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Studies on the bio-efficacy of some herbicides in transplanted summer rice (*Oryza sativa* L.)

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ABSTRACT

A field experiment was conducted during the *boro* season (2000) to study the bio-efficacy of some herbicides in transplanted summer rice against the predominant weed species such as *Echinochloa crusgalli, Leersia hexandra, Cyperus iria, C. difformis, Fimbristylis miliacea, Monochoria vaginalis, Sagittaria sagittifolia, Marsilea quadrifoliata, Ludwigia parviflora* and *Alternenthera sessilis.* The experimental result showed that handweeding twice at 20 and 40 DAT gave the highest grain and straw yields (5.14 and 6.23 ton/ ha respectively), which, however, did not differ significantly with the treatment Almix 20 WP @ 4 g a.i./ ha + Butachlor 50 EC @ 1250 g a.i./ha (tankmixed) applied as pre-emergence at 3 DAT. The herbicide mixture showed promising control of all categories of dominant weeds and finally gave higher yields (4.95 ton ha^{-1} for grain and 6.08 ton ha^{-1} for straw), exhibiting no phytotoxicity symptom to the crop plant.

India is one of the most important rice growing countries in Asia as well as in the world. Though India rank first in the world so far as area under rice cultivation is concerned, but in case of production it occupies second position (22%). Such unfortunate for production is due to low average productivity of 2.811. t ha^{-1} which is far behind the world average of 3.747 t ha^{-1} (The Hindu Survey of Indian Agriculture, 2000). The severe infestation of weeds in rice field offer the major obstacle to achieve the higher yield (Dikshit, 1974). Out of the total losses weeds alone caused 33% loss (Pesticide Information, 1998). Weed problem in transplanted rice culture is less acute than the direct seeded rice. The extent of yield reduction due to weeds alone is estimated to be around 15-20% for transplanted rice, 30-35% for direct seeded rice under puddle condition and over 50% for upland rice (Mukhopadhyay and Bhattacharya, 1969; Mukhopadhyay *et al.* 1972; Mukhopadhyay, 1983). Hand weeding was effective for controlling weed, but it was tedious, time consuming and expensive practice. Therefore, attempts have been made from time to time to replace this cumbersome method of weed control through the use for effective herbicides which are now being profitably used in major rice growing areas. Though several hebicides for controlling weeds in transplanted rice have been evolved, the use of herbicides is quite limited due to the lack of technology regarding dose, time and method of application. Several experiments are new in progress to find out some effective low dose herbicide which is expected to give an economic return to the cultivators. The present study envisages to understand the efficiency of some herbicides including sulfonylurea herbicide like Almix (mixture

of Ally and Classic) when applied alone and combination with Butachlor.

MATERIALS AND METHODS

The experiment was conducted at the University Teaching Farm, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during the *boro* season of 1999-2000. The soil of the experimental fields was typical Gangetic alluvial soil (Entisol) having clay loam texture, neutral in reaction and moderate in soil fertility status. The experimental area was under sub-tropical humid climate which is situated just at the south of Tropic of Cancer. The variety of rice (IET 4786 i.e. Satabdi) was transplanted on 31.1.2000. The experimental field was laid out in a randomised block design (RBD) having ten treatments with three replications with a net plot size of 5 m × 3 m. The details of the treatments were as follows (Table 1). Fertilizers applied were 120 kg N, 60 kg P_2O_5 and 60 kg K_2O/ha in the form of urea, single super phosphate (SSP) and muriate of potash (MOP) respectively. Half of the total N and full doses of P_2O_5 and K_2O were applied as basal at the time of final land preparation and 60 kg N in the form of urea was top dressed in two splits, at 20 and 40 days after transplanting (DAT). Other cultural practices and plant protection measures were taken equally in all plots as and when required. Then the crop was harvested on 16.5.2000.

Table 1 The details of the treatments

Treatment No.	Treatment	Concentration	Dosage (g a.i./ha)	Time of application (DAT**)
T_1	Almix*	20 WP	4	3
T_2	Butachlor	50 EC	1000	3
T_3	Butachlor	50 EC	1250	3
T_4	Almix + Butachlor	20 WP + 50 EC	4 + 1000	3
T_5	Almix + Butachlor	20 WP + 50 EC	4 + 1250	3
T_6	Pretilachlor	50 EC	625	3
T_7	Oxadiargyl	80 WP	75	3
T_8	Anilophos	30 EC	375	3
T_9	Hand weeding (twice)			20 and 40
T_{10}	Unweeded control			

* Almix = Metsulfuron Methyl + Chlorimuron Ethyl
** DAT = Days after transplanting

The weed index (WI) was also calculated by using the formula –

$$WI(\%) = \frac{x - y}{y} \times 100$$

where, x = grain yield from weed free (hand weeding) treatment and y = grain yield from treatment for which weed index is to be worked out.

RESULTS AND DISCUSSION

Predominant weed species, weed density and weed biomass

The observations reveal that the predominant weed species in the experimental field were *Echinochloa crusgalli, Leersia hexandra, Cyperus iria, C. difformis, Fimbristylis miliacea, Monochoria vaginalis, Sagittaria sagittifolia, Marsilea quadrifoliata, Ludwigia parviflora* and *Alternenthera sesssilis*. Mukhopadhyay *et al.* (1995 and 1997) were of the same view.

From the experiment it can be stated that the hand weeding treatment was superior to all other treatments in controlling all the three categories of weeds throughout the growth stages, but it was statistically at par with the treatment T_5 (Almix 20 WP @ 4 g a.i./ha + Butachlor 50 EC @ 1250 g a.i./ha). This corroborates the findings of Bhattacharya *et al.* (1997). Almix 20 WP @ 4 g a.i./ha in combination with Butachlor 50 EC @ 1000 g a.i./ha (T_4) also showed the best performance (Table 2).

Among the different chemicals tried in this investigation, tankmixed Almix 20 WP @ 4 g a.i./ha + Butachlor 50 EC @ 1250 g a.i./ha (T_5) applied as pre-emergence was found to be better in reducing total weed biomass. On the other hand, the maximum total weed biomass was observed with unweeded control treatment (T_{10}).

Weed control efficiency

So far as weed control efficiency is concerned, it can be stated that the treatment handweeding twice at 20 and 40 DAT maintained its superiority at all the stages of crop growth perhaps shading helped to keep the weeds under control (Table 3). So far as the efficiency of the herbicide is concerned treatment T_5 (Almix 20 WP @ 4 g a.i./ha. Butachlor 50 EC @ 1250 g a.i./ha) and T_4 (Almix 20 WP @ 4 g a.i./ha + Butachlor 50 EC @ 1000 g a.i./ha) showed satisfactory weed control efficiency at all the growth stages might be due to the reason that these treatments could reduce the weed dry matter weight (Weed biomass). This is in confirmity with the findings of Bhattacharya *et al.* (1997).

Yield and weed index

The experimental result showed that hand weeding twice at 20 and 40 DAT gave the highest grain and straw yield (5.14 and 6.23 ton/ha respectively), which, however, did not differ significantly with the treatment Almix 20 WP @ 4 g a.i./ha + Butachlor 50 EC @ 1250 g a.i./ha (tankmixed) applied as pre-emergence at 3 DAT (Table 3). The herbicide mixture showed promising control of all categories of dominant weeds and finally gave higher yields (4.95 ton/ha for grain and 6.08 ton/ha for straw), exhibiting no phytotoxicity symptom to the crop plant. On the other hand the lowest grain and straw yield was recorded with the unweeded control treatment (T_{10}). The work of Bhattacharya *et al.* (1993) supports the above finding.

So, from the above discussion it can be inferred that among all the

treatments tried in this investigation, hand weeding though topped the list in relation to all aspects of weed management, from economic point of view Almix 20 WP @ 4 g a.i./ha in combination with Butachlor 50 WC @ 1250 g a.i./ha can safely and profitably be used to replace the tedious, time consuming and expensive hand weeding practice of weed control in summer rice.

Table 2 Effects of methods of weed control on total weed density, total weed biomass and weed control efficiency at different growth stages

Treatments	Total weed density/m^2			Total weed biomass (g/m^2)			Weed control efficiency (%)		
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
T_1	15.66	23.00	28.66	7.26	11.52	14.95	41.07	39.24	40.27
T_2	13.33	21.66	27.00	6.65	9.95	14.34	46.02	47.52	42.70
T_3	12.66	20.00	25.66	5.42	9.05	13.05	56.00	52.26	47.86
T_4	10.00	17.33	23.00	4.60	8.02	11.85	62.66	57.70	52.65
T_5	8.66	15.00	21.66	3.85	6.95	10.82	68.75	63.34	56.77
T_6	16.33	23.66	30.33	7.97	11.75	15.95	35.30	38.02	36.27
T_7	17.00	25.33	31.00	8.51	12.82	16.22	30.92	32.38	35.19
T_8	19.33	27.66	33.66	9.02	13.94	17.05	26.78	26.47	31.88
T_9	7.66	13.33	20.33	3.48	6.53	10.41	71.75	65.55	58.40
T_{10}	26.33	38.00	50.33	12.32	18.96	25.03			
S.Em ±	0.40	0.65	0.88	0.36	0.42	0.35			
C.D. (P=0.05)	1.18	1.93	2.61	1.06	1.24	1.04			

DAT = Days after transplanting

TABLE 3 Effect of methods of weed control on grain yield, straw yield and weed index

Treatment	Grain yield (ton/ ha)	Straw yield (ton/ha)	W.I.(%)
T_1	4435	4840	21.45
T_2	5406	5872	4.25
T_3	4452	4862	21.15
T_4	5128	5540	9.17
T_5	5275	5737	6.57
T_6	4642	4950	17.78
T_7	5045	5383	10.64
T_8	5012	5370	11.23
T_9	5646	6108	0
T_{10}	3815	4335	32.43
S.Em ±	56	73	
C.D. (P=0.05)	167	218	

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