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Efficacy of herbicides for controlling weeds in winter rice (*Oryza sativa* L.)

A. P. PATRA AND MITHUN SAHA

Department of Agronomy, Bidhan Chandra Krishi Viswavidyalaya, *Mohanpur, Nadia – 741252*

ABSTRACT

A field experiment was conducted during *Kharif* 2003 and 2004 at the Instructional farm of BCKV, Nadia to evaluate the efficiency of herbicides for controlling weeds in transplanted winter rice under new alluvial zone of West Bengal. The weed flora mainly associated with crop were *Cyperus difformis, Fimbristylis miliaceae, Scirpus articulatus, Sphenochlea zeylanica* and *Ludwigia parviflora*. Weed free check produced the highest grain yield (5.17 t/ha), closely followed by manual weeding twice (4.90 t/ha).. Pre-emergence application of Butachlor @ 1.0 kg a. i./ha at 3 days after transplanting (3 DAT) combined with post-emergence application of Almix @ 0.004 kg a. i./ha at 25 DAT was superior to all other chemical treatments and at par with manual weeding by reducing dry weight and density of weeds at 30 and 60 DAT, resulting the enhancement of yield attributing characters, and finally the higher grain production (4.69 t/ha). Butachlor or Almix when applied alone resulted significant reduction in yield and yield components as compared to their combined application.

Key words: Winter rice, Chemical weed control, Herbicides

Weeds are widely regarded as pests of great agricultural menace as they pose serious problems by competing severely with the crop plants for nutrients, moisture, solar energy and space. During last 50 years, though the productivity of rice has increased three times from 700 kg/ha to 2000 kg/ha yet rice still suffers from various constraints of production and one of which is the weed-crop competition. The loss of yield occurs from 25 to 30% due to unchecked weed growth (Upadhyay and Gogoi, 1993).

Manual weeding is very costly, time consuming and cumbersome process. So, the only option left to the farmers is to switch over on chemical weed control. The use of herbicides make it possible to counteract the weed growth from the beginning of transplanted crop and offers scope to the crop plants for better utilization of resources (Sharanappa *et al.*, 1994). Hence, the present investigation was planned to test the efficacy of some new herbicides alone and also in combination, in transplanted winter rice.

MATERIAL AND METHODS

The field experiment was conducted during winter seasons of 2003 and 2004 at the Regional Research Station, New Alluvial Zone, Chakdah of Bidhan Chandra Krishi Viswavidyalaya in a clay loam soil having pH of 6.9 of moderate fertility status to evaluate the performance of different herbicides comprising low dosage - high efficacy ones, conventional herbicides and herbicide mixtures in controlling the weeds in transplanted winter rice.

During the two years period, 7 chemica treatments (butachlor @ 1.25 kg/ha at 3 DAT, almi 0.004 kg/ha at 3 DAT, almix + butachlor 0.004+1 kg/ha ta 3 DAT, butachlor followed by almix 1 kg/ha followed by 0.004 kg/ha at 3 and 25 DAT respectively, pyrazosulfuron ethyl 0.03 at 8 DAT, anilofos 0.4 kg/ha at 3 DAT, anilofos + 2,4-D 0.375+0.5 kg/ha at 3 DAT were compared with weed free check, hand weeded twice at 20 and 40 days after transplanting (DAT) and weedy check. The treatments were replicated thrice in a randomized block design with a plot size of 5 x 4 m^2. Thirty days old seedlings of rice cv. Satabdi (IET 4786) were transplanted and were fertilized with 60 kg N, 30 kg P_2O_5 and 30 kg K_2O/ha. Half of N and full dose of P_2O_5 and K_2O were applied as basal and rest half of N was top-dressed in two equal splits each a maximum tillering and panicle initiation stage. All other package of practices were followed uniformly to raise the crop. All the herbicides were applied by spraying using water at 500 l/ha. The data pertaining to the density and dry weight of weeds were recorded at 30 and 60 DAT by using a quadrate of one m^2. Regular and timely observation was taken to identify the different types of weeds prevalent in the experimental plots from the beginning of the experiment to harvest of the crop. The pooled analysis of the result of each year was also performed. Weed control efficiency was also worked out for each treatment by using the following formula,

$$WCE\ (\%) = \frac{U - T}{U} \times 100$$

Where U is the dry weight of weeds in untreated plot and T in treated plot. The weed index was also calculated by using the formula

$$WI\ (\%) = \frac{X - Y}{Y} \times 100$$

Where X is the grain yield from weed free check treatment and Y is the grain yield from treatment for which index will be calculated.

RESULTS AND DISCUSSION

Predominant weed flora appeared in crop field

The predominant weed flora present in the experimental field were *Echinochloa cruss galli, Cyperus difformis, Fimbristylis miliaceae, Scirpus articulatus, Leersia hexandra, Eclipta alba, Monochoria vaginalis, Ammania baccifera, Paspalum conjugatum, Sphenochlea zeylanica, Ludwigia parviflora.* and *Panicum repens.*

Effect of treatments on Weeds

All the treatments reduced both the density and dry weight of weeds significantly over weedy check (Table 1). Hand weeding twice resulted significantly lower weed density and dry weight as compared to herbicidal treatments and weedy check at all the observation. Butachlor 1 kg /ha at 3 DAT followed by almix 0.004 kg /ha at 25 DAT, among the chemical treatments, effectively lowered both the density and dry weight of weeds. This is in agreement with the finding of Bhanu Rekha *et al.* (2002). Combined application of butachlor and almix also reduced the weed growth which was followed by the sole application of butachlor 1 kg /ha as pre-emergence and mixed application of anilfos and 2, 4-DEE also as pre-emergence. The results are in line with the findings of Moorthy and Saha (2002). Anilofos 0.400 kg/ha at 3 DAT showed the poorest weed control efficiency.

Other than weed free check, higher weed control efficiency was noticed in hand weeded control at all the observations. Application of butachlor at 3 DAT followed by almix at 25 DAT controlled the weeds effectively, closer to hand weeding treatment. This treatment was closely followed by butachlor + almix, butachlor, anilofos + 2, 4-DEE (Table 1). Sequential application of butachlor and almix or mixed application of these two chemicals provided better weed control efficiency rather than their sole or single dose application.

Effect of treatments on Crop

None of the herbicides was phytotoxic to the rice crop. Weed free check recorded maximum number of panicles/m^2 and filled grains/panicle which was closely followed by hand weeding twice. Among the herbicidal treatments, butachlor at 3 DAT followed by almix at 25 DAT produced the highest number of panicles/m^2 and filled grains/panicle which was statistically at par with combined application of butachlor and almix. Single application of butachor and almix resulted significantly lower number of panicles/m^2 and number of filled grains/panicle as compared to sequential or combined application.

Weed free check produced the highest grain yield (5.17 t/ha). The next highest grain yield was recorded by hand weedings at 20 and 40 DAT which was at par with the application of butachlor at 3 DAT followed by almix at 25 DAT and mixed application of butachlor + almix at 3 DAT. The findigs collaborate with the result of Bhanu Rekha *et al.* (2002). The grain yields recorded with application butachlor and anilofos + 2,4-DEE were comparable to that received by almix + butahclor. Significantly lowest grain yield was observed in weedy check as compared to all other treatments. These results are in close conformity with the findings of Madhavi and Reedy (2002). The lowest weed index(5.2%) was observed with hand weeding twice treatments which was closely followed by the application of butachlor at 3 DAT followed by application of almix at 25 DAT (9.3%). Combined application of these two herbicides at 3 DAT also resulted lower weed index (13.6%).

From the above findings, it may be concluded that the laborious cumbersome and costly method of hand weeding can be replaced by either mixed application of butachlor 1kg/ha and almix 0.004 kg/ha at 3 DAT or by application of butachlor 1 kg/ha at 3 DAT followed by almix 0.004 kg/ha at 25 DAT for controlling the weeds in transplanted winter rice effectively.

Table 1 Effect of Weed control treatments on weeds in transplanted rice (pooloed of two years)

	Treatments	Dosage(kg/ha)	Time of application (DAT)	Weed density/m^2		Weed dry weight (g/m^2)		Weed control efficiency (%)	
				30 DAT	60 DAT	30 DAT	60 DAT	30 DAT	60 DAT
T_1	Butachlor	1.25	3	40.06	20.4	5.06	8.80	68.7	63.5
T_2	Almix	0.004	3	18.39	27.3	9.34	12.80	42.3	47.5
T_3	Butachlor + Almix	1 + .004	3	12.38	18.7	8.5	17.97	72.0	64.8
T_4	Butachlor fb* almix	1 fb 0.004	3 fb 25	11.43	16.5	7.2	14.25	74.7	70.2
T_5	Pyrazosulfuron ethyl	0.03	8	20.02	30.0	14.5	28.92	34.3	40.0
T_6	Anilofos	0.400	3	23.81	34.8	11.82	17.4	27.0	28.1
T_7	Anilofos + 2,4-DEE	0.375 + 0.500	3	16.85	24.6	7.02	9.8	57	59.5
T_8	Hand weeding	-	20 and 40	8.49	12.7	3.0	6.0	81.5	75.3
T_9	Weed free check	-	-	0	0	0	0	100	100
T_{10}	Weedy check	-	-	28.53	48.6	16.19	24.2	0	0
				0.76	1.28	0.36	0.50	-	-
	SEm (+) CD at 5%			2.20	3.72	1.05	1.46	-	-

* fb : followed by

Table 2 Effect of weed control treatments on yield attributes, grain yield of rice and weed index..

Treatments	Panicle/ m^2	No. of filled grains/panicle	Grain yield (t /ha)	Weed index (%)
T_1	320	70	4.41	14.7
T_2	308	65	4.1	20.7
T_3	320	73	4.52	13.6
T_4	330	75	4.69	9.3
T_5	302	64	4.08	24.5
T_6	292	63	3.84	25.7
T_7	315	68	4.3	16.8
T_8	336	79	4.9	5.2
T_9	344	82	5.17	-
T_{10}	261	60	3.04	41.19
SEm(±)	2.12	0.85	0.08	
CD at 5%	6.41	2.46	0.24	-

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