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Effectiveness of 2, 4-D Ethyl Ester 80% EC to control of weeds in *kharif* rice

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ABSTRACT

A field experiment was conducted at regional research station of Bidhan Chandra Krishi Viswavidyalaya, Chakdaha, Nadia, West Bengal in 2014 to study the effectiveness of weeds control in Kharif paddy by the application of 2,4-D Ethyl Ester 80 per cent EC. The predominant weed flora found in the experiment viz. Echinochloa colona, Echinochloa crussgalli, Cyperus difformis, Cyperus iria, Eclipta alba, Ludwigia parviflora etc. 2,4-D EE 80 per cent EC @ 3.40 kg a.i. ha^{-1} and 2,4 –D EE 80 per cent EC @ 1.70 kg a.i. ha^{-1} recorded the higher weed control efficiency compared to hand weeding twice at 20 and 40 DAT. Among yield parameters, the application of 2,4-D EE 80per cent EC @ 3.40 kg a.i.ha^{-1} plots found better results after hand weeding twice (20 & 40 DAT) plot. It was also revealed that 2, 4-D EE 80per cent EC @ 3.40 kg a.i. ha^{-1} was at par with other different doses of herbicide treatments.

Keywords **:** 2.4-D Ethyl Ester 80% EC, grain yield, weed management

Rice is an important cereal crop of India and also the staple food crop for over half of the world population. The first green revolution in the era of 1960's lead to an increase in the yield of rice up to 8-10 ton ha^{-1} in our country (Prasad, 2012). But , it is found that the yield is gradually decreasing day by day due to different factors in which weed is one of them. Weed problems vary according to region, soil type, crops and compete with the crop plants for soil moisture, nutrients, light etc. Uncontrolled weeds reduced the grain yield by 75.8, 70.6 and 62.6 per cent under dry-seeded rice (DSR), wet-seeded rice (WSR) and transplanted rice, respectively (Singh *et al*., 2005). Poor management of weeds is one of the major constraints in rice production. Hence, successful weed control is essential for obtaining optimum yield of rice (Hussain *et al*., 2008). Herbicides play a significant role in controlling the weeds and thereby increasing the production. Manual and mechanical methods do not ensure timely and effective weed management because labour problem should be more in cultivation of *kharif* rice. So use of herbicide assumes greater significance. According to Sheeja *et al.* (2013), it was found that 2, 4-D Na salt when applied @ 800 g ha^{-1} results weed control efficiency of 96.7 per cent .The objective of the experiment was to find out the weed control efficiency, yield advantage and weed index of different treatments.

MATERIALS AND METHODS

A field experiment was conducted at Regional Research Station (Chakdaha) of Bidhan Chandra Krishi Viswavidyalaya, Nadia in New Alluvial Zone of West Bengal, during *kharif*, 2014 to find out the efficacy of 2, 4-D Ethyl Ester 80 per cent EC in *Kharif* rice. The soil type of the experimental field was sandy loam with moderate pH level (6.8). Nine treatments comprising of T_1 - 2, 4-D EE 80% EC @ 0.425 kg a.i. ha^{-1}, T_2 - 2, 4-D EE 80% EC @ 0.850 kg a.i.ha^{-1}, T_3 - 2, 4-D EE 80% EC @ 1.280 kg a.i.ha^{-1}, T_4 - 2, 4-D EE 80% EC @ 1.700 kg a.i.ha^{-1}, T_5 - 2, 4-D EE 80% EC @ 3.400 kg a.i.ha^{-1}, T_6-2, 4-D EE 38% EC@ 0.850 kg a.i.ha^{-1} (Commercial),T_7 - Butachlor 50% EC@ 1.000 kg a.i. ha^{-1}, T_8 - Hand weeding at 20 DAT & 40 DAT, T_9 - Unweeded control were laid out in Randomized Block Design with three replications. The cultivar, Satabdi (IET- 4786) was grown in the experiment with recommended package of practices. Herbicides were sprayed by using knapsack sprayer fitted with a flat fan nozzle at a spray volume of 500 l ha^{1}.

The weed control efficiency (WCE) of different treatments was also obtained through this formula:

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

where x = weed dry weight in weedy check and

y = weed dry weight

Weed Index (WI) can also be obtained from these results through the formula:

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

Where x = weight of seed yield (q ha^{-1}) in treatment which has highest yield

y = weight of seed yield (q ha^{-1}) in treatment for which weed index is to be calculated

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Short Communication

Table 1: Effect of treatments on weed flora dynamics of *kharif* rice

Treatment	20 DAT				40 DAT				60 DAT			
	Grass (No. m^{-2})	Sedge (No. m^{-2})	Broadleaf (No. m^{-2})	Dry weight (g m^{-2})	Grass (No.m^{-2})	Sedge (No.m^{-2})	Broad leaf (No. m^{-2})	Dry weight (g m^{-2})	Grass (No.m^{-2})	Sedge (No.m^{-2})	Broad leaf (No. m^{-2})	Dry weight (g m^{-2})
T_1	0.35	0.87	1.26	19.50	2.70	2.80	4.87	30.21	3.33	3.46	6.52	28.72
T_2	0.13	0.29	0.51	19.31	1.26	2.14	2.89	29.3	1.08	2.73	4.47	30.10
T_3	0.30	0.57	0.75	16.30	1.10	2.63	3.58	23.50	2.66	3.46	7.18	28.10
T_4	0.26	0.47	0.80	16.21	1.88	2.69	4.40	24.20	2.79	3.63	5.69	31.00
T_5	0.16	0.29	0.55	15.30	1.59	1.95	3.69	23.11	1.41	2.81	5.16	29.30
T_6	0.18	0.46	0.72	20.10	2.24	2.16	3.60	29.50	1.66	3.41	4.68	31.42
T_7	0.19	0.45	0.65	19.40	1.14	3.16	3.81	29.80	1.96	3.29	5.04	30.70
T_8	0.02	0.07	0.10	9.20	0.55	0.51	1.25	21.42	1.53	3.68	5.00	26.40
T_9	0.45	1.23	2.06	22.13	1.97	6.88	7.54	36.20	3.90	7.31	13.16	40.20
SEm (±)	**0.01**	**0.02**	**0.04**	**0.78**	**0.08**	**0.14**	**0.22**	**1.32**	**0.13**	**0.17**	**0.35**	**1.40**
LSD (0.05)	**0.03**	**0.04**	**0.08**	**1.66**	**0.18**	**0.29**	**0.46**	**2.79**	**0.28**	**0.36**	**0.74**	**2.97**

Table 2: Effect of treatments on weed control efficiency (%), grain yield (t ha^{-1}) and weed index (%)

Tr. No.	Treatments	Dose (a.i. Kg ha^{-1})	WCE (%)			Grain yield (t ha^{-1})	Weed index (%)
			20 DAT	40 DAT	60 DAT		
T_1	2,4-D EE 80% EC	0.425	11.88	16.55	28.56	2.9	11.58
T_2	2,4-D EE 80% EC	0.85	12.74	19.06	25.12	3.00	8.53
T_3	2,4-D EE 80% EC	1.28	26.34	35.08	30.10	3.00	8.53
T_4	2,4-D EE 80% EC	1.7	26.75	33.15	22.89	2.95	10.06
T_5	2,4-D EE 80% EC	3.4	30.86	36.16	27.11	3.00	8.53
T_6	2,4-D EE 38% EC	0.85	9.17	18.51	21.84	2.85	13.10
T_7	Butachlor 50% EC	1	12.34	17.68	23.63	2.98	9.14
T_8	Hand weeding (twice)	-	58.43	40.83	34.33	3.28	-
T_9	Unweeded control	-	-	-	-	1.96	40.24
	S Em(±)					**0.10**	
	LSD (P=0.05)					**0.31**	

RESULTS AND DISCUSSION

Weed flora

The observations made on the weed flora at different stages indicated that different types of grassy and non-grassy weeds were found in the experimental plots. Among grassy weeds, predominant *Echinochloa colona*, *Echinochloa crusgalli etc*. and among non-grassy weeds, *Fimbristylis miliacea, Cyperus difformis, Cyperus iria, Schenoplectus pungens, Ludwigia perennis* and *Sphenoclea zeylanica* were the dominant weed species which corroborated the findings of Bhattacharya *et al*., (2005).

Grasses

It has revealed that hand weeding twice at 20 & 40 DAT (T_8) recorded the lowest grassy weed density. In chemical control treatments, 2,4-D EE 80% EC @ 0.85 kg a.i. ha^{-1} (T_2) resulted low grassy weed density and remained *at par* with 2,4-D EE 80% EC @ 3.40 kg ha^{-1} (T_5). At 20 & 40 DAT, hand weeding twice (T_8) was statistically *at par* with 2, 4-D EE 80% EC @ 1.280 kg a.i.ha^{-1} (T_3) and Butachlor 50% EC @ 1.000 kg a.i.ha^{-1} (T_7). At 60 DAT, 2, 4-D EE 80% EC @ 0.85 kg a.i. ha^{-1} (T_2) resulted the lowest grassy weed density followed by 2,4-D EE 80% EC @ 3.40 kg ha^{-1} (T_5). In all the observations, grassy weed density is higher in the unweeded plot (T_9). Such type of observations were found because of the poor control of grassy weeds by 2,4-D opined by Chauhan *et.al.*, (2015).

Sedges

At 20 DAT the lowest sedge weed density was observed in hand weeding twice (T_8). 2,4-D EE 80% EC @ 0.85 kg a.i. ha^{-1} (T_2) and 2,4-D EE 80% EC @ 3.40 kg ha^{-1} (T_5) showed low sedge weed density which are at par among themselves. This was because 2,4-D is a selective herbicide was recommended for controlling BLW and sedges in rice (Anitha and Mathew, 2010).Similar results were observed at 40 DAT. Whereas, at 60 DAT 2,4-D EE 80% EC @ 0.85 kg a.i. ha^{-1} (T_2) and 2,4-D EE 80% EC @ 3.40 kg ha^{-1} (T_5) showed low sedge weed density which are *at par* among themselves. The unweeded control treatment (T_9) recorded the highest sedge count.

Broad leaf weeds

The unweeded control treatment (T_9) recorded the highest BLW count. The hand weeding twice (T_8) at 20 and 40 DAT recorded the lowest broad leaf weed population which was followed by 2,4-D EE 80% EC @ 0.85 kg a.i. ha^{-1} (T_2) and 2,4-D EE 80% EC @ 3.40 kg ha^{-1} (T_5). Here, T_2 and T_5 treatments were *at par* among themselves. This was in close conformity with the findings of effectiveness of 2, 4-D against broad leaf weeds (Gopal *et al*., 2010; Jabran *et al*., 2012; Mahajanand Chauhan, 2013; Ahmed and Chauhan, 2014).

Weed dry weight and weed control efficiency

Significant differences in DMP were observed among the treatments at all stages. At 20, 40, 60 DAT the lowest DMP of 9.20, 21.42, 26.40 gm m^{-2} was recorded in the hand weeding twice at 20 & 40 DAT (T_8) followed by 2,4-D EE 80% EC 3.40 kg a.i. ha^{-1} (T_5) , 2,4-D EE 80% EC 1.70 kg a.i. ha^{-1} (T_4) and 2,4-D EE 80% EC 1.28 kg a.i. ha^{-1} (T_3). However, consequent decrease of weed density was observed in the following treatments. The dry weight of weeds was recorded least in the aforesaid treatments compared to the standard treatments *viz*. 2, 4-D EE 38 per cent EC (commercial) 0.85 kg a.i. ha^{-1} (T_6) and Butachlor 50 per cent EC 1.00 kg a.i. ha^{-1} at all the stages of observations.

The weed control efficiency (WCE) derived from the dry weight of weed revealed that hand weeding twice (T_8) resulted with the higher weed control efficiency of 58.43, 40.83 and 34.33 per cent during 20, 40 and 60 DAT respectively. The weed control efficiency remained comparable with each other. This was recorded that 2,4-D EE 80% EC 3.40 kg a.i. ha^{-1} (T_5) was the lowest WCE among other chemical controlled treatments giving 30.86, 36.16 and 27.11 per cent at 20, 40 and 60 DAT respectively. The lowest WCE was recorded in unweeded control plot (T_9).

Grain yield and weed index

Grain yield varied significantly among the weed management practices. Hand weeding twice (T_8) recorded the highest grain yield of 3.28 t ha^{-1} which was *on par* with 2,4-D EE 80% EC 3.40 kg a.i. ha^{-1} (T_5) (3.00 t ha^{-1}), 2,4-D EE 80 % EC 1.28 kg a.i ha^{-1} (T_3) (3.00 t ha^{-1}). This was followed by 2,4-D EE 80% EC 1.70 kg a.i. ha^{-1} (T_4) (2.95 t ha^{-1}).

The weed index derived from the grain yields reveal that Hand weeding twice (T_8) recorded the lowest weed index. This was followed by 2, 4-D EE 80% EC @ 0.850 kg a.i.ha^{-1} (T_2), 2, 4-D EE 80% EC @ 1.280 kg a.i.ha^{-1} (T_3), 2, 4-D EE 80% EC @ 3.400 kg a.i.ha-^{1}(T_5**)** which are *at par* among themselves. The lowest grain yield was registered in weedy check. Lower weed index indicated lesser grain yield reduction due to minimum crop-weed competition period suggested by Raj *et al*., 2013.

From this investigation, it may be inferred that 2, 4-D EE 80 per cent EC @ 3.40 kg a.i. ha^{-1} enhanced the grain yield over other herbicidal treatments after hand weeding twice at 20 and 40 DAT. Therefore, it should be advised to the farmers of gangetic - alluvial zone of West Bengal for betterment of crop cultivation by reducing weed population dynamics.

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