 kg/ha + pretilachlor at 750 g/ha at 1 DAS <i>fb</i> 2,4-D at 800 g/ha at 20 DAS	59.1	64.5	79.3	19.9	3.16	4.39	41.8
Azimsulfuron at 35 g/ha at 20 DAS	77.4	74.2	83.0	11.1	3.51	4.84	42.0
Pretilachlor at 750 g/ha at 1 DAS <i>fb</i> azimsulfuron at 35 g/ha at 20 DAS	82.5	84.9	89.6	4.7	3.76	5.15	42.2
Two hand weeding at 15 and 30 DAS	83.3	85.9	90.7	4.3	3.78	5.21	42.0
Two hand weeding at 20 and 40 DAS	88.0	90.7	91.8	0.0	3.95	5.38	42.3
Weedy check	-	-	-	56.1	1.73	2.44	41.5
LSD (P=0.05)					0.40	0.51	NS

azimsulfuron at 35 g/ha at 20 DAS yielded maximum (3.76 t/ha) with 54 % superiority over weedy check. Significantly maximum straw yield (5.38 t/ha) was obtained with hand weeding twice at 20 and 40 DAS which was statistically superior over other treatments except those treatments where pre-emergence application of herbicide was followed either by post-emergence application or hand weeding. The result was in close conformity to those given by Payman and Singh (2008). Different weed management practices have non-significant differences however maximum value of harvest index (42.30%) was recorded with hand weeding twice at 20 and 40 DAS and minimum with weedy check (41.50%).

SUMMARY

A field experiment was carried out at the Agricultural Research Farm, Rajendra Agricultural University, Pusa, Samastipur, Bihar (India), during *Kharif* season of 2012. The experiment involved 14 weed management treatments laid out in randomized block design with three replication. The highest grain yield (3.95 t/ha) was recorded with hand weeding twice at 20 and 40 DAS and lowest under weedy check (1.73 t/ha). Similar trend was observed in straw yield. Among different combination of herbicides, application of pretilachlor at 750 g/ha at 1

DAS *fb* azimsulfuron at 35 g/ha at 20 DAS was the best combination and comparable with hand weeding. Maximum weed control efficiency and weed control index were recorded under treatment hand weeding twice at 20 and 40 DAS and minimum under weedy check. However, weed density and weed dry weight were found maximum under weedy check and minimum with hand weeding twice at 20 and 40 DAS.

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