Indian J. Weed Sci. **42** (3 & 4) : 155-158 (2010)

Performance of Carfentrazone-ethyl 20% + Sulfosulfuron 25% WDG – A Formulated Herbicide for Total Weed Control in Wheat

U. S. Walia, Tarundeep Kaur, Shelly Nayyar and Kulbir Singh
Department of Agronomy
Punjab Agricultural University, Ludhiana-141 001 (Punjab), India

ABSTRACT

Carfentrazone-ethyl 20%+sulfosulfuron 25% WDG (Premix) was evaluated against mixed weed flora in wheat during **rabi** seasons of 2008-09 and 2009-10 at the Research Farm of Department of Agronomy, Punjab Agricultural University, Ludhiana. The experimental field was heavily infested with *Phalaris minor* and broadleaf weeds. Among the herbicidal treatments, post-emergence application (30-35 DAS) of premix herbicide i. e. carfentrazone + sulfosulfuron at 36, 45 and 54 g/ha either with 625 ml or 750 ml/ha of surfactants performed at par with the recommended herbicides i. e. Leader 75 WG (sulfosulfuron) at 25 g/ha and Total 75 WG (sulfosulfuron + metsulfuron) with respect to reduction in dry matter accumulation by *P. minor* as well as broadleaf weeds and production of grain yield of wheat. The bioefficacy of carfentrazone+sulfosulfuron at 45 g/ha without surfactant was found to be less as compared to its application with surfactants. Higher dose of this formulated herbicide i. e. 54 g/ha was more effective than its lower levels. Also alone application of carfentrazone 20 g/ha as well as unweeded (control) treatment produced significantly higher dry matter of *P. minor* and less grain yield as compared to all the herbicidal treatments.

Key words : Carfentrazone, sulfosulfuron, surfactant, weed control, wheat

INTRODUCTION

Wheat is the most important cereal crop of Punjab state which is badly infested with grassy as well as broadleaf weeds. Isoproturon was in use since 1982 continuously for many years for effective control of *Phalaris. minor* in wheat especially in rice-wheat rotation. But its efficacy has declined during the last 10-12 years due to development of resistance in *P. minor* in some parts of Haryana (Malik and Malik, 1994) and Punjab (Walia *et al*., 1997). To tackle the resistance problem, few alternate herbicides such as fenoxaprop-P-ethyl, clodinafop-propargyl and sulfosulfuron were recommended and are in use on a large scale. Fenoxaprop and clodinafop are very specific to *P. minor* and *Avena ludoviciana* but are ineffective against broadleaf weeds in wheat. Continuous use in these herbicides resulted in tremendous increase in density of broadleaf weeds especially *Rumex dentatus*, *Chenopodium album, Melilotus indica, Fumaria parviflora* and *Malva neglecta,* etc. at farmers' field which require follow up spray of broadleaf weed killer herbicides such as 2,4-D, metsulfuron, carfentrazone, etc. The alternate recommended herbicides i. e. fenoxaprop, clodinafop, sulfosulfuron, etc. are also not providing satisfactory control of this weed in the Punjab state under certain situations. So, there is a greater need for new molecules preferably broad spectrum in nature which can control grassy and broadleaf weeds in wheat. A new formulated herbicide i. e. carfentrazone-ethyl 20%+sulfosulfuron 25% (45 WDG) was thus evaluated against joint infestation of *P. minor* and broadleaf weeds in wheat in order to reduce number of sprays of herbicides in this crop.

MATERIALS AND METHODS

An investigation was conducted to evaluate the efficacy of carfentrazone-ethyl 20% + sulfosulfuron 25% WDG at the Experimental Farm of Department of Agronomy, Punjab Agricultural University, Ludhiana during the **rabi** seasons of 2008-2009 and 2009-2010 at variable levels. Soil of the experimental field was loamy sand in texture which was normal in reaction and low in organic carbon as well as available N and medium in available P and K. The experiment was laid out in a randomized block design with 12 treatments replicated three times. Wheat variety PBW 343 was sown on 25 November 2008 and 17 Novemebr 2009 with 100 kg seed per hectare by keeping row to row spacing of 22.5

cm during both the years of investigations. Recommended doses of fertilizers i. e. 125 kg N, 62.5 kg P_2O_5 and 30 kg K_2O/ha were applied to raise the crop. Whole of phosphorus and potassium and half of nitrogen was applied at the time of sowing and remaining nitrogen was applied with the first irrigation. The experimental field had sufficient population of *P. minor* and broadleaf weeds during both the years. The spray of this formulated herbicide at 36, 45 and 54 g/ha with 625 and 750 ml/ha of surfactant (commercial product) was done on 28 December 2008 and 22 December 2009 with hand operated knapsack sprayer fitted with flat fan nozzle. These treatments were compared with the recommended herbicides i. e. sulfosulfuron (Leader 75 WG) at 25 g/ha and sulfosulfuron + metsulfuron (Total 75 WG) at 30 g/ha. Apart from these treatments, alone application of carfentrazone+sulfosulfuron at 45 g/ha, sulfosulfuron 25 g/ha followed by carfentrazone 20 g/ha and alone application of carfentrazone at 20 g/ha were also included. The dry matter of *P. minor* and broadleaf weeds was recorded at different crop stages by using quadrant of 50 x 50 cm. The crop was raised with recommended agronomic and plant protection techniques. Data on dry weight of weeds were subjected to square root transformation before statistical analysis.

RESULTS AND DISCUSSION

Effect on Weeds

Dry matter accumulation by *P. minor* and broadleaf weeds recorded at the time of harvest is presented in Table 1. Post-emergence application (30-35 DAS) of carfentrazone 20%+sulfosulfuron 25% at 36, 45 and 54 g/ha with 625 ml or 750 ml/ha of surfactant (commercial) resulted in significant reduction in dry matter accumulation by *P. minor* and broadleaf weeds during both the years of study and all these treatments were found to be at par with the recommended herbicides i. e. sulfosulfuron 25 g/ha (Leader 75 WG) fb carfentrazone (Affinity 40 DF) 20 g/ha as well as sulfosulfuron+metsulfuron (Total 75 WG) 30 g/ha treatment. All the herbicidal treatments produced significantly less dry matter of *P. minor* and broadleaf weeds as compared to unweeded (control) and application of carfentrazone+sulfosulfuron at 45 g/ha without surfactant treatments. The efficacy of these treatments was better during 2008-09 as compared to 2009-10. Also application of carfentrazone+sulfosulfuron at 45 g/ha without surfactant produced significantly more dry matter of *P. minor* as compared to application of this herbicide at all levels with surfactants i. e. 625 and 750 ml/ha of commercial product. Brar *et al*. (2003) also reported that application of Atlantis 3.6 WDG (mesosulfuron+ iodosulfuron) at 12.0 g+2.4 g and 15.0 g+3.0 g/ha effectively controlled *P. minor* and broadleaf weeds in wheat.

Effect on Crop

During 2008-09, post-emergence application of carfentrazone+sulfosulfuron at 36, 45 and 54 g/ha with

Table 1. Effect of different weed control treatments on dry matter accumulation by weeds at harvest

Treatments	Dose (g/ha)	Dry weight of *Phalaris minor* (q/ha)		Dry weight of BLW (q/ha)	
		2008-09	2009-10	2008-09	2009-10
Carfentrazone 20%+sulfosulfuron 25% without surfactant	45	2.1 (5.6)	2.3 (4.6)	1.1 (0.2)	1.0 (0.0)
Carfentrazone 20%+sulfosulfuron 25% with 625 ml/ha surfactant	36	1.0 (0.0)	1.9 (2.7)	1.0 (0.0)	1.0 (0.0)
Carfentrazone 20%+sulfosulfuron 25% with 750 ml/ha surfactant	36	1.0 (0.0)	1.8 (2.4)	1.0 (0.0)	1.0 (0.0)
Carfentrazone 20%+sulfosulfuron 25% with 625 ml/ha surfactant	45	1.0 (0.0)	1.3 (0.9)	1.0 (0.0)	1.0 (0.0)
Carfentrazone 20%+sulfosulfuron 25% with 750 ml/ha surfactant	45	1.0 (0.0)	1.5 (1.3)	1.0 (0.0)	1.0 (0.0)
Carfentrazone 20%+sulfosulfuron 25% with 625 ml/ha surfactant	54	1.0 (0.0)	1.6 (1.5)	1.0 (0.0)	1.0 (0.0)
Carfentrazone 20%+sulfosulfuron 25% with 750 ml/ha surfactant	54	1.0 (0.0)	1.6 (1.8)	1.0 (0.0)	1.0 (0.0)
Leader 75 WG (Sulfosulfuron) fb Affinity 40 DF (Carfentrazone)	25, 20	1.0 (0.0)	1.7 (2.0)	1.1(0.4)	1.0 (0.0)
Affinity 40 DF (Carfentrazone ethyl) without surfactant	20	3.8 (15.3)	4.7 (23.1)	1.0 (0.0)	1.0 (0.0))
Leader 75 WG (Sulfosulfuron)+ Surfactant	25	1.0 (0.0)	1.0 (0.0)	1.1 (0.4)	1.0 (0.0)
Total 75 WG (Sulfosulfuron + metsulfuron)	30	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)
Control (unweeded)		4.5 (20.2)	5.2 (28.9)	2.2 (3.8)	2.3 (4.7)
LSD (P=0.05)		0.90	1.0	0.52	0.87

625 or 750 ml/ha of surfactant, sulfosulfuron 25 g/ha fb carfentrazone 20 g/ha, carfentrazone ethyl without surfactant at 20 g/ha and sulfosulfuron+metsulfuron at 30 g/ha (Total 75 WG) resulted in significant increase in plant height over formulated herbicide i. e. carfentrazone+sulfosulfuron at 45 g/ha without surfactant, sulfosulfuron+surfactant (Leader 75 WG) at 25 g/ha and unweeded (control) (Table 2). However, during 2009-10, all the herbicidal treatments produced significantly higher plant height as compared to control. All the herbicidal treatments at the time of harvest resulted in significant increase in ear length as compared to unweeded (control) treatment during both the years. During 2008-09, carfentrazone+sulfosulfuron 54 g/ha with 625 ml/ha of surfactant produced maximum number of effective tillers per metre row length which were statistically at par with all other herbicidal treatments except carfentrazone+sulfosulfuron without surfactant at 45 g/ha, carfentrazone ethyl without surfactant 20 g/ha and unweeded control. However, application of Total 75 WG (sulfosulfuron+metsulfuron) at 30 g/ha produced maximum number of effective tillers/m row length which were at par with all other herbicidal treatments except carfentrazone+sulfosulfuron at 45 g/ha without surfactant, carfentrazone+sulfosulfuron at 36 g/ha with surfactant at 750 ml/ha, carfentrazone ethyl without surfactant 20 g/ha, sulfosulfuron 25 g fb carfentrazone 20 g/ha, sulfosulfuron+surfactant at 25 g/ha and unweeded (control) treatments.

During 2008-09, maximum grain yield was recorded with the post-emergence application of sulfosulfuron+metsulfuron (Total 75 WG) at 30 g/ha which was statistically at par with all herbicidal treatments except carfentrazone-ethyl without surfactant at 20 g/ha and unweeded (control) treatment. Application of carfentrazone+sulfosulfuron at 36, 45 and 54 g/ha either with 625 or 750 ml/ha of surfactant produced significantly higher grain yield which was at par with all the herbicidal treatments except carfentrazone+sulfosulfuron (without surfactant) at 45 g/ha, carfentrazone-ethyl without surfactant at 20 g/ha and unweeded (control) treatments. During 2009-10, wheat grain yield was also recorded to be statistically at par with all the carfentrazone+ sulfosulfuron treatments (36, 45 and 54 g/ha with 625

Table 2. Effect of different weed control treatments on yield and yield attributes of wheat

Treatments	Dose (g/ha)	Plant height (cm)		Effective tillers/m length		Earhead length (cm)		Grain yield (q/ha)		
		2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	Mean
Carfentrazone 20%+sulfosulfuron 25% without surfactant	45	53.1	66.1	60.7	67.7	9.8	9.9	37.88	38.33	38.11
Carfentrazone 20%+sulfosulfuron 25% with 625 ml/ha surfactant	36	55.8	66.2	68.3	69.2	10.2	9.5	38.42	43.50	40.96
Carfentrazone 20%+sulfosulfuron 25% with 750 ml/ha surfactant	36	58.7	66.6	65.8	64.3	10.4	9.7	41.32	40.23	40.78
Carfentrazone 20%+sulfosulfuron 25% with 625 ml/ha surfactant	45	57.1	67.1	67.5	70.8	10.4	9.6	41.81	42.57	42.19
Carfentrazone 20%+sulfosulfuron 25% with 750 ml/ha surfactant	45	58.5	64.1	69.0	72.7	10.3	10.0	41.14	44.15	42.65
Carfentrazone 20%+sulfosulfuron 25% with 625 ml/ha surfactant	54	58.6	67.5	72.3	73.3	10.1	9.7	40.88	41.49	41.19
Carfentrazone 20%+sulfosulfuron 25% with 750 ml/ha surfactant	54	56.3	66.7	71.3	68.7	10.2	9.4	40.98	44.84	42.91
Leader 75 WG (Sulfosulfuron) fb Affinity 40 DF (Carfentrazone)	25, 20	57.4	65.5	70.5	67.8	10.2	9.3	41.27	46.32	43.80
Affinity 40 DF (Carfentrazone ethyl) without surfactant	20	57.8	64.1	63.7	64.7	10.2	9.7	30.79	32.71	31.75
Leader 75 WG (Sulfosulfuron)+Surfactant	25	53.5	65.3	68.2	65.8	10.3	9.9	38.77	42.12	40.45
Total 75 WG (Sulfosulfuron+metsulfuron)	30	54.3	65.0	69.5	76.5	10.2	10.1	43.77	42.76	43.27
Control (unweeded)		46.3	57.1	47.7	43.0	9.4	8.0	23.86	25.34	24.60
LSD (P=0.05)		4.9	3.4	7.6	8.04	0.7	0.81	7.07	5.31	3.31

or 750 ml/ha of surfactant) as compared to standard herbicidal treatments i. e. sulfosulfuron (Leader 75 WG) and sulfosulfuron+metsulfuron (Total 75 WG) treatments. The unweeded control as well as alone carfentrazone treated crop resulted in significant reduction in grain yield as compared to all the herbicidal treatments during both the years of study. On an average of two years, maximum grain yield was recorded with sulfosulfuron 25 g/ha fb carfentrazone at 20 g/ha which was at par with all herbicidal treatments and significantly higher than carfentrazone+sulfosulfuron at 45 g/ha without surfactant, carfentrazone-ethyl at 20 g/ha without surfactant, sulfosulfuron (Leader 75 WG) at 25 g/ha with surfactant and unweeded (control) treatment. Similarly, Chopra and Chopra, (2005) reported that tank mix application of clodinafop at 60 g/ha and fenoxaprop at 100 g/ha with carfentrazone 20 g/ha controlled both grassy and broadleaf weeds resulting in 88-90% weed control efficiency and increased grain yield of wheat.

It can be concluded that post-emergence application of formulated herbicides i. e. carfentrazone+ sulfosulfuron at 36, 45 and 54 g/ha either with 625 ml or 750 ml/ha of surfactants performed at par with the recommended herbicides i. e. Leader 75 WG (sulfosulfuron) at 25 g/ha and Total 75 WG (sulfosulfuron+metsulfuron) at 30 g/ha with respect to reduction in dry matter accumulation by *P. minor* as well as broadleaf weeds and production of grain yield of wheat. The bioefficacy of formulated herbicides i. e. carfentrazone+sulfosulfuron at 45 g/ha without surfactant was found to be less than its application with surfactants. Also alone application of carfentrazone at 20 g/ha as well as unweeded (control) treatment produced significantly higher dry matter of *P. minor* and significantly low grain yield as compared to all herbicidal treatments. Post-emergence application of premix herbicide i. e. carfentrazone+sulfosulfuron (45 WDG) even at highest dose i. e. 54 g/ha showed no phyto-toxicity symptoms on wheat crop from the day of spray upto harvest.

REFERENCES

Brar, L. S., U. S. Walia and B. S. Gill. 2003. Performance of Atlantis 3.6 WDG (mesosulfuron+iodosulfuron) for controlling *Phalaris minor* Retz. and other weeds of wheat. *Ind. J. Weed Sci.* **35** : 6-9.

Chopra, N. and N. K. Chopra. 2005. Bio-efficacy of fenoxaprop, clodinafop, metribuzin alone in combination against weeds in wheat and their residual effect on succeeding crops. *Ind. J. Weed Sci.* **37** : 163-166.

Malik, R. K. and Y. S. Malik. 1994. Development of herbicide resistance in India. In : *Appropriate Weed control in Southern Asia*, Sustroutome, S. S. and A. Bruce Avid (eds). CAB International, London. pp. 64-81.

Walia, U. S., L. S. Brar. and B. K. Dhaliwal. 1997. Resistance to isoproturon in *Phalaris minor* Retz. in Punjab. *Plant Protec. Quarterly* **12** : 138-140.