

Original Research Article

Effect of Pretilachlor 50% EC on Weed Control of Transplanted Rice under Alluvial Soil of West Bengal

ABSTRACT

A field experiment was conducted at Regional Research Station of Bidhan Chandra Krishi Viswavidyalaya, Gayeshpur, West Bengal during winter season of 2014 and 2015 to evaluate the bio-efficacy against weeds & phytotoxicity of pretilachlor 50% EC on transplanted rice. The experiment was tested under randomized complete block design with three replicates where the treatments were weed management. Among the herbicide applied, the highest weed control index was recorded in pretilachlor 50% EC @ 2 kg a.i.ha⁻¹ which imparted phytotoxic symptoms in rice plants resulting in yield reduction. However, the highest grain yield (3.59 t ha⁻¹) was obtained with the application of pretilachlor 50% EC @ 1.2 kga.i.ha⁻¹ which was statistically at par with two hand weeded among the herbicide applied plots was found in pretilachlor 50% EC @ 1.2 kga.i.ha⁻¹ which was statistically at par with twice hand weeded plots. From this research findings it can be concluded that the application of pretilachlor 50% EC @ 1.2 kga.i.ha⁻¹ can be recommended for effective weed management in transplanted rice in the study area.

Keywords: Pretilachlor, transplanted rice, weed management, hand weeding, phytotoxicity

1. INTRODUCTION

Rice (*Oryza sativa* L.) is the staple food over more than half of the world's population. It is the predominant dietary energy source for 17 countries in Asia and the Pacific, 9 countries in North and South America and 8 countries in Africa, providing almost 39% of calories [1]. In India, rice is cultivated in wide ranges of ecosystems from irrigated to shallow lowlands, mid-deep lowlands, deep water to uplands. In the rice agro-ecosystems, ideal environment conditions provided for optimal rice productivity are exploited by the associated weeds. The losses in grain yield due to weed competition for first 30, 60 and 90 days have been reported to the tune of 17.7 %, 11.8% and 5.0 % respectively [2]. Rice yield losses due to uncontrolled weed growth and weed competition were least (12%) in transplanted rice [3]. Besides yield reduction, weeds remove a large amount of plant available nutrients from the soil. An estimate shows that weeds can deprive the crops by 47%N, 42%P, 50%K, 39% Ca and 24% Mg of their nutrient uptake as well as reduce the yield potential by harbouring number of crop pests [4]. Among the various measures taken in weed control, application of herbicides is the most common practice as it is easier, time and labour saving and economical compared to hand weeding [5]. Among the herbicides pretilachlor is widely used

in transplanted rice crop. In this context an experiment is conducted to evaluate the performances of new formulation of pretilachlor in terms of the bio-efficacy against weed flora and phytotoxicity in transplanted rice.

2. MATERIAL AND METHODS

2.1. Experimental site

The experiment was conducted during the winter season of 2014 and 2015 at the Regional Research Station (RRS), in New Alluvial Zone of West Bengal under Bidhan Chandra Krishi Viswavidyalaya, Gayeshpur, Nadia, West Bengal. The climate during the experimentation was subtropical humid. The soil of the experimental field was typical Gangetic alluvial soil (Entisol) having clay loam texture with moderate fertility having neutral soil reaction.

2.2. Treatment details

Ten treatments were replicated thrice in a randomized block design (RBD) with a net plot size of 5.0 m x 4.0 m each. The treatments T₁ to T₆ consisted of six different doses (0.5, 0.75, 1.0, 1.2, 1.5, 2.0 kg a.i.ha⁻¹ respectively) of new pretilachlor [51218-49-6 2-Chloro-N-(2,6-diethylphenyl)-N-(2-propoxyethyl)acetamide] formulation, i.e. supplied by Mahamaya Lifesciences Pvt. Ltd., Gurgaon, India along with one commercial formulated pretilachlor i.e. (T₇) @ 0.750 kg a.i.ha⁻¹. Butachlor i.e. (T₈) @ 1.25 kg a.i.ha⁻¹ along with two hand weeding (T₉) at 20 and 40 Days after transplanting (DAT) were also used besides one unweeded control (T₁₀). The treatments were allocated randomly to different plots with the help of random number table [6].

2.3. Field trial

The rice variety used in this experiment was Satabdi (IET 4786). Rice crop was transplanted on 2nd February, 2014 with a spacing of 20 cm x 10 cm and fertilizer dose of 120 kg N, 60 kg P₂O₅ and 60 kg K₂O per hectare were applied in the form of Urea, SSP and MOP, respectively. Half of the total N and full doses of P₂O₅ and K₂O were applied as basal and rest amount of N was top dressed into two equal splits, one at 21 DAT and another at 42 DAT. The herbicides were applied as pre-emergence at 3 DAT with knapsack sprayer with flat jet nozzle. The crop was protected against the incidence of pests and diseases by employing effective plant protection measures as and when necessary.

2.3. Observations

Observations on weed density (count m⁻²), weed dry weight (g m⁻²), effective tiller (m⁻²), panicle length (cm), panicle weight (g), grain yield (t ha⁻¹) and straw yield (t ha⁻¹) were

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recorded. Weed control index of different treatments was obtained by using the following formula [7] –

$$\text{Weed Control index (\%)} = \frac{\text{WDW}_C - \text{WDW}_T}{\text{WDW}_C} \times 100$$

Where, WDW_C = Weeds dry weight (gm^{-2}) in unweeded plot

WDW_T = Weeds dry weight (gm^{-2}) in treated plot

Phytotoxic effect of herbicides on crop in terms of yellowing, stunting and necrosis were recorded at 7, 14, 21, 28 DAT and the crop response was rated in the scale of 0-10 as shown in the following Table 1.

Table 1. Quantitative description of treatment effects on crops in the visual scoring scale of 0-10

Rating	Effect	Verbal description
0	None	No injury, normal
1	Slight	Slight stunting, injury or discoloration
2		Some stand loss, stunting and discoloration
3		Injury more pronounced but not present
4	Moderate	Moderate injury recovery possible
5		Injury more persistent, recovery doubtful
6		Near severe injury, no recovery possible
7	Severe	Severe injury, stand loss.
8		Almost destroyed, a few plants surviving
9		Very few plants alive
10	Complete	Complete destruction

2.4. Statistical Analysis

The data were analyzed by analysis of variance (ANOVA) using standard variance techniques suggested by Gomez and Gomez (1984) [8] and ranked by using the critical differences (CD) at 5% level.

3. RESULTS AND DISCUSSION

3.1. Predominant weed species

Various categories of weeds as observed in the experimental field included *Echinochloa colona*, *Echinochloa crusgalli*, *Panicum repens*, *Leersia hexandra*, *Monochoria vaginalis*, *Ludwigia parviflora*, *Lemna minor*, *Ammanibaccifera*, *Aeschynomene indica*, *Hydrilla verticillata*, *Cyperus iria* and *Cyperus difformis*, etc. The dominant weed species were *Echinochloa colona*, *Echinochloa crusgalli* (Grasses), *Monochoria vaginalis*, *Commelinabenghalensis*, *Marsilea quadrifolia* (Broad Leaves) and *Cyperus difformis*, *Fimbristylis*.

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Comment [A6]: You should have putting the weed species in a table showing their composition and level of occurrence, grouping them into broad leaf, grasses and sedges. As such readers can vividly see which species is the most dominant.

Table 2. Treatment effects on total weed density, total weed dry weight and weed control index at different growth stages as influenced by different weed-control treatments (Two years pooled data)

Treatment	Treatment	Dose kg a.i. ha ⁻¹	Time of application	Total weed density (count m ⁻²)			Total weed dry weight (g m ⁻²)			Weed control index (%)		
				20 DAT	40 DAT	60 DAT	20 DAT	40 DAT	60 DAT	20DAT	40 DAT	60 DAT
T ₁	Pretilachlor	0.5	Pre-emergence	9.11	24.99	47.55	1.74	10.34	14.12	55.61	30.51	47.06
T ₂	Pretilachlor	0.75	Pre-emergence	9.05	21.01	33.88	1.7	9.08	13.37	56.63	38.98	49.87
T ₃	Pretilachlor	1	Pre-emergence	9.01	18.55	33.1	1.66	8.88	12.9	57.65	40.32	51.63
T ₄	Pretilachlor	1.2	Pre-emergence	8.4	17.33	32.55	1.49	8.49	12.69	61.99	42.94	52.42
T ₅	Pretilachlor	1.5	Pre-emergence	8.33	16.66	29.88	1.36	7.99	12.37	65.31	46.3	53.62
T ₆	Pretilachlor	2	Pre-emergence	7.78	12.54	25.32	1.27	6.46	9.99	67.6	56.59	62.54
T ₇	Pretilachlor (commercial)	0.75	Pre-emergence	9.67	35.1	56.1	1.98	11.65	14.34	49.49	21.71	46.23
T ₈	Butachlor	1.25	Pre-emergence	10	40.25	62	2.05	11.8	15.85	47.7	20.7	40.57
T ₉	Twice hand weeding	-	20 & 40 DAT	12.99	5.67	13.34	3.85	2.09	4.54	1.79	85.95	82.98
T ₁₀	Unweeded control	Unweeded	-	13.67	51.67	98	3.92	14.88	26.67	-	-	-
	SEm±			0.121	3.989	2.399	0.121	0.383	0.241	-	-	-
	LSD (p=0.05)			0.463	7.767	7.087	0.363	1.161	0.732	-	-	-

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Table 3. Phytotoxicity rating of different doses of herbicides in rice plants as influenced by different weed-control treatments
(Two years pooled data)

Treatments	Tretament details	Dose kg a.i. ha ⁻¹	Time of application	7 DAT			14 DAT			21DAT			28DAT		
				R ₁	R ₂	R ₃	R ₁	R ₂	R ₃	R ₁	R ₂	R ₃	R ₁	R ₂	R ₃
T ₁	Pretilachlor	0.5	Pre-emergence	0	0	0	0	0	0	0	0	0	0	0	0
T ₂	Pretilachlor	0.75	Pre-emergence	0	0	0	0	0	0	0	0	0	0	0	0
T ₃	Pretilachlor	1	Pre-emergence	0	0	0	0	0	0	0	0	0	0	0	0
T ₄	Pretilachlor	1.2	Pre-emergence	0	0	0	0	0	0	0	0	0	0	0	0
T ₅	Pretilachlor	1.5	Pre-emergence	1	1	1	1	1	0	0	0	0	0	0	0
T ₆	Pretilachlor	2	Pre-emergence	4	4	4	1	1	1	1	1	1	1	1	0
T ₇	Pretilachlor (commercial)	0.75	Pre-emergence	0	0	0	0	0	0	0	0	0	0	0	0
T ₈	Butachlor	1.25	Pre-emergence	0	0	0	0	0	0	0	0	0	0	0	0
T ₉	Twice hand weeding	HW (2)	20 & 40 DAT	0	0	0	0	0	0	0	0	0	0	0	0
T ₁₀	Unweeded control	unweeded		0	0	0	0	0	0	0	0	0	0	0	0

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Comment [A10]: The time of application of the herbicide did not vary with another, so there is no need of indicating the time of application.

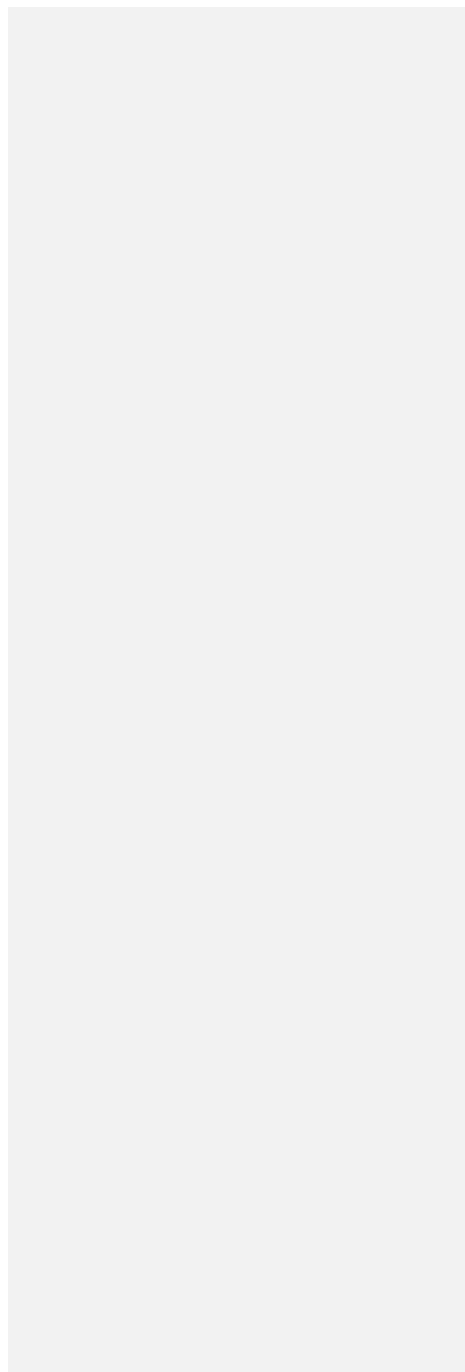
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Table 4. Yield attributes and yield of transplanted rice as influenced by different weed-control treatments (Two years pooled data)

Treatment	Treatment details	Dose kg a.i. ha ⁻¹	Time of application	Effective tillers m ⁻²	Panicle length (cm)	Panicle weight (g)	Filled grains panicle ⁻¹	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)
T ₁	Pretilachlor	0.5	Pre-emergence	318	20.17	2.08	138	3.13	5.08
T ₂	Pretilachlor	0.75	Pre-emergence	319	20.18	2.08	143.3	3.26	5.09
T ₃	Pretilachlor	1	Pre-emergence	329	22.52	2.1	146	3.47	5.13
T ₄	Pretilachlor	1.2	Pre-emergence	315.67	22.88	2.11	147	3.59	5.22
T ₅	Pretilachlor	1.5	Pre-emergence	302.1	20.1	1.95	136.5	2.95	5.2
T ₆	Pretilachlor	2	Pre-emergence	295.6	20.03	1.86	135.1	2.71	5.08
T ₇	Pretilachlor (commercial)	0.75	Pre-emergence	323.33	21.89	2.06	133.3	3.15	5.1
T ₈	Butachlor	1.25	Pre-emergence	322	22.26	2.07	140.3	3.21	5.08
T ₉	Twice hand weeding	-	20 & 40 DAT	339	23.77	2.25	150.7	3.61	5.25
T ₁₀	Unweeded control	unweeded		268	19.73	1.56	134.3	2.68	5.21
	SEm±			1.676	0.332	0.031	3.421	0.032	0.22
	LSD (p=0.05)			4.921	1.032	0.082	8.882	0.101	0.69

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UNDER PEER REVIEW



miliaceae(Sedges). Ghosh and Bhowmick (2000) [9] observed similar types of weed flora in rice field at Kalyani, West Bengal.

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3.2. Weed density and dry weight

Significant differences were observed among the treatments at all the observations in terms of density and dry weight of weed flora (Table 2). The lowest weed density and dry matter weight was recorded with twice hand weeded plots (T_9) at 40 and 60 DAT whereas unweeded control (T_{10}) resulted in highest weed density and dry matter weight in all the observations. This is in conformity with findings of Prashanth *et al.* (2015) [10] and Ehsanullah *et al.* (2009) [11]. Among the chemical treatments, new formulation of pretilachlor 50 % EC @ 2.0 kg a.i.ha⁻¹ (T_6) recorded the lowest weed count and dry biomass in all the observations which was followed by the lower doses of pretilachlor 50 % EC viz. 1.5 kg a.i.ha⁻¹ (T_5) and 1.2 kg a.i.ha⁻¹ (T_4). This result is in corroboration with the finding of Mondal *et al.* (2019) [12].

Comment [A14]: Dry weight is equivalent to dry matter, as such you cant use both at same time.

3.3. Weed control index

Weed control efficiency was observed highest under the twice hand weeded plots (T_9). Among the herbicidal treatments, pretilachlor 50% EC @ 2.0 kg ha⁻¹ (T_6) recorded highest weed control efficiency which is closely followed by pretilachlor 50% EC @ 1.5 kg ha⁻¹ (T_5).

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3.4. Phytotoxicity rating of different doses of herbicide on rice plant

Among the different treatments, there were no phytotoxicity effect on rice plants except with pretilachlor 50% EC when applied at the rate of 1.5 and 2.0 kga.i.ha⁻¹ (Table 3). Pretilachlor 50% EC @ 1.5 kga.i.ha⁻¹ (T_5) showed slight stunting and ~~injury or~~ discoloration of leaf at 7 DAT and 14 DAT and thereafter, no visual phytotoxicity symptoms were observed. Pretilachlor 50% EC @ 2.0 kga.i.ha⁻¹ (T_6) showed moderate injury, recovery possible initially 7 DAT. After that, it showed slight stunting ~~and, injury or~~ discoloration of the leaf. However, visually phytotoxicity symptoms continued up to 28 DAT. Similar result was observed by Suganthi *et al.* (2010) [13].

3.5. Yield attributes and yield

The highest yield attributing characters viz. filled grains panicle⁻¹, effective tillers m⁻² and grain yield (3.61tha⁻¹) were found with twice hand weeding (T_9) (Table 4). This result is in agreement with the findings of Tripathi *et al.* (2000) [14]. Among the herbicide treatments, highest yield attributing characters and grain yield were observed with pretilachlor 50% EC @ 1.2 kg a.i.ha⁻¹ (T_4) followed by pretilachlor 50% EC @ 1.0 kga.i.ha⁻¹ (T_3). This result is in line with the finding of Suganthi *et al.* (2010) [13].

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4. CONCLUSION

The grain yield of pretilachlor 50% EC@1.2 kg a.i.ha⁻¹ was statistically at par with twice hand weeding (T₉). Therefore, it can be concluded that the laborious, time consuming, costly and cumbersome hand weeding practice can economically be replaced by pretilachlor 50% EC @ 1.2 kg a.i.ha⁻¹ which is safer for the crop and environment.

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