

Compatibility of Sulfosulfuron with Carfentrazone-ethyl for the Control of Complex Weed Flora in Wheat

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ABSTRACT

A field experiment was conducted at CCS Haryana Agricultural University Regional Research Station, Karnal during **rabi** 2007-08 and 2008-09 to evaluate the efficacy of sulfosulfuron tank mixed with carfentrazone-ethyl against weeds in wheat. The treatments included tank-mix or sequential application of sulfosulfuron 25 g/ha with carfentrazone 20, 15 and 10 g/ha, alone application of sulfosulfuron 25 g/ha and carfentrazone 20 g/ha, sequential application of clodinafop 60 g/ha or sulfosulfuron 25 g/ha with metsulfuron 4 g/ha, sulfosulfuron+metsulfuron (ready-mix) 32 g/ha, pinoxaden 50 g/ha *fb* carfentrazone 20 g/ha, mesosulfuron+iodosulfuron (ready-mix) 14.4 g/ha, along with weed free and weedy checks. Tank mix or sequential application of sulfosulfuron with carfentrazone being at par reduced the density and dry weight of *Phalaris minor* similar to sulfosulfuron alone, mesosulfuron+iodosulfuron, sulfosulfuron+metsulfuron (ready-mix) and sulfosulfuron *fb* metsulfuron during both the years and it was as good as weed free check during 2008-09. All the tank-mix and sequential applications of sulfosulfuron with carfentrazone were at par with carfentrazone alone and similar to weed free check in respect of density and dry weight of broadleaf weeds. Tank-mix and sequential application of sulfosulfuron with carfentrazone were at par with sulfosulfuron alone, all other check herbicidal treatments (except carfentrazone alone being inferior) and weed free check in respect of effective tillers and grain yield of wheat. There was no phytotoxicity of combination treatments of sulfosulfuron with carfentrazone except some brown freckles appearing on the leaves due to tank-mix treatments or carfentrazone alone, which disappeared within two weeks without any adverse effect on the crop. Hence, carfentrazone was found compatible with sulfosulfuron as tank mixture against complex weed flora in wheat with no loss of herbicidal efficacy.

Key words : Herbicide compatibility, tank and ready mixtures, complex weed flora

INTRODUCTION

Sulfosulfuron has been reported to provide effective control of isoproturon resistant *Phalaris minor* alongwith marginal control of broadleaf weeds in wheat (Yadav and Malik, 2005). Several broadleaf weeds are becoming a serious problem along with grassy weeds in wheat. Metsulfuron-methyl and 2, 4-D have been recommended for the control of broadleaf weeds (BLW) in wheat. There is a need for tank-mix or sequential application of herbicides like 2, 4-D, metsulfuron or carfentrazone against complex weed flora in wheat. 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). However, sequential applications of these herbicides were found suitable for the control of broad spectrum weeds. But some of the problematic weeds like *Malwa parviflora* L. and *Convolvulus arvensis* L. have started emerging in wheat fields which are not

effectively controlled either by metsulfuron or 2,4-D. Carfentrazone-ethyl has already been reported very effective against most of the broadleaf weeds including these problematic weeds (Cauchy, 2000; Singh *et al.*, 2004; Walia and Singh, 2006). Hence, compatibility of sulfosulfuron with carfentrazone was studied for making a sound recommendation regarding their use as tank mix or sequential applications.

MATERIALS AND METHODS

To evaluate the compatibility of sulfosulfuron with carfentrazone against complex weed flora in wheat, a field experiment was conducted at CCS Haryana Agricultural University Regional Research Station, Karnal during **rabi** 2007-08 and 2008-09. The soil of experimental field was clay loam in texture, low in available nitrogen, medium in available phosphorus and potassium with slightly alkaline in reaction. The treatments included tank-mix or sequential application

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of sulfosulfuron 25 g/ha with carfentrazone 20, 15 and 10 g/ha, alone application of sulfosulfuron 25 g/ha and carfentrazone 20 g/ha, sequential application of clodinafop 60 g/ha or sulfosulfuron 25 g/ha with metsulfuron 4 g/ha, sulfosulfuron+metsulfuron (ready-mix) 32 g/ha, pinoxaden 50 g/ha *fb* carfentrazone 20 g/ha, mesosulfuron+iodosulfuron (ready-mix) 14.4 g/ha along with weed free and weedy checks. The experiment was laid out in randomized block design with three replications in a plot size of 5.4 x 2.2 m. All the herbicides were applied 35 days after sowing (DAS) by knapsack sprayer fitted with flat fan nozzle using 500 l water/ha. Wheat cultivar PBW 502 was sown on 24 November, 2007 and DBW 17 on 19 November, 2008 using seed rate of 112.5 kg/ha with a row spacing of 20 cm. The reason for including different wheat cultivars during second year was just to screen its sensitivity against various herbicidal treatments as this variety is picking up very fast in various climatic zones of Haryana. Crop was raised according to Package of Practices of the State University. Density and dry weight of weeds were recorded at 90 DAS during 2007-08 and 75 DAS during 2008-09, and yield and yield attributes at maturity of the crop. Data on crop phytotoxicity were recorded at 15 and 30 days after treatment (DAT). Crop was harvested on 20 April 2008 and 14 April 2009. Small brown necrotic spots/ freckles appeared on the leaves of wheat in the

first week of carfentrazone alone or with sulfosulfuron application which disappeared within two weeks; hence, data not presented in this respect.

RESULTS AND DISCUSSION

Effect on Weeds

The experimental plots were dominated mainly by *P. minor* Retz. *Coronopus didymus* Sw., *Anagallis arvensis* L., *Melilotus indica* All. Fl. Ped., *Medicago denticulata* L., *Rumex dentatus* L., *Vicia sativa* L. and *Lathyrus aphaca* L. were the major broad-leaved weeds (BLW). However, the infestation of BLW was very low during 2007-08.

Significant reduction in density and dry weight of *P. minor* under tank mix treatments of sulfosulfuron and carfentrazone indicated their compatibility as tank mixture (Table 1). Tank mixture of sulfosulfuron 25 g/ha+carfentrazone 10-20 g/ha resulted in density and dry weight of *P. minor* at par with sulfosulfuron 25 g/ha alone or its sequential application with carfentrazone 10-20 g/ha. During 2007-08, the density and dry weight of *P. minor* under tank-mix or sequential application of sulfosulfuron with carfentrazone were at par with sulfosulfuron 25 g/ha, mesosulfuron+iodosulfuron 14.4 g/ha, sulfosulfuron+metsulfuron (ready-mix) 32 g/ha and

Table 1. Effect of different herbicidal treatments on density and dry weight of weeds in wheat

Treatment	Dose (g/ha)	Density of weeds (No./m ²)*				Dry weight of weeds (g/m ²)			
		<i>P. minor</i>		BLW		<i>P. minor</i>		BLW	
		2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09
SSN+CZN	25+20	7.73 (60.7)	1.96 (3.3)	1.00 (0.0)	1.00 (0.0)	13.5	2.3	0.0	0.00
SSN+CZN	25+15	7.32 (52.7)	1.96 (3.3)	1.00 (0.0)	1.00 (0.0)	11.5	2.3	0.0	0.00
SSN+CZN	25+10	8.30 (68.0)	2.10 (4.0)	1.24 (0.7)	1.00 (0.0)	11.9	0.9	0.07	0.00
SSN <i>fb</i> CZN	25 & 20	8.26 (67.3)	2.07 (3.3)	1.00 (0.0)	1.00 (0.0)	19.6	3.1	0.0	0.00
SSN <i>fb</i> CZN	25 & 15	8.66 (74.0)	2.24 (4.0)	1.24 (0.7)	1.24 (0.7)	15.5	3.1	0.07	0.40
SSN <i>fb</i> CZN	25 & 10	8.34 (68.7)	2.24 (4.0)	1.41 (1.3)	2.28 (5.3)	18.1	3.4	0.13	0.73
SSN	25	7.29 (52.7)	1.67 (2.7)	1.00 (0.0)	2.51 (6.7)	11.7	1.2	0.0	1.73
CZN	20	12.72 (161.3)	7.85 (60.7)	1.24 (0.7)	1.24 (0.7)	87.1	83.4	0.13	0.20
CDF <i>fb</i> MSM	60 & 4	4.38 (18.7)	1.82 (2.7)	1.49 (1.3)	2.18 (4.7)	3.5	2.5	0.13	0.67
SSN <i>fb</i> MSM	25 & 4	6.73 (45.3)	1.96 (4.7)	1.00 (0.0)	1.00 (0.0)	14.5	0.8	0.0	0.00
SSN+MSM (RM)	32	8.79 (76.7)	1.82 (2.7)	1.41 (1.3)	1.00 (0.0)	12.1	2.3	0.07	0.00
PDN <i>fb</i> CZN	50 & 20	4.04 (15.3)	1.24 (0.7)	1.79 (2.7)	2.28 (5.3)	2.8	1.1	0.13	0.47
MSN+ISN (RM)	14	7.02 (49.3)	2.99 (8.0)	1.00 (0.0)	1.00 (0.0)	10.5	2.7	0.0	0.00
FNP	120	-	3.58 (12.0)	-	5.78 (34.0)	-	7.1	-	3.40
Weed free		1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	0.0	0.0	0.0	0.00
Weedy check		13.39 (184.7)	7.63 (57.3)	2.51 (5.3)	5.55 (30.0)	96.8	82.5	0.53	3.13
LSD (P=0.05)		1.96	1.22	0.67	1.31	10.0	5.6	0.19	0.97

*Original figures in parentheses were subjected to square root transformation ($\sqrt{X+1}$) before statistical analysis.

SSN-Sulfosulfuron, CZN-Carfentrazone, MSM-Metsulfuron, CDF-Clodinafop, PDN-Pinoxaden, MSN-Mesosulfuron and ISN-Iodosulfuron.

sulfosulfuron 25 g/ha fb metsulfuron 4 g/ha; however, these were inferior to weed free check. Among different herbicidal treatments, the lowest dry weight was recorded in penoxaden fb carfentrazone which was better than sulfosulfuron+carfentrazone, sulfosulfuron fb carfentrazone or sulfosulfuron fb metsulfuron during 2007-08. While during 2008-09, all the herbicidal treatments except fenoxaprop 120 g/ha were as good as weed free check in respect of density and dry weight of *P. minor*. Lower efficacy of mesosulfuron+iodosulfuron and all sulfosulfuron treatments was observed against *P. minor* during 2007-08 compared to 2008-09. Clodinafop 60 g/ha fb metsulfuron 4 g/ha or pinoxaden 50 g/ha fb carfentrazone 20 g/ha reduced the density and dry weight of *P. minor* similar to weed free check during both the years. Carfentrazone 20 g/ha was as good as weedy check in respect of density and dry weight of *P. minor*.

All the tank-mix combinations of sulfosulfuron 25 g/ha+carfentrazone (10-20 g/ha) were at par with carfentrazone 20 g/ha in respect of density and dry weight of broadleaf weeds (Table 1). Also these were at par with sequential application of sulfosulfuron with carfentrazone (10-20 g/ha), sequential application of clodinafop 60 g/ha fb metsulfuron 4 g/ha, sulfosulfuron 25 g/ha fb metsulfuron 4 g/ha, pinoxaden 50 g/ha fb carfentrazone 20 g/ha, and ready-mix treatments of sulfosulfuron+metsulfuron 32 g/ha, mesosulfuron+

iodosulfuron 14.4 g/ha and even weed free check in respect of density and dry weight of broadleaf weeds.

Effect on Crop

During 2007-08, plant height of wheat under different herbicidal treatments except carfentrazone 20 g/ha was similar to each other and superior to weedy check. While during 2008-09, the influence of different treatments on plant height was non-significant. Effects of different treatments on earhead length were non-significant during both the years. Tank-mix and sequential application of sulfosulfuron with carfentrazone were at par with sulfosulfuron alone and other herbicidal treatments (except carfentrazone alone being inferior) in respect of effective tillers and were even at par with weed free checks during both the years. There was no phytotoxicity of any of the herbicidal treatments except little phytotoxicity (4-4.7% at 15 DAS) under mesosulfuron+iodosulfuron 14.4 g/ha, which recovered within 30 DAS. However, some brown freckles appeared on the leaves of wheat after spray of carfentrazone as tank-mix with sulfosulfuron, which disappeared within one-two weeks, and had no effect on the crop (data not given).

All the tank-mix and sequential treatments of sulfosulfuron with carfentrazone were statistically at par with each other and sulfosulfuron alone in respect of grain yield of wheat (Table 2). The tank-mix or

Table 2. Effect of different herbicidal treatments on yield and yield attributing characters of wheat

Treatment	Dose (g/ha)	Plant height (cm)		Effective tillers/ m ²		Earhead length (cm)		Grain yield (kg/ha)	
		2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09
SSN+CZN	25+20	86.5	79.3	87.7	90.7	8.9	9.4	4944	5210
SSN+CZN	25+15	87.1	79.5	86.7	87.5	8.9	9.3	4966	4944
SSN+CZN	25+10	86.1	80.7	89.3	87.0	9.0	9.1	4854	4822
SSN fb CZN	25 fb 20	86.7	79.4	87.3	91.0	8.9	9.4	5078	5182
SSN fb CZN	25 fb 15	86.1	80.3	87.0	88.0	9.1	9.1	5056	4909
SSN fb CZN	25 fb 10	87.6	79.5	91.8	87.3	9.0	9.0	4998	4843
SSN	25	86.0	80.3	88.7	87.5	8.9	9.1	4989	4908
CZN	20	84.5	79.1	70.2	78.5	8.7	9.0	3813	4100
CDF fb MSM	60 fb 4	86.8	79.3	86.5	90.5	8.9	9.3	5286	5086
SSN fb MSM	25 fb 4	85.9	79.1	83.0	90.2	8.9	9.1	5264	5045
SSN+MSM (RM)	32	86.1	79.3	75.8	93.5	8.8	9.5	4659	5238
PDN fb CZN	50 fb 20	86.3	79.5	90.8	90.5	8.9	9.3	5309	5320
MSN+ISN (RM)	14	86.7	80.8	83.0	88.0	8.9	9.1	5130	4798
FNP	-	-	79.6	-	84.0	-	9.0	-	4695
Weed free		87.9	85.2	93.7	91.5	9.3	9.7	5600	5334
Weedy check		84.3	76.4	58.7	76.7	8.7	8.9	3360	3859
LSD (P=0.05)		1.5	NS	16.7	8.3	NS	NS	739	518

SSN–Sulfosulfuron, CZN–Carfentrazone, MSM–Metsulfuron, CDF–Clodinafop, PDN–Pinoxaden, MSN–Mesosulfuron and ISN–Iodosulfuron. NS–Not Significant.

sequential application of sulfosulfuron with carfentrazone resulted in grain yield at par with other herbicidal treatments (except carfentrazone alone being inferior) and weed free check during both the years. Among different herbicidal treatments, the lowest grain yield was obtained under carfentrazone 20 g/ha which was at par with weedy check. However, among grass killing herbicides, the lowest grain yield was obtained under sulfosulfuron+metsulfuron (ready-mix) 32 g/ha during 2007-08 and fenoxaprop 120 g/ha during 2008-09.

Carfentrazone-ethyl was compatible with sulfosulfuron as tank mixture and there was no adverse effect on the efficacy of both the herbicides against complex weed flora in wheat. Thus, carfentrazone 20 g/ha may be applied as tank-mix or as sequential application with sulfosulfuron 25 g/ha for achieving maximum weed control efficacy and satisfactory grain yield of wheat.

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