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Chemical Control of *Cyperus rotundus* in Maize

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ABSTRACT

Cyperus rotundus is a troublesome perennial weed of **kharif** season. In maize, it is not controlled with the already recommended herbicide i. e. atrazine 50 WP. All the three formulations of 2,4-D i. e. sodium, di-methyl amine and ethyl ester were applied as post-emergence on *C. rotundus* infested crop of maize from 2007 to 2009 as blanket spray after the pre-emergence application (20-25 DAS) of atrazine 1.0 kg/ha. Out of the three formulations, post-emergence application of 2,4-D di-methyl amine at 0.44, 0.58 and 0.73 kg/ha was found more effective for controlling *C. rotundus* as compared to other formulations i. e. sodium and ethyl ester. All the three formulations showed no adverse effect on plant growth and produced grain yield of maize statistically similar to each other. On an average of three years, post-emergence application of 2,4-D di-methyl amine at 0.44, 0.58 and 0.73 kg/ha increased maize grain yield significantly over unweeded control and all these treatments produced 23.8, 31.1 and 26.7% higher yield than unweeded control treatment, respectively.

Key words : *Cyperus rotundus,* herbicide, maize, 2, 4-D

INTRODUCTION

Weeds are serious problem in maize as its sowing coincides with commencement of monsoon rains and the congenial growing conditions i. e. high temperature and humidity and use of FYM full of weed seeds encourages weed growth in this crop. The growth rate of maize especially during early stages is rather slow which helps weeds to offer effective competition in their favour. Reductions in yield to the extent of 32.4 to 42.3% due to weed growth have been estimated in maize (Sharma *et al*., 2000). *C. rotundus* is one of the most troublesome perennial weeds in maize, and is ranked as one of world's worst weeds (Holm *et al*., 1977) and is a perennial **kharif** weed in 52 crops in more than 90 tropical and sub-tropical countries (Bendixen and Nandihalli, 1987). It is mainly propagated by tubers, which have several buds that can sprout repeatedly which make cultural or manual methods ineffective for its control. Research workers from time to time have suggested various cultural, mechanical, chemical and biological control measures for the control of *C. rotundus*, yet this weed continues to infect vast productive land and still remains as the problematic weed of major cultivated crops especially of **kharif** season. In maize, this is not controlled with the already recommended herbicides i. e. atrazine and on the other hand, hoeing of maize is tedious, time consuming and expensive and also sometimes under unfavourable climatic conditions, it is difficult to get proper control of associated weeds by mechanical methods. So, the present investigation was carried out to find out effective herbicidal control of *C. rotundus* (Dila/Motha) in maize with the post-emergence application of different formulations of 2,4-D.

MATERIALS AND METHODS

A field experiment was conducted for three years during **kharif** 2007, 2008 and 2009 at the experimental farm of the Department of Agronomy, Punjab Agricultural University, Ludhiana. The soil of experimental field was loamy sand in texture, normal in soil reaction and low in available nitrogen (230 kg/ha), medium in available phosphorus (18.6 kg/ha) and potassium (150 kg/ha). The experiment was laid out in randomized block design by keeping 10 treatments and four replications. PMH 1 hybrid of maize was sown during all the three years. After sowing maize, uniform application of atrazine 1.0 kg/ha as pre-emergence was made in the entire experiment. The treatments for the control of *C. rotundus* consisted of three formulations of 2,4-D i. e. sodium 80 WP @ 0.6, 0.8 and 1.0 kg/ha, di-methyl amine 58 SL @ 0.44, 0.58 and 0.73 kg/ha and ethyl ester 38 EC @ 0.29 and 0.38 kg/ha as post-

emergence (20-25 days after sowing) and were compared with two hand weedings and unweeded control. The maize was sown in first week of June during all the three crop seasons. The crop was sown with row to row spacing of 60 cm and with plant to plant distance of 22 cm. The crop was given recommended amount of nutrients i. e. 125 kg N/ha, 60 kg P_2O_5/ha and 30 kg K_2O/ha. One third nitrogen and full dose of phosphorus and potassium was applied as basal dose and remaining two-third of nitrogen was applied in two equal splits at knee-high and pre-tasseling stage. Data related to population before and after spray and dry matter of *C. rotundus* were recorded by using quadrate of 50 x 50 cm which was subjected to square root transformation before statistical analysis.

RESULTS AND DISCUSSION

Effect on *Cyperus rotundus*

The data recorded for count of *C. rotundus* before spray (Table 1) indicated that the field had uniform population of this weed. It was observed that mortality of this weed took place with the passage of time during all the years (Table 1). During 2007, population and dry matter accumulation by *C. rotundus* recorded 15 days after spray revealed that lowest weed population and dry matter were recorded with the application of 2,4-D (sodium salt) at 1.0 kg/ha which was at par with all doses of three formulations of 2,4-D (sodium salt, di-methyl amine and ethyl ester) and two hand weedings except the lower dose i. e. sodium salt at 0.6 kg/ha, di-methyl amine at 0.44 kg/ha. All herbicidal treatments reduced population and dry matter of *C. rotundus* significantly compared to weedy check. During 2008, all the three doses of 2,4-D di-methyl amine (0.44, 0.58 and 0.73 kg/ha), 2, 4-D ethyl ester at 0.38 kg/ha and sodium salt at 1.0 kg/ha recorded lowest population of *C. rotundus* which were at par with each other and significantly superior to two hand weedings and control treatments. However, all the herbicidal treatments resulted in significant reduction in dry matter accumulation by *C. rotundus* as compared to control. During 2009, 2, 4-D di-methyl amine at all levels resulted in significantly lower *C. rotundus* population and dry matter as compared to all other herbicidal treatments, hand weedings and control (unweeded) treatments.

Effect on Crop

During 2007, the maximum plant height was recorded with the application of 2,4-D di-methyl amine 0.73 kg/ha which was at par with its lower dose i. e. 0.58 kg/ha, 2,4-D sodium salt 0.8 and 1.0 kg/ha and all these treatments were significantly superior over other herbicidal and control (unweeded) treatments (Table 2). During 2008, post-emergence application of 2,4-D sodium at 0.6 and 0.8 kg/ha and 2,4-D di-methyl amine at 0.58 and 0.73 kg/ha resulted in significantly higher plant height than the (unweeded) control treatments. The data of plant height during 2009 and also pooled data revealed that there was no effect of any herbicide formulation on plant height as the differences were non-significant.

During 2007, application of 2,4-D di-methyl amine 0.73 kg/ha resulted in maximum grain yield (68.0 q/ha) which was at par with 2,4-D sodium salt 1.0 kg/ha (59.5 q/ha) and 2, 4-D ethyl ester 0.38 kg/ha (57.4 q/ha) and all herbicidal treatments (except 2,4- D ethyl ester 0.29 kg/ha) produced significantly higher yield than (unweeded) control treatment (Table 2). During 2008, maximum grain yield was obtained with the application of 2,4-D ethyl ester 0.29 kg/ha which was at par with all the doses of 2,4-D sodium and di-methyl amine salt and two hand weedings treatments and all these treatments produced significantly higher yield than that of 2,4-D ethyl ester 0.38 kg/ha and control. During 2009, all the herbicidal treatments except 2,4-D sodium salt 0.60 kg/ha produced significantly higher yield than (unweeded) control treatment. Highest grain yield was recorded in all treatments of 2,4-D di-methyl amine followed by ethyl ester and sodium salt, respectively. The pooled data revealed that grain yield did not differ significantly among all the formulations of 2,4-D except that of 2,4-D sodium 0.60 kg/ha but it was also significantly superior over control.

It can be concluded that post-emergence application of all the three formulations of 2,4-D i. e. sodium, di-methyl amine and ethyl ester at all the tried levels resulted in significant reduction in population and dry matter accumulation by *C. rotundus* as compared to unweeded (control) treatment. All the three formulations showed no adverse effect on plant growth. The grain yield of maize was found to be significantly higher at all the levels of three formulations of 2,4-D as compared to unweeded control. Among different formulations, 2,4-

Table 1. Effect of different herbicidal treatments on intensity of *Cyperus rotundus* in maize

Treatments	Dose (kg/ha)	*Cyperus rotundus* population before spray (No./m^2)			*Cyperus rotundus* population after spray (No./m^2)			*Cyperus rotundus* dry matter (q/ha) at harvest		
		2007	2008	2009	2007 (15 DAS)	2008 (30 DAS)	2009 (30 DAS)	2007	2008	2009
2,4-D sodium salt	0.60	137.3	110.0	57.4	30.0	6.7 (44.5)	8.5 (42.2)	5.2 (25.9)	2.88 (7.40)	8.6 (72.7)
2,4-D sodium salt	0.80	129.6	117.7	59.8	21.7	6.7 (44.4)	7.0 (48.0)	4.6 (20.3)	1.44 (1.48)	5.9 (33.8)
2,4-D sodium salt	1.00	172.6	114.8	58.5	14.3	2.6 (11.1)	5.8 (41.3)	3.9 (14.4)	3.31 (9.99)	5.1 (30.7)
2,4-D di-methyl amine	0.44	140.3	116.3	59.8	27.7	1.0 (0.0)	1.0 (0.0)	4.8 (21.9)	1.0 (0)	1.0 (0)
2,4-D di-methyl amine	0.58	159.3	114.7	56.3	23.0	1.0 (0.0)	1.0 (0.0)	4.0 (15.8)	1.0 (0)	1.0 (0)
2,4-D di-methyl amine	0.73	120.8	117.0	61.1	16.7	1.0 (0.0)	1.0 (0.0)	3.1 (11.2)	1.0 (0)	1.0 (0)
2,4-D ethyl ester	0.29	136.8	107.4	59.4	22.7	8.2 (66.7)	4.3 (22.2)	4.1 (15.9)	2.36 (5.55)	4.2 (19.8)
2,4-D ethyl ester	0.38	143.0	99.2	61.8	16.7	1.0 (0.00)	4.12 (19.4)	4.0 (14.7)	1.0 (0)	4.1 (18.8)
Two hand weedings		163.0	116.7	61.9	23.0	4.5 (25.9)	4.6 (24.9)	4.2 (16.2)	2.15 (4.44)	4.4 (22.2)
Unweeded (Control)		143.8	120.6	67.6	153.3	12.3 (151.8)	14.7 (216.5)	7.03 (48.7)	6.74 (45.5)	8.2 (66.1)
LSD (P=0.05)		NS	NS	NS	9.6	3.16	2.1	1.6	3.16	2.1

Figures in parentheses are means of original values. NS : Not Significant.

Table 2. Effect of different herbicidal treatments on plant height and grain yield of maize

Treatments	Dose (kg/ha)	Plant height (cm)				Grain yield (q/ha)			
		2007	2008	2009	Pooled	2007	2008	2009	Pooled
2,4-D sodium salt	0.60	194.0	151.4	198	181.1	42.6	30.0	52.3	41.6
2,4-D sodium salt	0.80	191.7	148.1	198	179.3	49.5	29.8	59.7	46.3
2,4-D sodium salt	1.00	207.0	138.4	200	181.8	59.5	27.9	58.4	48.6
2,4-D di-methyl amine	0.44	190.80	135.8	199	175.2	42.3	27.8	66.5	45.5
2,4-D di-methyl amine	0.58	197.37	147.5	201	182.0	46.1	30.3	67.6	48.0
2,4-D di-methyl amine	0.73	215.47	145.7	199	186.7	68.0	28.3	58.8	51.7
2,4-D ethyl ester	0.29	177.50	144.0	199	173.5	39.2	32.7	66.5	46.1
2,4-D ethyl ester	0.38	187.30	140.4	204	177.2	57.4	24.4	63.5	48.4
Two hand weedings		189.77	139.0	200	164.4	51.5	29.1	64.3	48.3
Unweeded (Control)		165.87	138.7	199	167.9	30.0	23.9	48.3	34.1
LSD (P=0.05)		24.40	6.33	NS	NS	10.8	6.33	10.8	7.3

NS : Not Significant.

D di-methyl amine performed better than the sodium and ester formulations in all the years as there was less population and dry weight of *C. rotundus* resulting in higher grain yield in the former formulation.

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