

Efficacy of some herbicides for ecosafety and economic weed management in transplanted Kharif Rice

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ABSTRACT

Field experiment was conducted in a randomized block design with three replications at Instructional Farm of New Alluvial Zone, BCKV at Jaguli, Nadia, West Bengal during kharif seasons of 2003 – 2004 on sandy clay loam soil having pH 7.01 with the objectives to study the efficacy of some herbicides in transplanted kharif rice vis-à-vis to develop a safe farmer's acceptable economic method of chemical weed control. The experimental results revealed that among the ten treatments, Hand weeding twice at 25 and 45 DAT (Days after transplanting) gave the highest grain yield (4.50 t ha⁻¹), which, however did not differ significantly with the treatment Fentrazamide 50 WP @ 150 g.a.i. ha⁻¹ applied as pre-emergence at 7 DAT. This herbicide @ 150 g.a.i. ha⁻¹ offered promising control of all categories of dominant weeds and finally gave second highest grain yield (4.39 t ha⁻¹), exhibiting no phytotoxicity symptom to the crop plant. Regarding benefit : cost ratio, highest value (1.03) was obtained with the use of Fentrazamide 50WP @ 150 g.a.i. ha⁻¹ which was closely followed by Fentrazamide 50 WP @ 120 g.a.i. ha⁻¹ (0.94). So tedious, time consuming and costly hand weeding method can profitably be replaced by the application of Fentrazamide 50 WP @ 150 g.a.i. ha⁻¹ as pre-emergence at 4-7 DAT, which has been found to be the most cost saving and also a safe weed control treatment.

Key words : Fentrazamide, promising, cost saving.

In India rice is grown as a staple cereal food crop under manifold agroclimatic condition mainly in the states like West Bengal, Andhra Pradesh, Orissa, Assam, Bihar, UP, Tamil Nadu and Kerala etc. Among the different states, West Bengal is the leading state contributing 16.4% to all India production of rice and occupy first position in terms of area and production. It covers an area of 6.07 million hectares, producing 15.26 million tones of grain with an average yield of 2.51 t ha⁻¹ (Economic Review, Govt. W. B. 2002–03). Though India ranks first in the world so far as area is concerned and occupies second position in relation to production, the Indian national average yield is 2.09tonnes ha⁻¹ which is far behind the world average of 3.92 tonnes ha⁻¹. A careful study of the whole situation revealed that among the different factors, severe infestation of weeds in rice fields is considered to be one of the major obstacle in achieving the higher yield (Dikshit, 1974).

Keeping the above discussions in mind, the present experiment was conducted to find out an effective method of weed management with promising pre and post emergence herbicides with

the objectives i) To study the bio-efficacy of new generation herbicides as well as proper effective dose to control weeds in transplanted rice; ii) To study the effect of herbicides on the growth and yield of transplanted rice in kharif season; iii) To develop a safe, farmer's acceptable economic method of chemical weed control by making use of different herbicides.

MATERIALS AND METHODS

A field experiment was conducted at the Instructional Farm, Jaguli of BCKV, Nadia, West Bengal during the kharif seasons of 2003 – 2004. The rice variety was Satabdi (IET-4786).

The experiment was laid out at Randomized Block Design having 10 treatments (Table 1) with 3 replications. Soil type was Gangetic alluvial with sandy clay loam in texture having pH 7.1.

Weed density and weed biomass was taken in both the years at 30, 60 and 90 DAT of the rice crop. Crop yield and benefit : cost ratio were recorded. Weed control efficiency (WCE) and Weed index (WI) were also computed.

Table 1 : Treatments used in the experiment

	Treatment	Dose (g.a.i. ha ⁻¹)	Time of application (DAT)
T ₁	Fenoxaprop-p-ethyl 9 EC	45.00	20-25
T ₂	Fenoxaprop-p-ethyl 9 EC	56.25	20-25
T ₃	Fenoxaprop-p-ethyl 9 EC	112.50	20-25
T ₄	Fenoxaprop-p-ethyl 9 EC	225.00	20-25
T ₅	Fentrazamide 50 WP	120.00	4-7
T ₆	Fentrazamide 50 WP	150.00	4-7
T ₇	Pyrazosulfuron ethyl 5 WP	20.00	8-10
T ₈	Butachlor 50 EC	1500.00	3-5
T ₉	Hand weeding (twice)	-	25-45
T ₁₀	Unweeded control	-	-

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RESULTS AND DISCUSSION

The most competitive weed flora in the experimental field were *Echinochloa crus-gallis*, *E. glabrescens*, *E. colona*, *Cyperus rotundus*, *C. iria*, *Marsilea quadrifoliata*, *Ludwigia parviflora* and *Eclipta alba*.

Effect of treatments on weeds

Among the chemical treatments Fentrazamide 50 WP@150 g.a.i. ha⁻¹ treatment resulted the lowest weed density (Table 2) which was statistically at par with Fentrazamide @ 120 g.a.i. ha⁻¹ and hand weeding twice treatments.

Table 2 : Effect of treatments on population of weeds and weed biomass (Mean data)

Treatments	Total weed population m ² ⁻¹			Total weed biomass (g m ² ⁻¹)		
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
T ₁ Fenoxaprop-p-ethyl 9 EC	197.00	233.33	270.33	27.36	33.32	40.00
T ₂ Fenoxaprop-p-ethyl 9 EC	189.33	229.33	256.30	25.94	32.81	36.57
T ₃ Fenoxaprop-p-ethyl 9 EC	167.00	203.33	230.67	23.86	23.59	33.38
T ₄ Fenoxaprop-p-ethyl 9 EC	142.33	187.00	217.33	20.47	26.71	31.30
T ₅ Fentrazamide 50 WP	116.67	157.33	179.66	16.74	22.41	25.72
T ₆ Fentrazamide 50 WP	111.33	142.67	174.33	16.01	18.93	25.62
T ₇ Pyrazosulfuron ethyl 5 WP	137.33	179.33	204.00	19.61	27.90	30.14
T ₈ Butachlor 50 EC	128.00	163.33	193.00	18.57	22.93	27.69
T ₉ Hand weeding (twice)	104.66	139.33	167.33	14.98	17.91	23.92
T ₁₀ Unweeded control	370.33	410.00	438.66	52.16	57.94	62.57
S. Em (±)	2.679	2.053	2.992	1.364	1.414	1.414
CD at 5%	7.957	6.096	8.886	4.052	4.200	4.200

Though the conventional hand weeding method was best treatment to keep weeds under control in rice field but from the economic point of view, Fentrazamide 50 WP @ 150 g.a.i. ha⁻¹ was quite sound to keep weeds of all categories under control and gave a satisfactory crop yield. The herbicide Fentrazamide 50 WP @ 150 g.a.i. ha⁻¹ gave a good result in controlling weeds over the other chemical treatments because of the fact that this treatment controlled a broad spectrum of weed, due to its inhibiting effect on cell division and cell growth of weeds. This findings was similar with the reporting of Yanagi (2001).

Regarding weed control efficiency (Table 3) the table shows that the weed control efficiency decreased with the advancement of crop growth as the persistence of herbicides in soil decreased with time. However in all the cases i.e., at 30, 60 and 90 DAT highest weed control efficiency was achieved by the treatment T₉ (Hand weeding). Among the chemical treatments, T₆ (Fentrazamide @ 150 g.a.i. ha⁻¹) recorded the highest Weed control efficiency which was closely followed by T₅ (Fentrazamide @ 120 g.a.i. ha⁻¹). The treatment T₈ (Butachlor @ 1500 g.a.i. ha⁻¹) has recorded also good weed control efficiency followed by T₇ (Pyrazosulfuron @ 20 g.a.i. ha⁻¹).

Effect on Crops

All the treatments except Fenoxaprop-p-ethyl 9 EC @ 112.50 and 225.00 g.a.i. ha⁻¹ (T₃ and T₄), did not show any phytotoxic symptoms on the crop plant. The above two treatments T₃ and T₄, however had caused moderate and heavy injury to the rice

crop respectively. It might be due to the fact that at high dose whip super was more toxic to rice crop as also reported by Lourens *et al.*, (1989).

Hand weeding twice treatment proved its superiority in obtaining maximum grain yield over all the treatments. Among the chemical treatments, the highest grain yield (4.397t ha⁻¹) was recorded in T₆ (Fentrazamide @ 150 g.a.i. ha⁻¹) treatment which was also statistically at par with the treatments hand weeding (T₉) and Fentrazamide @ 120 g.a.i. ha⁻¹ (T₅). Hand weeding treatment lagged behind this chemical treatment so far as benefit : cost is concerned (Table 4). Other chemical treatments like T₇ (Pyrazosulfuron ethyl 5 WP @ 20 g.a.i. ha⁻¹) and T₈ (Burachlot 50 EC @ 1500 g.a.i. ha⁻¹) were also statistically at par with the superior treatment T₆ and showed their promising result in controlling weeds of different categories.

It is also evident from the table 2 that the hand weeding treatment always recorded lowest dry weight of weeds and it was statistically at par with the Fentrazamide @ 150 g.a.i. ha⁻¹. In general at 30, 60 and 90 DAT, the chemical treatments like T₆, T₅ and T₈ recorded lowest weed biomass which did not show any significant difference among these treatments.

From the above findings it can be said that among the chemical treatments, Fentrazamide @ 150 g.a.i. ha⁻¹ produced good result due to its broad herbicidal spectrum against both annual and perennial weeds in rice field and hence resulting minimum dry weight of weeds. This findings corroborates that of Goto *et al.* (2001).

Table 3 : Weed control efficiency of different treatments (Mean data)

Treatments		Weed control efficiency (%)		
		30 DAT	60 DAT	90 DAT
T ₁	Fenoxaprop-p-ethyl 9 EC	47.54	42.49	36.07
T ₂	Fenoxaprop-p-ethyl 9 EC	50.26	43.37	41.55
T ₃	Fenoxaprop-p-ethyl 9 EC	54.25	48.92	46.65
T ₄	Fenoxaprop-p-ethyl 9 EC	60.75	53.90	49.97
T ₅	Fentrazamide 50 WP	67.79	61.32	58.89
T ₆	Fentrazamide 50 WP	69.30	67.32	59.05
T ₇	Pyrazosulfuron ethyl 5 WP	62.40	51.84	51.82
T ₈	Butachlor 50 EC	64.39	60.42	55.74
T ₉	Hand weeding (twice)	71.28	69.08	61.77
T ₁₀	Unweeded control	0	0	0

Table 4 : Treatment effects on grain yield, weed index, net profit and benefit : cost ratio (Mean data)

Treatments	Grain yield (t ha ⁻¹)	Weed Index	Net Profit (Rs. ha ⁻¹)	Benefit : Cost ratio	
T ₁	Fenoxaprop-p-ethyl 9 EC	3.725	17.38	10667	0.67
T ₂	Fenoxaprop-p-ethyl 9 EC	4.015	10.95	13311	0.84
T ₃	Fenoxaprop-p-ethyl 9 EC	3.716	17.58	10293	0.64
T ₄	Fenoxaprop-p-ethyl 9 EC	3.432	23.88	8033	0.48
T ₅	Fentrazamide 50 WP	4.187	7.14	14709	0.94
T ₆	Fentrazamide 50 WP	4.397	2.48	16214	1.03
T ₇	Pyrazosulfuron ethyl 5 WP	4.040	10.40	13080	0.81
T ₈	Butachlor 50 EC	4.065	9.84	13151	0.80
T ₉	Hand weeding (twice)	4.509	-	14247	0.76
T ₁₀	Unweeded control	3.013	33.17	6304	0.41
S. Em (±)	0.1258				
CD at 5%	0.3737				

It is clear from the Table 4 that treatments like T₇ (Pyrazosulfuron ethyl @ 20 g.a.i. ha⁻¹), T₈ (Butachlor @ 1500 g.a.i. ha⁻¹) and T₂ (Fenoxaprop-p-ethyl @ 56.25 g.a.i. ha⁻¹) were statistically at par among themselves in giving promising grain yield. The lowest grain yield (3.432 t ha⁻¹) was recorded with T₄ treatment (Fenoxaprop-p-ethyl @ 225g.a.i.ha⁻¹) due to the phytotoxic effect of this chemical, because it was more toxic to rice plant at high dose but proved better weed control.

Among the different chemical and cultural treatments, T₆ (Fentrazamide @ 150 g.a.i. ha⁻¹) gave highest net profit which was followed by the treatments T₅ (Fentrazamide @ 120 g.a.i. ha⁻¹) and T₉ (Hand weeding). Here Hand weeding treatment to some extent recorded less net profit than that of T₆ (Fentrazamide @ 150 g.a.i. ha⁻¹) treatment due to its high treatment cost.

Regarding weed index, unweeded control treatment (T₁₀) recorded highest weed index (33.17%) where as the lowest (2.48%) was recorded with the treatment T₆ (Fentrazamide @ 150 g.a.i. ha⁻¹). Among the different chemicals used, the treatment T₄ (Fenoxaprop-p-ethyl @ 225 g.a.i. ha⁻¹) resulted the highest weed index (23.88%).

It can be concluded that the tedious, time consuming and costly hand weeding method can safely and profitably be replaced by the herbicide Fentrazamide 50 WP @ 150 g.a.i. ha⁻¹ at 4-7 DAT as pre-emergence. The low dose of Fentrazamide i.e., at

120 g.a.i. ha⁻¹ can also give promising result and may be adopted wherever possible and wherever there is scarcity of labour. In acute stage of crop-weed competition, now-a-days non-availability of labourer is a major problem in most of the rice growing areas. Use of chemical herbicide having no residual effect in future is thus, becoming popular day by day for management of weeds in paddy field.

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