

## Studies on bio-efficacy and phytotoxicity of 2, 4-d ethyl ester 80% ec in wheat

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### ABSTRACT

A field experiment was conducted during winter of 2012-13 at Regional Research Station, Chakdaha of West Bengal. Eight different weed control treatments viz. Four different doses of 2, 4 - D EE 80% EC applied at 0.225, 0.450, 0.675 and 0.900 kg a.i. ha<sup>-1</sup>, 2, 4-D EE 38% EC at 0.450 kg a.i. ha<sup>-1</sup>, Metsulfuron methyl 20% WP at 0.004 kg a.i. ha<sup>-1</sup>, hand weeding twice at 25 and 45 DAS and unweeded control was studied in a randomized block design with replications thrice. The post emergence application of 2, 4-D EE 80 % EC @ 0.900 kg a.i. ha<sup>-1</sup> and 2, 4-D EE 80 % EC @ 0.675 kg a.i. ha<sup>-1</sup> resulted in effective weed control, recording the least weed density and weed dry weight. Hand weeding twice produced highest grain yield followed by 2, 4-D EE 80 % EC @ 0.900 kg a.i. ha<sup>-1</sup>.

**Keywords:** 2, 4-D Ethyl Ester, metsulfuron-methyl, phytotoxicity, yield

Wheat (*Triticum aestivum* L.) is the second important food crop, being next to rice in India. Besides staple food for human beings, wheat straw is a good source of feed for a large population of cattle in our country (Singh, 2013). It is grown in about 31.19 million ha area in the country with the production of 95.91 million tonnes in India. In West Bengal, it is grown in 0.34 million ha area with the production of 0.95 million tones and productivity 2802 kg ha<sup>-1</sup> (Agril. Statistics, 2014). A major concern about weed management in the agricultural scenario is persistence, mobility, and bioavailability of pesticide residues in the environment (Sachan *et al.*, 2007). Weeds compete with crop plants for nutrients, light, space, moisture and many other growth (Gupta, 2004). Uncontrolled weeds are reported to cause upto 66 Per cent reduction in wheat grain yield or even more depending upon the weed density, type of weed flora and duration of infestation (Kumar *et al.*, 2011). Hand weeding recorded highest grain yield followed by clodinafop + 2, 4-D EE treatment, which were 48.1 and 38.9 per cent higher over weedy check respectively (Barui *et al.* 2006). Singh *et al.* (2015) recorded that metribuzin + clodinafop-propargyl at 500-600 g ha<sup>-1</sup> were as effective as two hand weeding at 30 and 50 DAS in reducing the weed density at 30 and 60 days after application as compared to rest treatments.

A field experiment was conducted to study the effect of bio-efficacy and phytotoxicity of 2, 4-D Ethyl Ester 80% EC in wheat in *rabi* season of 2012-13 in the sub-humid and sub-tropical condition of West Bengal. The experiment was conducted at Regional Research Station, Chakdaha of West Bengal, which is situated at 28°5.3' N

latitude and 83°5.3' E longitude and the altitude of 9.75 m above mean sea level. Topography of the land was referred as medium land situation. The experiment was laid out in randomized block design (RBD) with three replications comprising eight different weed control treatments viz. four different doses of 2, 4-D EE 80% EC (Nufarm) applied at 0.225, 0.450, 0.675 and 0.900 kg a.i. ha<sup>-1</sup>, 2, 4-D EE 38% EC (commercial) at 0.450 kg a.i. ha<sup>-1</sup>, metsulfuron methyl 20% WP at 0.004 kg a.i. ha<sup>-1</sup>, hand weeding twice at 25 and 45 DAS and unweeded control. Wheat variety 'PBW 343' was sown in 20 cm spacing using 100 kg seed ha<sup>-1</sup> on December 07, 2012. Herbicidal treatments were applied as post emergence (after first irrigation) 34 days after sowing at their respective doses as per treatments. Spraying was done with the help of knapsack sprayer fitted with a flat fan nozzle with the spray volume of water 500 l/ha. Weed population was taken by quadrat method and dry weight was done as per standard method. The weeds inside each quadrat were uprooted, cleaned and dried. After sun drying, weeds were dried for 48 hours to obtain a constant weight. After drying, weight and weed control efficiency was calculated using standard formula.

The total weed density was significantly reduced in the herbicide treatments. The data on weed count has revealed that 2, 4-D EE 80 % EC (Nufarm) @ 0.900 kg a.i. ha<sup>-1</sup> has resulted in effective control of all type of weeds and has recorded least weed count at 20, 40 and 60 DAS and remained *on par* among themselves and superior to the other treatments except hand weeding twice. 2, 4-D EE 80 % EC (Nufarm) @ 0.900 kg a.i. ha<sup>-1</sup> was *on par* with 2, 4-D EE 80 % EC (Nufarm) 0.675

Table 1 : Effect of treatments on density of different weeds in Wheat (No. m<sup>-2</sup>)

Treatments	Doses (kg a.i. ha <sup>-1</sup> )	Broad leaf weed						Grassy weed						Sedge weed						Total weed population					
		20		40		60		20		40		60		20		40		60		20		40		60	
		DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	
2,4-D EE 80% EC T <sub>1</sub> (Nufarm)	0.225	1.03	2.07	3.62	0.38	0.89	1.62	0.70	1.27	1.92	2.01	4.23	7.39												
2,4-D EE 80% EC T <sub>2</sub> (Nufarm)	0.450	0.98	1.44	2.07	0.30	0.56	0.74	0.60	1.02	1.51	1.98	3.00	4.32												
2,4-D EE 80% EC T <sub>3</sub> (Nufarm)	0.675	0.92	1.38	1.91	0.28	0.53	0.73	0.59	0.93	1.24	1.89	2.95	3.89												
2,4-D EE 80% EC T <sub>4</sub> (Nufarm)	0.900	0.92	1.18	1.78	0.23	0.51	0.60	0.58	0.62	1.09	1.67	2.31	3.29												
2,4-D EE 38% EC T <sub>5</sub> (Commercial)	0.450	0.99	1.45	2.53	0.32	0.60	0.93	0.69	1.06	1.61	1.99	3.07	5.38												
Metsulfuron methyl T <sub>6</sub> 20% WP	0.004	1.02	1.61	3.43	0.36	0.89	1.24	0.70	1.20	1.87	2.00	3.43	6.23												
Hand weeding twice T <sub>7</sub> (25 and 45 DAS)	-	0.58	0.90	1.47	0.11	0.43	0.43	0.41	0.48	0.78	1.11	2.00	3.00												
Control (Unweeded check) T <sub>8</sub>	-	3.43	4.11	5.47	0.75	1.07	1.85	2.06	3.75	3.04	6.23	8.93	10.13												
SE(d)		0.05	0.10	0.15	0.02	0.04	0.06	0.02	0.06	0.07	0.28	0.39	0.40												
LSD (0.05)		0.12	0.22	0.32	0.03	0.08	0.12	0.05	0.14	0.15	0.60	0.83	0.86												

Table 2 : Effect of treatments on total weed dry matter accumulation, weed control efficiency, phytotoxicity and grain yield of Wheat.

Treatments	Doses (kg a. i. ha <sup>-1</sup> )	Total weed dry matter accumulation (g m <sup>-2</sup> )			Weed control efficiency (%)			Phytotoxicity observation			Grain yield (t ha <sup>-1</sup> )
		20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS	7 DAHA	14 DAHA	21 DAHA	
2,4-D EE 80% EC (Nufarm)	0.225	0.97	3.24	8.47	26.52	0.61	17.20	0	0	0	1.39
2,4-D EE 80% EC (Nufarm)	0.450	0.73	2.00	7.21	44.70	38.65	29.52	0	0	0	1.70
2,4-D EE 80% EC (Nufarm)	0.675	0.63	2.00	7.21	52.27	38.65	29.52	0	0	0	1.70
2,4-D EE 80% EC (Nufarm)	0.900	0.61	1.63	7.20	53.79	50.00	29.62	0	0	0	1.72
2,4-D EE 38% EC (Commercial)	0.450	0.86	2.39	8.20	34.85	26.69	19.84	0	0	0	1.42
Metsulfuron methyl 20% WP	0.004	0.87	3.21	8.27	34.09	1.53	19.16	0	0	0	1.40
Hand weeding twice at 25 & 45 DAS	-	0.50	1.50	6.23	62.12	53.99	39.10	0	0	0	1.85
Control (Unweeded check)	-	1.32	3.26	10.23	-	-	-	0	0	0	1.32
SE(d)		0.03	0.15	0.47	-	-	-	-	-	-	0.21
LSD (0.05)		0.07	0.32	0.99	-	-	-	-	-	-	NS

Note: EE= Ethyl Ester, EC= Emulsified concentration, WP= Wettable powder, a.i.= Active ingredient, L= Litre, DAS= Days after sowing, DAHA=Days after herbicide application

kg a.i. ha<sup>-1</sup> in controlling the total weed population. The unweeded control treatment recorded the highest weed count at all the observations with the pre dominance of broad leaf weeds followed by sedges and grasses respectively. The dry matter production of weeds was recorded at 20, 40 and 60 DAS. Significant differences in DMP were observed among the treatments at all the stages. At 20, 40 and 60 DAS, the lowest DMP of 0.50, 1.50 and 6.23 g m<sup>-2</sup> was recorded in hand weeding twice followed by 2, 4-D EE 80 % EC (Nufarm) @ 0.900 kg a.i. ha<sup>-1</sup> and 2, 4-D EE 80 % EC (Nufarm) @ 0.675 kg a.i. ha<sup>-1</sup>. Consequent to the lower density of weeds observed in hand weeding twice followed by 2, 4-D EE 80 % EC (Nufarm) @ 0.900 kg a.i. ha<sup>-1</sup> and 2, 4-D EE 80 % EC (Nufarm) @ 0.675 kg a.i. ha<sup>-1</sup>. The weed dry weight was recorded least in the aforesaid treatments. The weed dry weight in the aforesaid treatments remained on par among themselves and remain significantly superior to the other treatments at all the stages especially that the standard treatments viz., 2, 4-D EE 38 % EC (commercial) @ 0.450 kg a.i. ha<sup>-1</sup> and Metsulfuron methyl 20% WP 0.004 kg a.i. ha<sup>-1</sup>. The weed control efficiency derived from the weed dry weight revealed, hand weeding twice resulted with the higher weed control efficiency of 62.12, 53.99 and 39.10 % during 20, 40 and 60 DAS respectively. This was followed by 2, 4-D EE 80 % EC (Nufarm) @ 0.900 kg a.i. ha<sup>-1</sup> (53.79, 50.00 and 29.62% at 20, 40 and 60 DAS respectively) and 2, 4-D EE 80 % EC (Nufarm) @ 0.675 kg a.i. ha<sup>-1</sup> (52.27, 38.65 and 29.52% at 20, 40 and 60 DAS respectively). The weed control efficiency of the aforesaid treatments remained comparable with each other and better than other treatments. The lowest WCE was recorded in unweeded control plot. Hand weeding twice recorded the highest grain yield of 1.85 t ha<sup>-1</sup> which was followed by 2, 4-D EE 80 % EC (Nufarm) @ 0.900 kg a.i. ha<sup>-1</sup> (1.72 t ha<sup>-1</sup>), 2, 4-D EE 80 % EC (Nufarm) @ 0.675 kg a.i. ha<sup>-1</sup> (1.70 t ha<sup>-1</sup>) and 2, 4-D EE 80 % EC (Nufarm) @ 0.450 kg a.i. ha<sup>-1</sup> (1.70 t ha<sup>-1</sup>) respectively. The observation on visual crop toxicity was done 07, 14 and 21 days after herbicide application. The visual crop toxicity symptoms like leaf injury, vein clearing, epinasty, hyponasty, scorching and necrosis were observed. There were no crop Phytotoxicity symptoms among the different treatments as well as at

the highest dose of 2, 4-D EE 80 % EC (Nufarm) @ 0.900 kg a.i. ha<sup>-1</sup>.

From the above study, it is inferred that 2, 4-D EE 80 % EC (Nufarm) @ 0.900 kg a.i. ha<sup>-1</sup> and 2, 4-D EE 80 % EC (Nufarm) @ 0.675 kg a.i. ha<sup>-1</sup> has resulted in effective weed control, recording the least weed density and weed dry weight and there by higher weed control efficiency after manual weeding twice treatment plot. In case of yield, 2, 4-D EE 80 % EC (Nufarm) @ 0.900 kg a.i. ha<sup>-1</sup> resulted better yield after manual weeding twice plot which was *on par* with aforesaid treatments. 2, 4-D ethyl ester 80 % EC tested at different doses for Phytotoxicity has revealed that there is no Phytotoxicity symptom observed in any of the doses and the tested new formation is safe to the wheat crop.

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