Indian J. Weed Sci. **41** (3 & 4) : 157-160 (2009)

Compatibility of Fenoxaprop-P-ethyl with Carfentrazone-ethyl Metsulfuron-methyl and 2, 4-D for Controlling Complex Weeds of Wheat

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ABSTRACT

The compatibility of fenoxaprop-P-ethyl with carfentrazone-ethyl for the control of complex weed flora in wheat was evaluated during **rabi** 2005-06 and 2006-07 at CCS Haryana Agricultural University Regional Research Station, Karnal, India. The treatments included fenopxaprop+carfentrazone 100 and 120 g/ha in 4 : 1, 5 : 1 and 6 : 1 ratio, fenoxaprop+metsulfuron-methyl 100 g/ha in 30 : 1 and 40 : 1 ratio, fenoxaprop+2, 4-D Ester and Na salt 500 g/ha in 1 : 4 ratio, in comparison to fenoxaprop+A (adjuvant) 100 g/ha, fenoxaprop 120 g/ha and carfentrazone 20 g/ha along with weed free and weedy check. The density and dry weight of *Phalaris minor* decreased with widening of the ratio from 4 : 1 to 6 : 1 combination of fenoxaprop+carfentrazone at both the doses. In general, fenoxaprop+carfentrazone 120 g/ha was better than 100 g/ha in respect of density and dry weight of *P. minor*. Fenoxaprop+carfentrazone at 120 g/ha in all the ratios resulted in grain yield at par with weed free check during both the years. Among all the treatments, maximum number of effective tillers and grain yield were recorded with fenoxaprop+carfentrazone 120 g/ha (5 : 1) during both the years. Carfentrazone was compatible with fenoxaprop as tank mixture and there was no adverse effect on efficacy of both the herbicides. Fenoxaprop+carfentrazone 120 g/ha (5 : 1) appeared to be the best combination for achieving maximum weed control efficacy and improved grain yield. Metsulfuron 2, 4-D Ester and Na salt had antagonistic effect on the efficacy of fenoxaprop when applied as tank mixture with it.

Key words : Broad spectrum, weed control, antagonism efficiency, weed flora shift

INTRODUCTION

Fenoxaprop-P-ethyl is one of the alternate herbicides recommended for the control of isoproturon resistant *Phalaris minor* Retz. in wheat in the Indo-Gangetic Plains of India. Continuous use of these alternate herbicides resulted in increased infestation of broadleaf weeds in wheat over the years. 2, 4-D and metsulfuron have been used for the control of broadleaf weeds in wheat. However, the combinations of 2, 4-D and metsulfuron with clodinafop, fenoxaprop and sulfosulfuron were found incompatible as tank mixture (Banga and Yadav, 2004; Singh and Singh, 2005). Hence, there is a need for sequential application of these herbicides for control of broad spectrum weeds. Secondly, some of the problematic weeds like *Malwa parviflora* L. and *Convolvulus arvensis* L. have started emerging in wheat fields which are not controlled by metsulfuron and 2,4-D effectively. Carfentrazone-ethyl is a new herbicide which is effective against some of the broad-leaved weeds including these problematic weeds (Cauchy, 2000; Singh *et al*., 2004; Walia and Singh, 2006). Hence, compatibility of fenoxaprop with carfentrazone was studied for making any sound recommendation regarding their use as tank mix application.

MATERIALS AND METHODS

The compatibility of fenoxaprop with carfentrazone was evaluated during **rabi** 2005-06 and 2006-07 at CCS Haryana Agricultural University Regional Research Station, Karnal, India. The soil of experimental field was clay loam in texture, low in available nitrogen, medium in available P_2O_5 and high in K_2O with slightly alkaline in reaction (pH 8.1). The treatments included fenoxaprop+carfentrazone 100 and 120 g/ha in 4 : 1, 5 : 1 and 6 : 1 ratios, fenoxaprop+metsulfuron 100 g/ha in 30 : 1 and 40 : 1 ratios, fenoxaprop+2, 4-D Ester and Na salt 500 g/ha in 1 : 4 ratios, in comparison to fenoxaprop+A (adjuvant) 100 g/ha, fenoxaprop 120 g/ha and carfentrazone 20 g/ha along with weed free and weedy checks. The experiment was laid out in a randomized block design with three replications in a plot size of 5.4 x 2.2 m. All the herbicides were applied at 35 days after sowing (DAS) by knapsack sprayer fitted

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with flat fan nozzle using 500 litres of water per hectare. Wheat cultivar PBW-343 was sown on 16 November, 2005 and PBW-502 on 20 November, 2006 using a seed rate of 112.5 kg/ha with a row spacing of 20 cm. Crop was raised according to package of practices of the university. Density and dry weight of weeds were recorded at 75 DAS, and yield and yield attributes at maturity of the crop. Data on crop phyto-toxicity were recorded at 10, 20 and 30 days after treatment. Crop was harvested on 21 April, 2006 and 22 April, 2007. However, small brown necrotic spots/ freckles appeared on the leaves of wheat in the first week of carfentrazone application which disappeared within a week, hence data in this respect have not been included herein.

RESULTS AND DISCUSSION

Effect on Weeds

The experimental plots were dominated mainly by *Phalaris minor* Retz., *Coronopus didymus* L., *Anagallis arvensis* L., *Melilotus indica* All. Fl. Ped., *Medicago denticulata* L., *Rumex dentatus* L., *Vicia sativa* L. and *Lathyrus aphaca* L.

Data on density and dry weight of *P. minor* under tank mix treatments of fenoxaprop and carfentrazone indicated their compatibility as tank mixture (Table 1). Tank mixture of fenoxaprop+carfentrazone 120 g/ha in all the ratios resulted in density of *P. minor* at par with fenoxaprop 120 g/ha. The density and dry weight of *P. minor* decreased with widening of the ratio from 4 : 1 to 6 : 1 of fenoxaprop+carfentrazone at both the doses. In general, fenoxaprop at 120 g/ha was better than 100 g/ha against *P. minor*. At 120 g/ha, the combinations of fenoxaprop with carfentrazone provided good control of *P. minor* as well as the broadleaf weeds. However, their combinations at all the ratios were at par with each other at respective dose. But the control of *P. minor* slightly increased with widening of ratio, particularly at 100 g/ha. Compatibility of fenoxaprop and carfentrazone as tank mixture in controlling complex weed flora in wheat has been reported by earlier workers as well (Singh and Singh, 2005; Chopra *et al*., 2008). Efficacy of fenoxaprop in reducing the density and dry weight of *P. minor* was adversely affected by tank mix application of metsulfuron, 2, 4-D Ester and 2, 4-D Na salt during both the years, indicating their non-compatibility as tank mixture. Non-compatibility of fenoxaprop with metsulfuron and 2, 4-D has been reported earlier also (Banga and Yadav, 2004; Singh and Singh, 2005).

All the combinations of fenoxaprop+ carfentrazone were at par with carfentrazone alone in

Table 1. Effect of tank-mix application of fenoxaprop with carfentrazone, metsulfuron and 2, 4-D on density and dry weight of weeds in wheat

Treatments	Ratio	Dose (g/ha)	Weed density* (No./m²)				Weed dry weight (g/m²)			
			P. minor		Broad-leaved weeds		Grassy		Broad-leaved weeds	
			2005-06	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07
Fenoxaprop+Carfentrazone+S	4 : 1	100	4.6 (20.7)	7.5 (56.0)	1.8 (2.7)	1.0 (0.0)	37.8	58.4	2.72	0.0
Fenoxaprop+Carfentrazone+S	5 : 1	100	3.9 (14.7)	6.1 (36.0)	2.5 (5.3)	1.0 (0.0)	38.1	16.7	2.74	0.0
Fenoxaprop+Carfentrazone+S	6 : 1	100	3.6 (12.7)	5.7 (31.3)	2.6 (6.0)	1.4 (1.3)	33.7	17.1	5.67	0.2
Fenoxaprop+Carfentrazone+S	4 : 1	120	3.8 (14.0)	5.5 (29.3)	1.9 (3.3)	1.0 (0.0)	33.8	18.3	5.68	0.0
Fenoxaprop+Carfentrazone+S	5 : 1	120	3.6 (12.0)	4.9 (24.0)	1.7 (2.7)	1.2 (0.7)	34.2	12.7	8.95	0.3
Fenoxaprop+Carfentrazone+S	6 : 1	120	3.1 (9.3)	4.3 (18.7)	2.7 (6.0)	1.2 (0.7)	33.9	10.3	8.36	0.2
Fenoxaprop+Metsulfuron+S	30 : 1	100	5.8 (33.3)	8.1 (64.7)	1.9 (2.7)	1.0 (0.0)	51.2	42.1	5.69	0.0
Fenoxaprop+Metsulfuron+S	40 : 1	100	5.4 (28.7)	7.5 (56.0)	2.7 (6.7)	1.0 (0.0)	49.6	41.3	5.57	0.0
Fenoxaprop+2,4-D Na+S	1 : 4	500	4.7 (21.0)	7.7 (58.7)	2.7 (6.0)	1.0 (0.0)	42.2	47.5	8.80	0.0
Fenoxaprop+2,4-D Ester+S	1 : 4	500	5.1 (25.7)	8.4 (70.0)	1.7 (2.0)	1.2 (0.7)	41.7	60.8	5.71	0.2
Fenoxaprop+S	-	100	2.6 (6.0)	4.1 (20.7)	5.0 (24.0)	3.6 (12.7)	35.2	18.2	13.41	2.3
Fenoxaprop	-	120	3.4 (10.7)	5.0 (26.7)	5.3 (26.7)	3.1 (8.7)	34.0	15.1	14.15	2.0
Carfentrazone	-	20	8.4 (70.0)	12.0 (143.3)	2.0 (3.3)	1.0 (0.0)	103.1	135.5	5.93	0.0
Weed free	-	-	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	0.0	0.0	0.0	0.0
Weedy check	-	-	9.2 (84.0)	11.5 (130.7)	4.9 (23.3)	3.6 (12.0)	109.7	137.7	9.12	2.7
LSD (P=0.05)	-	-	1.0	1.8	1.0	0.7	6.2	14.0	6.22	0.4

*Original data in parentheses were subjected to square root (density) and angular transformation (% visual control) before analysis.
S–Surfactant (0.2%).

respect of density and dry weight of broad leaved weeds, indicating compatibility of tank mixture in this respect (Table 1). However, tank mixture of metsulfuron, 2, 4-D Ester and 2, 4-D Na salt with fenoxaprop also reduced the density and dry weight of broad leaved weeds similar to carfentrazone 20 g/ha alone clearly indicating that there was no antagonistic effect of fenoxaprop on control of broadleaf weeds by metsulfuron and 2,4-D.

Effect on Crop

Plant height of wheat was not influenced significantly by different herbicidal treatments in 2005-06 (Table 2). During 2006-07, lowest plant height was recorded under weedy check plots. Lower plant height was also recorded under combinations of fenoxaprop with metsulfuron and 2, 4-D. Fenoxaprop alone and tank mix treatments of fenoxaprop with carfentrazone were at par with each other during 2006-07. Fenoxaprop+carfentrazone treatments were at par with fenoxaprop alone in respect of effective tillers and were even at par with weed free checks. Among all the treatments, maximum numbers of effective tillers were recorded under fenoxaprop+carfentrazone 120 g/ha (5 : 1) during both the years. Carfentrazone alone and tank mixture of fenoxaprop with metsulfuron and 2,4-D resulted in lower number of effective tillers of wheat. During 2005-06, fenoxaprop+carfentrazone treatments were at par with each other and weed free check in respect of earhead length. Lowest earhead length was recorded under weedy check plots. Earhead lengths under carfentrazone alone and tank mixture of fenoxaprop with metsulfuron and 2, 4-D were lower than the weed free check. However, the differences among different treatments in respect of earhead length were non-significant during 2006-07. However, small brown necrotic spots/freckles appeared on the leaves in the first week of its application which disappeared within a week, causing no phyto-toxicity on the crop (data not given).

All the treatments of fenoxaprop+carfentrazone were statistically at par with each other in respect of grain yield of wheat (Table 2); however, yield increased with increase in dose from 100 to 120 g/ha. Fenoxaprop+carfentrazone at 120 g/ha in all the ratios resulted in grain yield at par with weed free check during both the years. Whereas, grain yield under fenoxaprop+carfentrazone at 100 g/ha in all the ratios was significantly lower than weed free check during 2006-07. The combination of fenoxaprop+metsulfuron resulted in grain yield significantly lower than weed free check during both the years. Similarly, combination of fenoxaprop with 2, 4-D produced significantly lower grain yield than weed free check during 2006-07.

Table 2. Effect of tank-mix application of fenoxaprop with carfentrazone, metsulfuron and 2, 4-D on yield and yield attributes of wheat

Treatments	Ratio	Dose (g/ha)	Plant height (cm)		Effective tillers/ mrl		Earhead length (cm)		Grain yield (kg/ha)	
			2005-06	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07
Fenoxaprop+Carfentrazone+S	4 : 1	100	84.1	86.3	94.3	86.3	9.5	9.6	5204	5451
Fenoxaprop+Carfentrazone+S	5 : 1	100	84.3	85.3	96.3	87.8	9.5	9.5	5092	5502
Fenoxaprop+Carfentrazone+S	6 : 1	100	83.3	86.4	93.3	89.0	9.5	9.5	5241	5552
Fenoxaprop+Carfentrazone+S	4 : 1	120	83.9	85.1	91.3	88.0	9.4	9.3	5419	5829
Fenoxaprop+Carfentrazone+S	5 : 1	120	84.7	86.2	99.3	94.8	9.6	9.5	5538	6006
Fenoxaprop+Metsulfuron+S	6 : 1	120	84.1	86.1	89.0	90.0	9.6	9.5	5258	5931
Fenoxaprop+Metsulfuron+S	30 : 1	100	83.9	84.1	83.3	84.3	9.3	9.5	4751	5049
Fenoxaprop+Carfentrazone+S	40 : 1	100	84.0	84.3	86.0	85.3	9.2	9.5	4813	5155
Fenoxaprop+2,4-D Na+S	1 : 4	500	84.3	83.9	88.7	86.0	9.4	9.5	4930	5202
Fenoxaprop+2,4-D Ester+S	1 : 4	500	84.6	83.5	90.3	81.8	9.2	9.3	4998	4925
Fenoxaprop+S	-	100	83.7	85.5	93.7	83.5	9.5	9.3	5290	5632
Fenoxaprop	-	120	84.7	86.1	92.7	88.7	9.6	9.4	5377	5804
Carfentrazone	-	20	84.3	83.5	82.3	61.5	9.2	9.2	4546	4163
Weed free	-	-	84.7	87.2	98.7	94.5	9.8	9.8	5557	6279
Weedy check	-	-	83.1	82.9	80.7	63.3	8.9	9.3	4063	3771
LSD (P=0.05)	-	-	NS	1.7	8.5	8.9	0.4	NS	656	641

mrl–Metre row length, S–Surfactant (0.2%). NS–Not Signficant.

Among the herbicidal treatments lowest grain yield was obtained under carfentrazone 20 g/ha. Maximum grain yield among the herbicidal treatments was recorded under fenoxaprop+carfentrazone 120 g/ha (5 : 1) during both the years.

Carfentrazone was compatible with fenoxaprop as tank mixture and there was no adverse effect on efficacy of both the herbicides against complex weed flora in wheat. Fenoxaprop+carfentrazone 120 g/ha (5 : 1) appeared as the best combination for achieving maximum weed control efficacy and satisfactory grain yields. Metsulfuron, 2, 4-D Ester and 2, 4-D Na salt had antagonistic effect on the efficacy of fenoxaprop against *P. minor* when applied as tank mixture with it. However, fenoxaprop did not affect the efficacy of metsulfuron, 2, 4-D Ester and 2, 4-D Na salt against broadleaf weeds in wheat.

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