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Studies on Bio-efficacy and Phytotoxicity of 2, 4-D Ethyl Hexyl Ester 60% EC in Non-crop area

Utpal Biswas, Champak Kumar Kundu, Arindam Kundu, Himangshu Das, Madhab Kumar Datta and Pintoo Bandopadhyay

Abstract
The experiment was conducted for two years during *kharif* season of 2014 and 2015 at Directorate of Research building, BCKV, Kalyani of West Bengal to find out the bio-efficacy and phytotoxicity of 2, 4-D ethyl hexyl ester 60% EC for weed control in non-crop area. *Elusine indica, Cynodon dactylon, Imperata cylindrica, Cyperus rotundus, Cyperus iria, Ageratum conyzoides and Lantana camera*were the dominant weeds. The application of 2,4-D EHE 60% EC 1.296 kg a.i ha^{-1} and 2,4-D EHE 60% EC 1.152 kg a.i ha^{-1} has resulted in effective weed control recording the least weed density and weed dry weight and there by higher weed control efficiency after hand weeding treatment plot. The herbicide 2, 4-D EHE 60% EC tested at different doses was found safe to the non-crop area.

Keywords: 2, 4-D, weed, non-crop area, phytotoxicity

Introduction
The term 'non-crop area' in its strictest interpretation could refer to all areas where a crop, or any intentionally planted vegetation, is not grown. Weeds growing primarily in the wild communities, but often encroach to non-crop, waste and fallow lands are called "wasteland weeds (Das, 2013) [1]." Vegetation on non-crop areas such as rights-of way, road sides, storage areas, public works yards, parking lots and transmission lines can create problems ranging from creating fire hazards, reducing drainage, reducing accessibility and visibility to snow blockage (Manitoba, 2006) [9]. Increasing trend of certain pernicious weeds like *Parthenium hysterophorus, Lantana camara etc.* in non-crop areas can jeopardize the natural environment (Duary *et al.*, 2005; Kumar and Duary, 2015) [3, 4]. There are available manual or mechanical options like mowing, burning, grazing, discing, hand pulling, tillage etc., which are, however, cost-prohibitive and time-consuming (Duary *et al.*, 2016) [2]. 2, 4-Dichlorophenoxyacetic acid (2, 4-D) was first registered in 1947 as an agricultural herbicide and it is still the most widely used herbicide worldwide. End-use products, however, are generally formulated as inorganic or amine salts, or as esters (Wilson *et al.* 1997) [11]. 2, 4-D is selective as well as systemic and effective against broad-leaved plants/weeds and has some sedge. The esters are mainly liquid (EC; emulsifiable concentrate) formulation. However, they are more volatile than amines. The molecular weight esters like methyl, ethyl, propyl, butyl, pentyl, hexyl esters of 2, 4-D have higher penetrability through plant surface, but are not safe to use since they have more volatility. The esters are readily absorbed by foliage. The ester formulation of 2, 4-D is preferred to amine and sodium salts formulation for control of difficult weeds like *Asphodelus tenuifolius, Convolvulus arvensis* and *Cirsium arvense* because of the fastest absorption on the plant surface (Das, 2013) [1]. These herbicides mimic the activity of the plant hormone auxin, and profoundly interfere with the plants ability to regulate growth (Gover, 1997) [7]. 2, 4-D is a systemic herbicide that is absorbed through foliage and roots and is translocated to actively growing areas within the plant. Symptoms include bending and twisting of leaves and stems within 2 to 7 days, followed by browning and plant death 3 to 4 weeks after application (Manitoba, 2006) [9]. In the non-crop areas 2, 4-D forms a component herbicides for obtaining wide-spectrum vegetation control (Gupta, 2011) [8].

Methods and materials
The field experiment was conducted to study the effect of bio-efficacy and Phytotoxicity of 2, 4-D Ethyl Hexyl Ester 60% EC on Non-crop area during *kharif* season of 2014 and 2015 in the sub-humid and sub-tropical condition of West Bengal.

All the experiments were conducted under Bidhan Chandra Krishi Viswavidyalaya in different Research Stations. The experiments were conducted at Directorate of Research building, BCKV, Kalyani of West Bengal and the Research Stations are situated at 23.5^0 N latitude and 89^0 E longitude and the election of 9.75 m above the mean sea level. The Research Station under Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal. Topography of the land was referred as medium land situation. The comprising eight different weed control treatments *viz.* four different doses of 2,4-D EHE 60% EC (Nufarm) applied at 0.576, 0.964, 1.152 and 1.296 kg a.i. ha^{-1}, 2,4-D EE 38% EC (Commercial) at 1.35 kg a.i. ha^{-1}, glyphosate 41 % SL at 1.230 kg a.i. ha^{-1}, hand weeding and unweeded control, replicated thrice in a randomized block design (RBD). Spraying was done with the help of hand operated knapsack sprayer fitted with a flat fan hooded nozzle with the spray volume of water 500 l ha^{-1}. Data were recorded on predominant weed flora, weed density and dry weight of weeds. Phytotoxic effect of herbicides on crop in terms of yellowing, stunting and necrosis were recorded at 7, 14 and 21 Daha. The weed related observations were recorded as per the standard procedure and the data were statistically analyzed by following the procedure as given by Gomez and Gomez (2010) [6].

Results and discussion

The dominant weed flora of the experimental field during both the years was infested with grasses, *viz. Elusine indica, Cynodon dactylon, Imperata cylindrica;* sedges *viz. Cyperus rotundus, Cyperus iria,* and few broad-leaved weeds, *viz. Ageratum conyzoides, Lantana camera.*

During *kharif* 2014, it was observed that the population of broad leaf weed, grassy weed and sedge varied significantly to weed control treatments (Table 1). The population of broad leaf weed (28.37 and 22.28 no. m^{-2} respectively), grassy weed (41.03 and 32.50 no. m^{-2} respectively) and sedge weed (12.40 and 8.50 no. m^{-2} respectively) populations was lower under hand weeding at 20 and 40 DAA. Among the herbicides, 2,4-D EHE 60% EC 1.296 kg a.i. ha^{-1} recorded least weed population at 20 and 40 DAA and followed by 2,4-D EHE 60% EC 1.152 kg a.i. ha^{-1}. The total weed density was significantly reduced in the herbicide treatments. The data on weed count has revealed that 2,4-D EHE 60% EC 1.296 kg a.i. ha^{-1} has resulted in effective control of all type of weeds and has recorded least weed count at 20 and 40 DAA and remained on par among themselves and superior to the other treatments except hand weeding. 2,4-D EHE 60% EC 1.296 kg a.i. ha^{-1} was on par with 2, 4-D EHE 60% EC 1.152 kg a.i. ha^{-1} in controlling the total weed population. The unweeded control treatment recorded the highest weed count at all the observations with the pre dominance of grasses (142.12 and 156.52 no. m^{-2} respectively) followed by broad leaf weeds (74.90 and 107.30 no. m^{-2} respectively) and sedges (58.80 and 64.50 no. m^{-2} respectively) at 20 and 40 DAA. The dry matter production of weeds was recorded at 20 and 40 DAA. Significant differences in dry matter production were observed among the treatments at all the stages. At 20 and 40 DAA, the lowest dry matter production of 37.42 and 28.02g m^{-2} was recorded in hand weeding followed by 2,4-D EHE 60% EC 1.296 kg a.i ha^{-1} and 2, 4-D EHE 60% EC 1.152 kg a.i ha^{-1}. The weed control efficiency derived from the weed dry weight revealed, hand weeding resulted with the higher weed control efficiency of 87.83 and 91.74% during 20 and 40 DAA respectively. This was followed by 2,4-D EHE 60% EC 1.296 kg a.i ha^{-1} (83.27 and 86.43% at 20 and 40 DAA respectively) and 2,4-D EHE 60% EC 1.152 kg a.i ha^{-1} (82.34 and 84.96% at 20 and 40 DAA respectively). Similar trend was recorded during both the years.

During *kharif* 2015, all the weed controlling treatments significantly reduced the weed population and total weed dry matter production over the control treatments (Table 2). The application of 2,4-D EHE 60% EC 1.296 kg a.i ha^{-1} and 2,4-D EHE 60% EC 1.152 kg a.i ha^{-1} resulted in the minimum weed density and weed dry weight and the maximum weed control efficiency after hand weeding treatment plot at 20 and 40 DAA. Ghosh *et al.* (2002) [5] also reported excellent kill of diverse weed species within 20 days after spraying of glyphosate IPA (isopropyl amine) salt 13.5% + 2, 4-D IPA salt 13.5% (ready mix) at 8 litres ha^{-1} or glyphosate IPA salt 18% + 2, 4-D IPA salt 9% (ready mix) at 4.5 litres ha^{-1}, preventing their growth and regeneration for about two months of application in non-crop areas.

Phytotoxicity

The observation on visual crop toxicity was done on 7, 14 and 21 days after herbicide application (DAHA). The visual crop toxicity symptoms like leaf injury, vein clearing, epinasty, hyponasty, scorching and necrosis were observed (Table 3). The observation on the level of phytotoxicity through visual assessment of crop response was rated in the scale of 1-10. There were no crop phytotoxicity symptoms among the different treatments as well as at the highest dose of 2, 4-D EHE 60% EC 1.296 kg a.i. ha^{-1}.

Table 1: Effect of treatments on weed density, total weed dry weight and weed control efficiency in non-crop area during *Kharif,* 2014

Treatment	Dose kg a.i. ha^{-1}	Broadleaved weeds (No. m^{-2})		Grasses (No. m^{-2})		Sedges (No. m^{-2})		Total weed population (No. m^{-2})		Total weed dry matter production (g m^{-2})		Weed control efficiency (%)	
		20 DAA	40 DAA	20 DAA	40 DAA	20 DAA	40 DAA	20 DAA	40 DAA	20 DAA	40 DAA	20 DAA	40 DAA
2,4-D EHE 60% EC	0.576	55.30	46.42	80.58	72.09	37.96	35.25	173.84	153.76	117.95	104.30	61.65	69.26
2,4-D EHE 60% EC	0.964	39.68	34.20	59.28	52.38	25.52	20.40	124.48	106.98	67.68	59.85	78.00	82.36
2,4-D EHE 60% EC	1.152	35.20	31.68	47.36	41.12	19.48	16.80	102.04	89.60	54.33	51.03	82.34	84.96
2,4-D EHE 60% EC	1.296	32.65	28.40	44.68	35.32	15.35	13.28	92.68	77.01	51.45	46.05	83.27	86.43
2,4 D EE 38% EC	1.35	46.69	41.23	73.20	64.90	29.84	26.24	149.73	132.37	98.25	83.74	68.06	75.32
Glyphosate 41% SL	1.230	48.14	43.80	76.70	69.50	33.10	30.96	157.94	144.26	102.09	87.95	66.81	74.08
Hand weeding	-	28.37	22.28	41.03	32.50	12.40	8.50	81.81	63.29	37.42	28.02	87.83	91.74
Unweeded control	-	74.90	107.30	142.12	156.52	58.80	64.50	275.82	328.33	307.60	339.28	-	-
SE (d)		3.06	3.34	4.21	3.80	2.62	3.03	8.81	4.07	8.27	9.52	-	-
CD (P= 0.05)		9.29	10.13	12.78	11.53	7.94	9.18	26.72	12.35	25.10	28.89	-	-

Table 2: Effect of treatments on weed density, total weed dry weight and weed control efficiency in non-crop area during *Kharif*, 2015

Treatment	Dose kg a.i. ha^{-1}	Broadleaved weeds (No. m^{-2})		Grasses (No. m^{-2})		Sedges (No. m^{-2})		Total weed population (No. m^{-2})		Total weed dry matter production (g m^{-2})		Weed control efficiency (%)	
		20 DAA	40 DAA	20 DAA	40 DAA	20 DAA	40 DAA	20 DAA	40 DAA	20 DAA	40 DAA	20 DAA	40 DAA
2,4-D EHE 60% EC	0.576	63.07	56.02	89.25	81.18	40.55	38.36	192.87	175.56	135.07	123.72	60.66	65.90
2,4-D EHE 60% EC	0.964	46.76	41.20	68.05	59.22	29.64	26.07	144.45	126.49	89.18	77.14	74.02	78.74
2,4-D EHE 60% EC	1.152	43.41	38.68	53.17	47.25	24.07	20.64	120.65	106.57	71.67	65.01	79.12	82.08
2,4-D EHE 60% EC	1.296	41.29	35.40	52.44	45.03	20.67	16.40	114.40	96.84	68.39	61.46	80.08	83.06
2,4 D EE 38% EC	1.35	52.81	46.23	79.10	72.50	35.40	29.03	167.31	147.77	112.24	101.30	67.31	72.08
Glyphosate 41% SL	1.230	54.02	49.80	87.28	80.31	38.24	32.18	179.54	162.29	117.50	104.64	65.77	71.16
Hand weeding	-	35.67	29.79	48.03	41.64	15.09	11.71	98.79	83.14	52.62	43.57	84.67	87.99
Unweeded control	-	94.52	123.18	157.31	168.20	66.73	71.28	318.56	362.66	343.31	362.80	-	-
SE (d)		4.34	5.29	4.63	6.67	2.02	3.34	8.52	9.36	8.87	9.78	-	-
CD (P= 0.05)		13.17	16.06	14.05	20.23	6.14	10.14	25.85	28.40	26.91	29.68	-	-

Table 3: Effect of treatments on phytotoxicity in non-crop area during both the years (*Kharif* 2014 and 2015)

Treatment	Dose kg a.i. ha^{-1}	7 DAHA	14 DAHA	21 DAHA
2,4-D EHE 60% EC	0.576	0	0	0
2,4-D EHE 60% EC	0.964	0	0	0
2,4-D EHE 60% EC	1.152	0	0	0
2,4-D EHE 60% EC	1.296	0	0	0
2,4 D EE 38% EC	1.35	0	0	0
Glyphosate 41% SL	1.230	0	0	0

Conclusion

Based on the result of present investigation, it could be concluded that the application of 2, 4-D EHE 60% EC 1.296 kg a.i ha^{-1} and 2, 4-D EHE 60% EC 1.152 kg a.i ha^{-1} has resulted in effective weed control, recording the least weed density and weed dry weight and there by higher weed control efficiency after hand weeding treatment plot.

The herbicide 2,4-D Ethyl Hexyl Ester 60% EC tested at different doses for Phytotoxicity has revealed that there is no Phytotoxicity symptoms observed in any of the doses and the tested new formulation is safe to the non-crop area.

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References

1. Das TK. Weed science basics and applications. Jain Brothers. New Delhi, 2013.
2. Duary B, Dash S, Teja KC. Impact of tillage on seed bank, population dynamics and management of weeds. Satsa Mukhapatra-Annual Technical. 2016; 20:104-112.
3. Duary B, Mondal DC, Hossain A. Studies on biology and management of *Parthenium* in lateritic belt of West Bengal, India. In: Proceedings of the Second International Conference on *Parthenium* Management December 5-7, 2005, University of Agricultural Sciences, GKVK Campus, Bangalore, Karnataka, India. 2005, 251-252.
4. Kumar S, Duary B. *Parthenium* problem and its management in India. Indian Farming, 2015; 65(7):47-51.
5. Ghosh RK, Bhowmick MK, Ghosh P. Efficacy of glyphosate and 2, 4-D combinations for weed management in non-crop areas. Environment and Ecology, 2002; 20(1):143-146.
6. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research. Wiley India Pvt. Ltd., New Delhi, 2010.
7. Gover AE. Selective Weed Control in Non-crop areas. Department of Horticulture, College of Agricultural Sciences. 1997, 17.
8. Gupta OP. Weed Management principles and practices. Agrobios, Jodhpur, India. 2011, 118.
9. Manitoba. Weed control for Non-crop areas. Manitoba Agriculture, Food and Rural Initiatives, 2006.
10. Patel CJ, Raghavani BR, Khanapara VD, Khavani DH, Malavia DD. Comparative efficacy of herbicides for weed control in onion. Indian J Weed Sci. 1987; 19:66-70.
11. Wilson RD, Geronimo J, Armbruster A. 2, 4-D Dissipation in Field Soils after Applications of 2, 4-D Dimethylamine Salt and 2, 4-D 2-Ethyl Hexyl Ester. Environmental Toxicology and Chemistry, 1997; 16(6):1239-1246.