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Efficacy of Clodinafop, Fenoxaprop, Sulfosulfuron and Triasulfuron Alone and as Tank Mixture Against Weeds in Wheat

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ABSTRACT

Clodinafop at 50 and 60 g ha^{-1} and fenoxaprop at 100 and 120 g ha^{-1} were very effective (85-90%) against grassy weeds but totally ineffective against broadleaf weeds in wheat. Triasulfuron at 20 to 25 g ha^{-1} was not at all effective against grassy weeds but highly effective (80-93%) against broadleaf weeds. Sulfosulfuron at 20 to 25 g ha^{-1} provided 79-84% control of grassy weeds and 21-47% control of broadleaf weeds. Tank mixture of triasulfuron at 25 g ha^{-1} with clodinafop at 50 g ha^{-1}, fenoxaprop at 100 g ha^{-1} or sulfosulfuron at 20 g ha^{-1} proved very effective (76-87%) against both grasses and non-grasses in wheat.

INTRODUCTION

In large part of north-west India, grassy weeds (*Phalaris minor* and *Avena ludoviciana*) together with many broadleaf weeds infest wheat crop causing huge yield losses (Malik *et al.*, 1992; Balyan, 2001; Singh and Singh, 2002). Tank mixture of isoproturon with 2, 4-D (Balyan and Malik, 1988) or with metsulfuron (Yadav *et al.*, 2000) was found successful against complex weed flora in the past especially in the situation where isoproturon was effective against *P. minor*. But to manage complex weed flora dominated by either *A. ludoviciana* or isoproturon resistant *P. minor,* suitable combination of clodinafop, fenoxaprop or sulfosulfuron with some broad-spectrum herbicide is needed because under such situations isoproturon based combinations do not work satisfactorily. Metsulfuron-methyl or 2, 4-D when tank mixed with clodinafop, fenoxaprop or sulfosulfuron results in poor efficacy against grassy weeds due to antagonistic effects (Yadav *et al.*, 2002). Hence, present investigation was planned to evaluate the efficacy of clodinafop, fenoxaprop, sulfosulfuron and triasulfuron alone and in combination against complex weed flora in wheat.

MATERIALS AND METHODS

A field experiment was conducted at Research Farm of CCS Haryana Agricultural University, Hisar, India during winter season of 2002-03 and 2003-04. The soil of the experimental field was sandy loam in texture, medium in fertility and slightly alkaline in reaction (pH 8.2). Wheat variety PBW 343 using seed rate of 35 kg ha^{-1} was sown under furrow irrigated raised bed system (FIRBS) on November 12 in 2002-03 and November 23 in 2003-04 keeping two rows on the top of beds. The crop was raised with all other recommended package of practices. The experiment consisted various doses of clodinafop, sulfosulfuron and fenoxaprop each alone and in combination with triasulfuron at 20 g ha^{-1}, triasulfuron alone at 20 and 25 g ha^{-1}, weedy and weed-free check (Table 1). The experiment was laid out in randomized block design replicated thrice. All the herbicides were applied 35 days after sowing (DAS) using knapsack sprayer fitted with flat fan nozzle using 650 l of water per hectare.

RESULTS AND DISCUSSION

The field was infested with complex weed flora comprising both grassy (70% in 2002-03 and 85% in 2003-04) as well as broadleaf weeds (30% in 2002-03 and 15% in 2003-04). Anong grassy weeds, *A. ludoviciana* was the major weed (90%) alongwith *P. minor* (10%). Whereas broadleaf weeds comprised mainly *C. album* (50%), *R. retroflexus*

Table 1. Population/density and dry weight of weeds as affected by herbicide treatments

Herbicide	Dose ($g\ ha^{-1}$)	Population of weeds ($No.\ m^{-2}$)				Dry weight of weeds ($g\ m^{-2}$)							
		90 DAS				60 DAS				90 DAS			
		Grassy weeds		Broadleaf weeds		Grassy weeds		Broadleaf weeds		Grassy weeds		Broadleaf weeds	
		2002-03	2003-04	2002-03	2003-04	2002-03	2003-04	2002-03	2003-04	2002-03	2003-04	2002-03	2003-04
Clodinafop	50	16	23	44	32	15.4	19.4	32.0	26.8	41.3	59.2	48.9	34.8
Clodinafop	60	6	10	45	36	10.1	14.9	30.9	25.9	22.6	35.5	51.4	36.1
Sulfosulfuron	20	21	32	30	19	24.0	33.7	23.1	15.0	64.1	92.0	38.7	26.7
Sulfosulfuron	25	15	25	26	14	14.1	22.1	21.4	10.8	47.6	78.7	33.8	17.8
Fenoxaprop	100	14	21	45	38	17.0	24.9	31.2	26.9	44.2	66.2	50.6	51.0
Fenoxaprop	120	4	8	44	34	9.7	17.8	29.5	24.7	23.7	43.8	49.8	34.2
Triasulfuron	20	105	177	4	6	82.1	128.6	3.7	5.8	312.4	464.7	6.5	6.6
Triasulfuron	25	108	175	1	2	84.8	134.3	1.3	3.1	306.3	459.2	3.4	4.2
Clodinafop+Triasulfuron	50+20	14	21	8	4	21.1	29.9	5.2	2.9	49.7	71.9	7.2	5.2
Clodinafop+Triasulfuron	60+20	7	12	7	4	13.3	21.4	4.5	2.5	21.7	36.8	7.9	4.7
Sulfosulfuron+Triasulfuron	20+20	24	36	5	2	23.5	31.9	4.7	1.9	71.6	98.4	6.3	5.2
Sulfosulfuron+Triasulfuron	25+20	14	22	3	1	11.9	18.1	3.8	1.7	49.7	76.0	6.2	3.4
Fenoxaprop+Sulfosulfuron	100+20	8	11	32	22	20.7	26.6	23.7	17.0	43.6	57.8	40.7	25.4
Fenoxaprop+Sulfosulfuron	120+20	4	4	28	21	13.3	14.5	21.8	15.9	21.8	24.6	41.9	30.0
Weedy	-	104	173	43	31	81.8	128.3	29.2	24.0	302.6	457.8	48.8	33.9
Weed-free	-	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSD (P=0.05)		5.8	7.4	5.9	4.7	3.3	4.7	2.8	4.4	6.6	15.3	3.0	3.6

(10%), *C. didymus* (20%), *M. alba* (10%) and miscellaneous weeds (10%).

Effect on Weeds

The density of grassy weeds at 90 DAS (Table 1) was significantly reduced by clodinafop (50 and 60 g ha^{-1}), fenoxaprop (100 and 120 g ha^{-1}), sulfosulfuron (20 and 25 g ha^{-1}) alone or in combination with triasulfuron at 20 g ha^{-1}. Clodinafop and fenoxaprop were ineffective against broadleaf weeds but sulfosulfuron provided 21-47% control of broadleaf weeds. Triasulfuron being very effective against broadleaf weeds (80-93%) was ineffective against grassy weeds. Similar effect was observed in terms of dry weight accumulation by weeds at 60 and 90 DAS. Combination of triasulfuron at 20 g ha^{-1} with clodinafop at 50 g ha^{-1}, fenoxaprop at 100 g ha^{-1} or sulfosulfuron at 20 g ha^{-1} proved very effective (76-87%) against complex flora of weeds during both the years. Efficacy of aforesaid tank mixtures was also almost similar when higher dose of clodinafop (60 g ha^{-1}), fenoxaprop (120 g ha^{-1}) or sulfosulfuron (25 g ha^{-1}) was tank mixed with triasulfuron. Antagonistic effect of triasulfuron on the efficacy of clodinafop against weeds has already been reported (Yadav *et al.*, 2002). Since the weed flora under present experimentation was pre-dominated by *A. ludoviciana*, the expected antagonistic effect might have not been reflected because *A. ludoviciana* can be controlled with 20-25% less dose of any of these herbicides compared to *P. minor*.

Effect on Crop

All the herbicidal treatments resulted in significantly higher number of spikes and grain yield of wheat (Table 2). The maximum number of spikes and grain yield of wheat (5028 and 4989 kg ha^{-1}) were recorded in the plots kept weed-free throughout the crop season. However, it was at par with tank mix application of triasulfuron at 20 g ha^{-1} with clodinafop at 60 g ha^{-1}, fenoxaprop at 120 g ha^{-1} or sulfosulfuron at 25 g ha^{-1} during both the years and sulfosulfuron alone at 25 g ha^{-1} during 2002-03 only. Clodinafop, fenoxaprop and triasulfuron applied alone resulted in lower grain yield of wheat compared to their tank mix application and also statistically inferior to weed-free check. This could be due to poor control of complex weed flora by these herbicides. Weeds growing throughout the crop

Table 2. Weed control efficiency and grain yield of wheat as influenced by herbicide treatments

Herbicide	Dose ($g\ ha^{-1}$)	Weed control efficiency at 90 DAS: Grassy weeds		Broadleaf weeds		Spikes ($No.\ m^{-2}$)		Grain yield ($kg\ ha^{-1}$)	
		2002-03	2003-04	2002-03	2003-04	2002-03	2003-04	2002-03	2003-04
Clodinafop	50	86	87	0	0	360	351	4518	4444
Clodinafop	60	92	92	0	0	366	354	4634	4592
Sulfosulfuron	20	79	80	21	21	351	342	4529	4387
Sulfosulfuron	25	84	83	32	47	372	351	4696	4563
Fenoxaprop	100	85	85	0	0	357	348	4498	4416
Fenoxaprop	120	92	90	0	0	360	354	4533	4659
Triasulfuron	20	0	0	88	80	348	333	3891	3240
Triasulfuron	25	0	0	93	88	354	342	4244	3706
Clodinafop+Triasulfuron	50+20	84	84	85	85	369	357	4799	4704
Clodinafop+Triasulfuron	60+20	93	92	84	86	375	366	4881	4842
Sulfosulfuron+Triasulfuron	20+20	76	78	87	85	360	363	4633	4498
Sulfosulfuron+Triasulfuron	25+20	84	83	87	90	372	360	4853	4752
Fenoxaprop+Sulfosulfuron	100+20	86	87	17	25	357	348	4481	4589
Fenoxaprop+Sulfosulfuron	120+20	93	95	14	11	369	357	4639	4797
Weedy	-	0	0	0	0	297	288	2892	2469
Weed-free	-	100	100	100	100	384	372	5028	4989
LSD (P=0.05)						16	14	361	289

season reduced the grain yield of wheat to the extent of 42.5 and 50.5% during 2002-03 and 2003-04, respectively. Performance of these herbicidal mixtures also needs to be examined against complex flora of weeds pre-dominated by *P. minor* in wheat.

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