Journal of Crop and Weed, 13(2): 228-230 (2017)

Evaluation of 2, 4-D Ethyl Ester 38% EC for Controlling weeds in *Kharif* rice

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Received : 20-01-2017 ; Revised : 25-08-2017 ; Accepted : 31-08-2017

ABSTRACT

The field experiment was conducted to study the effect of 2.4-D Ethyl Ester 38% EC on rice during the period of 2012 in the sub-humid and sub-tropical situation of *Regional Research Station, BCKV,West Bengal. The dominant weed floras found in this experiment were Echinochloa colona, Echinochloa crussgalli, Cyperus deformis, Cyperus iria, Ludwigia parviflora, Alternenthera phyloxeroides etc. The pre-emergence application of 2, 4-D EE 38% EC @ 3.40 kg a.i. ha^{-1} (T_5), 2, 4-D EE 38% EC @ 1.70 kg a.i. ha^{-1} (T_4) and 2, 4-D EE 38% EC @ 0.85 kg a.i. ha^{-1} (T_2) resulted in effective weed control, recording the least weed density and weed dry weight. In case of yield, 2, 4-D EE 38% EC 3.40 kg a.i. ha^{-1} (T_5) resulted better yield after hand weeding twice which was at par with other aforesaid treatments.*

***Keywords*:** 2.4-D Ethyl Ester, hand weeding, weed management, yield

Rice is the most important cereal crop in Asia and Indian sub continent. Out of 44 m ha of rice grown in India, about 57 per cent (25 m ha) is grown under irrigated condition (GOI, 2010). A major hindrance in the cultivation of rice is heavy infestation of weeds. To achieve adequate and stable supplies of rice, it is important to find out the critical crop-weed competition period for effective control of weeds affecting the yield of rice. 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 per cent respectively (Moorthy and Saha, 2005). Traditional method of weed management practices are widely adopted for control of weeds in rice however, these practices are tedious, time consuming, labour intensive, costly and not possible to practice over an extensive area. Further, due to labour scarcity and high labour wages as a result of rapid industrialization and urbanization, traditional weed management practices are being impracticable. Chemical weed control is more economical, less time consuming, less expensive and provide early weed control and crop establishes in a weed free environment as a results it reduces the competition for light, space and nutrients. Several herbicides are available in the market and some new herbicides are continuously being introduced. But information on their usage under field conditions, suitability for *kharif* rice and their concentrations for effective weed control of weeds is scarce. 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 (Rekha *et al*., 2003). Herbicide usage for control of weeds in crop lands has been proved successful in many advanced countries and is now gaining importance in Indian agriculture. In view of the above facts, a field experiment was conducted.

A field experiment was conducted at Regional Research Station (Chakdaha) of B.C.K.V, Nadia in New Alluvial Zone of West Bengal, India during *kharif* , 2012 to find out the "bio-efficacy of 2-4, D Ethyl Ester 38% EC in *Kharif* rice" . The soil type of the experimental field was sandy loam with moderate pH level (6.8). Nine treatments were laid out in Randomized Block Design with three replications. All the herbicides were applied as pre-emergence herbicides at 2 DAT. The cultivar grown for the experiment was Satabdi (IET-4786) with recommended package of practices. Herbicides were sprayed using knapsack sprayer fitted with a flat fan nozzle at a spray volume of 500 l ha^{-1}.

$$\text{Weed Control Efficiency (\%)} = \frac{\text{DMPW in unweeded plot} - \text{DMPW in treated plot}}{\text{DMPW in unweeded plot}}$$

DMPW = Dry matter production of weeds.

Different types of weed flora were grown in the experimental field. Among them, grassy weeds (*Echinochloa colona*, *Echinochloa crusgalli* etc.), sedge weeds (*Cyperus deformis*, *Cyperus iria etc*.) and broadleaf weeds (*Ludwigia parviflora*, *Alternenthera phyloxeroides etc*.) were important. Similar trends were opined by Das *et al*. (1997) and Kumar *et al*. (200 l).

The lowest grass weed density was showed in T_8 (hand weeding twice at 20 and 40 DAT) and T_9 recorded highest grass population among different treatments. From 20 to 60 DAT all the grass weed densities increased with the increase in crop growth in all the treatments. In all the observations from 20 DAT an almost similar type of significant variations were recorded. This may be due to regeneration of grassy weeds after the initial control either through hand weeding twice or different doses of herbicide application.

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Table 1 : Effect of treatments on weed density (no. m^{-2}), weed control efficiency and grain yield of *kharif* rice

Treatment	20 DAT					40 DAT					60 DAT					Grain yield (t ha^{-1})
	Grass	Sedge	BLW	TWD	WCE (%)	Grass	Sedge	BLW	TWD	WCE (%)	Grass	Sedge	BLW	TWD	WCE (%)	
T_1	0.30	0.75	1.09	0.71	14.10	3.20	3.32	5.79	4.12	12.43	4.53	4.71	8.87	6.05	50.32	2.90
T_2	0.25	0.42	0.73	0.47	18.30	1.66	2.82	3.81	2.76	16.67	1.61	4.09	6.70	4.13	43.32	3.27
T_3	0.31	0.57	0.75	0.54	31.80	1.35	3.24	4.41	2.09	15.25	2.60	3.38	7.02	4.32	38.56	3.00
T_4	0.24	0.43	0.72	0.46	30.39	1.76	2.51	4.10	2.79	25.14	3.45	4.50	7.05	5.00	47.09	3.15
T_5	0.16	0.28	0.54	0.33	7.74	1.38	1.70	3.20	2.09	23.42	1.99	3.39	7.31	4.23	48.80	3.45
T_6	0.16	0.57	0.90	0.54	14.84	2.38	2.30	3.83	2.84	14.97	2.23	4.60	6.30	4.38	40.26	3.00
T_7	0.30	0.70	1.00	0.67	24.73	1.14	3.16	3.81	2.70	19.46	2.70	4.55	6.96	4.74	47.94	2.95
T_8	0.02	0.08	0.10	0.07	66.78	0.55	0.51	1.25	0.77	22.32	0.52	1.25	1.70	1.16	34.63	3.78
T_9	0.51	1.41	2.36	1.43	0.00	2.01	7.03	7.70	5.58	0.00	4.70	8.81	15.86	9.79	0.00	2.00
S.Em. (±)	**0.01**	**0.02**	**0.04**	**0.01**		**0.09**	**0.15**	**0.23**	**0.02**		**0.16**	**0.20**	**0.43**	**0.04**		**0.45**
LSD(0.05)	**0.03**	**0.04**	**0.09**	**1.45**		**0.19**	**0.31**	**0.49**	**1.42**		**0.35**	**0.43**	**0.92**	**1.28**		**0.96**

WCE: Weed control efficiency; DAT : Days after transplanting, BLW: Broadleaf weed, TWD = Total weed density

T_1 - 2, 4-D EE 38% EC @ 0.425 kg a.i. ha^{-1}, T_2 - 2, 4-D EE 38% EC @ 0.850 kg a.i. ha^{-1}, T_3 - 2, 4-D EE 38% EC @ 1.280 kg a.i. ha^{-1}, T_4 - 2, 4-D EE 38% EC @ 1.700 kg a.i. ha^{-1}, T_5 - 2, 4-D EE 38% EC @ 3.400 kg a.i. ha^{-1}, T_6 - 2, 4-D EE 38 per cent EC @ 0.850 kg a.i. ha^{-1} (commercial), T_7 - Butachlor 50 per cent EC @ 1.000 kg a.i. ha^{-1}, T_8 - Hand weeding twice at 20 and 40 DAT, T_9 - Unweeded control.

The treatments T_5, T_4, T_2 and T_8 controlled the sedge weeds effectively. It was due to the weed control twice through hand weeding at 20 and 40 DAT in case of T_8 and application 2, 4-D EE 38% EC with comparable doses in case of T_5, T_4 and T_2. It was reported by Yadav *et al*., 2014 that post-emergence application of 2, 4-D Ester or Amine @ 500 g ha^{-1} in combination with Bispyribac Sodium @ 25 g ha^{-1} provide effective control of broadleaf weeds and sedges.

From 20 to 60 DAT all the treatments showed lower increasing rate than the treatment T_9 (2.36 to 15.86 m^{-2}). At 60 DAT the lowest weed density was recorded in T_8 (1.70 m^{-2}). There was significant effect of the treatments on the broadleaved weed density at all the stages of crop growth. It is inferred that T_5, T_4 and T_2 were statistically *at par* with each other.

The total weed density was significantly reduced in the herbicide treatments. The data on weed count per ha revealed that 2, 4-D EE 38% EC @ 3.400 kg a.i. ha^{-1} (T_5) resulted in effective weed control of all types of weeds and recorded least count at 20,40 and 60 DAT and remained *at par* among themselves and superior to the other treatments except hand weeding twice at 20 & 40 DAT (T_8) . 2, 4-D EE 38% EC @ 3.400 kg a.i. ha^{-1} (T_5) was *at par* with 2, 4-D EE 38% EC @ 1.700 kg a.i. ha^{-1} (T_4). The unweeded control treatment (T_9) recorded the highest weed count at all the observations with the pre-dominance of broadleaf weeds followed by sedges and grasses respectively. It is clearly noticed that weed density increased with advancement of time. It may be due to more flushes of weed emergence in later stage of crop growth. Weed community in the aerobic rice is generally dominated by broadleaf weeds followed by sedges and grasses reported by Jayadeva *et al*. (2011).

The lowest weed control efficiency (WCE) was recorded in unweeded control plot (T_9). Among different treatments, weed control efficiency remained comparable at all stages of observation. At 20 DAS, T_3 (31.80%) and T_4 (30.39%) showed highest WCE compared to hand weeding twice (66.78%) at 20 & 40 DAT. After that, the effective rate of increasing of WCE was observed in T_5 treatment from 20 DAT (7.74%) to 60 DAT (48.80%). So, the higher WCE revealed the lowest no. of weeds as well as lowest weed dry matter production.

Hand weeding twice at 20 & 40 DAT (T_8) recorded the highest grain yield of 3.78 t ha^{-1} which was *at par* with T_5 @ 2, 4-D EE 38% EC @ 3.400 kg a.i. ha^{-1} (3.45 t ha^{-1}), T_2 @ 2, 4-D EE 38% EC @ 0.850 kg a.i. ha^{-1} (3.45 t ha^{-1}) and T_4 @ 2, 4-D EE 38% EC @ 1.700 kg a.i. ha^{-1} (3.45 t ha^{-1}) respectively. The higher grain yield was obtained by higher dose of 2, 4-D EE due to better control of pre-dominant weeds and reduced weed dry weight which to more nutrient uptake, exposure to sunlight and weed free condition at critical stages of crop growth period. Similar finding was also reported by Ghosh *et al*., 2007 working on clomazone + 2, 4-D EE. Thus, it can be concluded that the application of 2, 4-D EE 38% EC @ 3.400 kg a.i. ha^{-1} was most effective to check weed population which may be recommended to replace the tedious, time consuming and expensive hand weeding practice of weed control in rice.

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