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Grass Weed Control in Wheat by Clodinafop Applied with and without Surfactant

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ABSTRACT

Weed control efficacy of clodinafop applied at varying doses with surfactant and without surfactant was evaluated in wheat. With the increase in the doses of clodinafop from 40 to 50 or 60 g ha^{-1}, there was a gradual decline in the population and dry matter accumulation of grassy weeds. Addition of surfactant (0.25 or 0.5 or 1.0%) enhanced the grass weed control efficacy of clodinafop. However, no significant difference was observed in clodinafop efficacy with different surfactant concentrations. Clodinafop did not provide any control of broad leaf weeds. Maximum wheat yields of 4891 and 5163 kg ha^{-1} were observed in season long free situations followed closely by diclofop-methyl 700 g, clodinafop 60 and 50 g with surfactant applied after first irrigation.

INTRODUCTION

In wheat bowl of India, particularly in rice-wheat rotation, the infestation of wild canary grass (*Phalaris minor*) had acquired alarming proportions. The other weed emerging at faster rate in this sequence is jangli palak (*Rumex retroflex*). While in south-western Haryana in crop rotation like cotton-wheat, bajra-wheat, fallow-wheat, pulse-wheat, the major weed is wild oat (*Avena ludoviciana*) followed by lambsquarter (*Chenopodium album*). Depending upon the type and density of weeds, season long competition from weeds caused grain yield reduction from 25 to 60% or sometimes more (Malik *et al.*, 1989). Isoproturon, metoxuron and diclofop-methyl are grass killer and 2, 4-D and metsulfuron-methyl are effective broadleaf weed killin in wheat. Continuous use of isoproturon more than 10 years to minimize grass weeds in rice-wheat sequence leads to development of resistance in *P. minor* (Malik and Singh, 1993).

To combat isoproturon resistant *P. minor,* a few new herbicides i. e. clodinafop, fenoxaprop, sulfosulfuron and tralkoxydim were found quite effective (Malik *et al.*, 2001). These new herbicides though reported quite effective against major grass weeds of wheat, but are quite costly. In this study, efforts have been made to economize the application dose of clodinafop by applying it in tank mix with surfactant.

MATERIALS AND METHODS

Field investigation was conducted during the **rabi** seasons of 2000-01 and 2001-02 at the Research Farm of Department of Agronomy, CCS Haryana Agricultural University, Hisar. The soil of the experimental field was sandy loam in texture, medium in organic carbon (0.38%) with pH 8.1. Wheat variety PBW 343 was drilled with a bed planter on raised beds at 100 kg seed ha^{-1} on November 21 and 17 in 2000-01 and 2001-02, respectively, in a plot size of 6.0 x 2.1 m. Recommended dose of fertilizer and irrigations were applied uniformly to all plots as recommended in package of practices. Experiment with 15 treatments replicated three times was laid in a randomized block design (Tables 1 and 2). Three concentrations of surfactant (Triton AE, non-ionic) 0.25, 0.5 and 1.0% were used with clodinafop applied after first irrigation. Herbicides were applied with the help of a knapsack sprayer using 500 l water ha^{-1} at 30 days after sowing (DAS) during both the seasons. Visual scores of

Table 1. Visual toxicity and population of weeds (75 DAS) as affected by herbicide treatments

Herbicide	Dose (g ha^{-1})	Time of application	Visual toxicity (%)				Population of weeds (No. m^{-2})			
			Grassy weeds		Broad leaf weeds		Grassy weeds		Broad leaf weeds	
			2000-01	2001-02	2000-01	2001-02	2000-01	2001-02	2000-01	2001-02
Clodinafop	40	BFI	60	60	0	0	39	36	58	50
Clodinafop	50	BFI	70	70	0	0	24	21	62	42
Clodinafop	60	BFI	75	75	0	0	13	13	54	46
Clodinafop	40	AFI	70	75	0	0	28	22	64	48
Clodinafop	50	AFI	80	85	0	0	12	9	56	45
Clodinafop	60	AFI	85	85	0	0	9	8	60	42
Clodinafop+S	40+0.25%	AFI	70	70	0	0	26	20	56	46
Clodinafop+S	40+0.5%	AFI	75	75	0	0	24	20	60	47
Clodinafop+S	40+1.0%	AFI	75	80	0	0	24	18	52	44
Clodinafop+S	50+0.25%	AFI	80	80	0	0	12	9	52	42
Clodinafop+S	50+0.5%	AFI	80	80	0	0	10	7	56	50
Clodinafop+S	50+1.0%	AFI	80	80	0	0	11	7	52	48
Diclofop-methyl	700	AFI	85	90	0	0	7	5	64	46
Weedy	-	-	0	0	0	0	112	96	60	47
Weed-free	-	-	100	100	100	100	0	0	0	0
LSD (P=0.05)			9.0	7.5			4.5	6.1	6.0	9.1

BFI–Before first irrigation, AFI–After first irrigation, S–Surfactant, DAS–Days after sowing.

Table 2. Dry weight of weeds (120 DAS) and yield of wheat as influenced by herbicide treatments

Herbicide	Dose (g ha^{-1})	Time of application	Dry weight of weeds (g ha^{-1})				Spikes m^{-2}		Grain yield (kg ha^{-1})	
			Grassy weeds		Broad leaf weeds		2000-01	2001-02	2000-01	2001-02
			2000-01	2001-02	2000-01	2001-02				
Clodinafop	40	BFI	50.7	40.3	54.8	42.5	252	260	3371	3556
Clodinafop	50	BFI	39.9	30.2	52.5	39.9	260	272	3568	3765
Clodinafop	60	BFI	31.4	25.2	53.9	38.2	272	286	3923	4139
Clodinafop	40	AFI	37.7	27.5	50.8	39.5	277	292	3960	4180
Clodinafop	50	AFI	28.4	20.3	52.4	38.0	289	306	4288	4528
Clodinafop	60	AFI	19.4	15.7	48.9	40.0	300	315	4522	4776
Clodinafop+S	40+0.25%	AFI	36.5	27.9	56.6	47.1	280	297	4074	4302
Clodinafop+S	40+0.5%	AFI	32.0	24.7	59.0	44.4	286	306	4213	4449
Clodinafop+S	40+1.0%	AFI	34.4	22.4	53.4	45.5	292	309	4176	4476
Clodinafop+S	50+0.25%	AFI	27.9	24.5	52.6	46.1	295	312	4298	4538
Clodinafop+S	50+0.5%	AFI	26.1	26.0	54.7	41.4	297	317	4266	4505
Clodinafop+S	50+1.0%	AFI	24.7	25.5	57.2	43.4	303	323	4317	4557
Diclofop-methyl	700	AFI	18.3	10.1	54.3	41.9	315	337	4555	4809
Weedy	-	-	119.4	100.7	56.9	45.6	226	240	2918	3112
Weed-free	-	-	0	0	0	0	352	363	4891	5163
LSD (P=0.05)			5.1	13.5	2.5	8.5	20.6	20.9	326.6	328.7

BFI–Before first irrigation, AFI–After first irrigation, DAS–Days after sowing, S–Surfactant.

per cent weed control were done at 75 DAS on the basis of 100 scale (where, 0=no control and 100=complete control). Weed population and dry weight of grasses as well as broadleaf weeds were recorded at 75 and 120 DAS with the help of a 50 x 50 cm quadrate from three random places in a plot.

RESULTS AND DISCUSSION

Effect on Weeds

The experimental field was infested with *Avena ludoviciana, Phalaris minor, Chenopodium album, Rumex retroflex, Anagallis arvensis* and *Convolvulus arvensis*. However, grassy weeds were dominant during both the years.

Per cent control of clodinafop-propargyl on grass weeds increased with the increase in the dose, maximum being at 60 g ha^{-1} (Table 1). Likewise addition of surfactant at varying concentrations increased the grass control efficacy of clodinafop-propargyl; this was particularly true at lower dose (40 g ha^{-1}). Clodinafop-propargyl at all the doses failed to control any of the broad leaf weeds (Table 1). Therefore, with the increase in the dose of clodinafop, irrespective of stages of application, the population and dry matter of grassy weeds decreased gradually. Likewise addition of surfactant with clodinafop too helped to reduce the population and dry weight of grass weeds compared to clodinafop application alone (Tables 1 and 2).

Lower grassy weeds population and dry matter accumulation with increased dose of clodinafop were owing to increased toxicity on grass weeds. Addition of surfactant at 0.25, 0.5 and 1.0% concentration with clodinafop helped to increase the retention, penetration and finally toxicity of clodinafop on grass weeds. These findings are in confirmation with the earlier findings of Malik *et al.* (1989) and Malik *et al.* (2001) who concluded that addition of surfactant increased the grass weeds control efficacy of fenoxaprop, chlorsulfuron, tralkoxydim and isoproturon.

Effect on Crop

Maximum and minumum grain yield of wheat were recorded in season long weed-free and unweeded situations, respectively (Table 2). Clodinafop at 60 g ha^{-1} provided more or less similar wheat yield when compared with diclofop-methyl applied at 700 g ha^{-1}. Like number of spike and grain yield of wheat too increased gradually with the increase in clodinafop dose, irrespective of its application times (Table 2). Addition of surfactant at 0.25 to 1.0% with clodinafop significantly improved the crop yield compared to its application without surfactant, particularly at lower dose (40 g ha^{-1}).

Higher and lower crop yield under different weed management treatments were owing to excellent and poor control of dominant grass weeds, respectively (Table 1). Secondly, it was because of good and poor crop growth, higher and lower effective wheat tillers during both the seasons. Significantly lower crop yield under different clodinafop treatments applied alone or with surfactant even after providing satisfactorily control of grass weeds was because of no control of broad leaf weeds, which competed throughout crop growth.

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