Integrated weed management in direct seeded rainfed rice of eastern Uttar Pradesh

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ABSTRACT

A field experiment was carried out at Narendra Deva University of Agriculture and Technology, Faizabad during wet season of 2008 to evaluate the effect of integrated weed management practices on direct seeded rice. It was observed that pre-emergence application of anilophos at 0.3 kg ha^{-1} +1 hand weeding at 30 days after sowing (DAS) was found the most effective in reducing total weed population as well as dry matter as compared to rest of the treatments excluding weed free followed by two hand weeding at 30 and 45 DAS. All the growth and yield contributing characters of rice and grain yields were the highest with weed free and pre-emergence application of anilophos @ 0.3 kg ha^{-1}+1 HW at 30 DAS. The highest net return of Rs. 17640 ha^{-1} and benefit-cost ratio(1.62) was recorded with anilophos at 0.3 kg ha^{-1}.

Key words: *direct seeded rice, weed management, herbicides, rainfed*

India ranks first in acreage (43.81 m ha), the second in production (99.18 m tonnes), only after China with average productivity of 2.20 t ha^{-1} (Anonymous, 2008). In Uttar Pradesh, rice is grown in area of 5.69 m ha with the production of 11.74 m tonnes and average productivity of about 2.06 tonnes ha^{-1} (Anonymous, 2008). Weeds rank second to drought in reducing grain yield and quality of upland rice (Sankaran and De Dutta, 1985). Aerobic soil conditions and dry tillage practices in dry seeded rain fed rice besides alternate wetting and drying conditions make the conditions conducive for germination and growth of highly competitive grasses, sedges followed by certain dicots which cause a grain yield loss of 50-91% (Paradkar *et al.*, 1997). The key to success to direct-sown rice is the availability of efficient weed control technique (Pandey and Velosco, 2002). Weed management in direct seeded rice can be accomplished by mechanical, cultural and chemical methods. Mechanical method of weed control consisting of repeated weeding and hoeing by use of hand hoe is effective, but labour intensive and reduces the benefit: cost ratio. Hence, for direct seeded rice, the chemical method of weed management is a good option. The most common herbicides recommended for control the grasses in India are butachlor (1.5 kg ha^{-1}), pendimethalin (1.2 kg ha^{-1}) and anilophos (0.4 kg ha^{-1}) as pre-emergence (Gogoi and Sharma, 1993). Mulching has been reported to be very effective for weed control and conservation of soil moisture. The present investigation Integrated weed management in direct seeded rice under rain fed condition of eastern Uttar Pradesh was conducted to find out the most effective and economic method of weed management.

Field experiment was conducted during wet season of 2008 at Narendra Deva University of Agriculture and Technology, Faizabad (Uttar Pradesh) under rain fed condition. There were 10 treatments *viz.*, butachlor at 1.5 kg ha^{-1}, butachlor at 1.5 kg ha^{-1}+1 hand weeding (HW) at 30 days after sowing (DAS), anilophos at 0.3 kg ha^{-1}, anilophos at 0.3 kg ha^{-1} +1 HW at 30 DAS, pendimethalin at 1.5 kg ha^{-1}, pendimethalin at 1.5 kg ha^{-1}+1 HW at 30 DAS, saw dust mulching at 2.0 t ha^{-1}, two hand weeding at 30 and 45 DAS, weedy and weed free. The experiment was conducted in randomized block design with three replications. Available nitrogen, available phosphorous and available potash in the experimental plot were 195.5, 23.4 and 276.5 kg ha^{-1}, respectively, whereas the soil pH, organic carbon and electrical conductivity were 8.1, 0.38 per cent and 0.35 dSm^{-1}, respectively. The rice cultivar

'Vandana' was dry seeded manually. Well decomposed FYM at 5 t ha^{-1} was applied during the final land preparation and mixed uniformly in the soil. Uniform fertilizer dose of 60, 30, 30 and 25 kg ha^{-1} N, P_2O_5, K_2O and $ZnSO_4$ respectively, was also applied. Half the amount of nitrogen and full amount of phosphorus, potassium and zinc fertilisers were applied as basal dose at the time of sowing. Remaining half of nitrogen was top dressed in two equal splits *viz.*, the first at active tillering and the second at panicle initiation stage. Data on population and dry matter of weeds were recorded at 60 DAS from four places of border row on either side of each plot. A total amount of 1035 mm rainfall was recorded during the crop season (June to November).

The minimum weed density and dry matter at 60 DAS (Table 1) was observed in plots treated with anilophos at 0.3 kg ha^{-1} +1 HW at 30 DAS followed by two hand weeding at 30 and 45 DAS. However, anilophos at 0.3 kg ha^{-1} +1 HW at 30 DAS had significantly lower weed density and dry matter as compared to rest of the treatment excluding weed free. Sharma and Singh (2010) also reported that application of anilophos at 0.5 Kg ha^{-1} significantly reduced weed population and dry matter. Ram *et al*. (2004) also reported that pre-emergence application of anilophos at 0.4 kg ha^{-1} resulted in maximum reduction in weed density and dry matter and recorded the higher weed control efficiency and grain yield. Weed free plots had the highest weed control efficiency, however, anilophos at 0.3 kg ha^{-1} +1 HW at 30 DAS recorded more weed control efficiency (%) than two hand weeding at 30 and 45 DAS.

Treatment of anilophos at 0.3 kg ha^{-1} +1 HW at 30 DAS recorded significantly taller plants over the rest of the treatments excluding weed free at 60 DAS (Table 2). Anilophos at 0.3 kg ha^{-1} +1 HW at 30 DAS recorded the highest crop dry matter after weed free being at par with two hand weeding at 30 and 45 DAS. Anilophos at 0.3 kg ha^{-1} +1 HW at 30 DAS recorded significantly higher leaf area index than the rest of the treatments excluding weed free.

Table 1. Effect of integrated weed management on the weed density and weed dry matter at 60 days after sowing

Treatment	Weed Density							
	Echinochloa colonum	*Echinochloa crusgalli*	*Cyperus rotundus*	*Phylanthus niruri*	Other weeds	Total weed density	Weed dry (%) matter	WCE
T_1-Butachlor@1.5 kg ha^{-1}	(59.4) 7.7	(95.0) 9.8	(142.5) 11.9	(63.3) 8.0	(33.6) 6.0	(396.0) 19.9	(142.5) 11.9	16.2
T_2-T_1+1 HW at 30 DAS	(51.7) 7.2	(82.8) 9.1	(124.2) 11.1	(55.2) 7.4	(31.0) 5.6	(345.0) 18.6	(124.2) 11.12	21.8
T_3- Anilophos @0.3 kg ha^{-1}	(42.6) 6.6	(68.1) 8.3	(102.2) 10.1	(45.4) 6.8	(25.5) 5.1	(284.0) 16.6	(102.2) 10.12	28.8
T_4-T_3+1 HW at 30 DAS(T_4)	(34.8) 5.9	(55.6) 7.5	(83.5) 9.1	(37.1) 6.1	(20.8) 4.6	(232.0) 15.2	(83.5) 9.1	35.9
T_5-Pendimethalin@1.5 kg ha^{-1}	(62.9) 7.9	(99.6) 10.0	(149.4) 12.2	(66.4) 8.2	(37.35) 6.1	(415.0) 20.3	(149.4) 12.2	14.0
T_6- T_5+1 HW at 30 DAS	(54.7) 7.4	(87.6) 9.4	(131.4) 11.5	(58.4) 7.7	(32.6) 5.8	(365.0) 19.1	(131.4) 11.5	19.0
T_7- Saw dust mulching@ 2.0 t ha^{-1}	(57.1) 7.6	(91.4) 9.6	(137.1) 11.7	(60.9) 7.8	(34.2) 5.9	(381.0) 19.5	(137.1) 11.7	17.6
T_8- Two hand weeding at 30 and 45 DAS	(41.1) 6.4	(65.7) 8.1	(98.6) 9.9	(43.8) 6.6	(24.6) 5.0	(274.0) 16.5	(98.6) 9.9	30.2 30.2
T_9- Weedy check	(84.0) 9.2	(134.4) 11.6	(201.6) 14.2	(89.6) 9.5	(50.4) 7.1	(560.0) 23.6	(201.6) 14.2	0.0
T_{10}- Weed free	(0.0) 1.0	(0.0) 1.0	(0.0) 1.0	(0.0) 1.0	(0.0) 1.0	(0.0) 1.0	(0.0) 1.0	92.9
SEm±	0.15	0.19	0.23	0.15	0.11	0.39	0.23	
CD (P=0.05)	0.44	0.56	0.69	0.46	0.34	1.15	0.69	

Anilophos at 0.3 kg ha^{-1} +1 HW at 30 DAS recorded more number of panicles m^{-1} than the rest of the treatments being at par with two hand weeding at 30 and 45 DAS. The same treatment recorded more number of grains $panicle^{-1}$. Comparison to butachlor at 1.5 kg ha^{-1}+1 HW at 30 DAS was at par with two hand weeding at 30 and 45 DAS. However, these treatments recorded significantly higher grain yield than the rest of the treatments. After weed free two hand weeding at 30 and 45 DAS, had highest harvest Index followed by anilophos at 0.3 kg ha^{-1} +1 HW at 30 DAS.

Economic analysis of data revealed that the net return was the highest in anilophos at 0.3 kg ha^{-1} followed by anilophos at 0.3 kg ha^{-1} +1 HW at 30 DAS. However, B:C ratio was the highest in anilophos at 0.3 kg ha^{-1} followed by anilophos @ 0.3 kg ha^{-1} +1 HW at 30 DAS. It is concluded that for high productivity of direct seeded rice, weeds can be effectively managed by application of anilophos @ 0.3 kg ha^{-1} +1 HW at 30 DAS.

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