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Effect of Sulfosulfuron and Mesosulfuron+Iodosulfuron on Weeds and Wheat Yield

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ABSTRACT

DMA by *Phalaris minor* and BLB was significantly more in unsprayed control than all other herbicide treatments. On an average, the per cent reduction in dry matter of *P. minor* varied from 26.19 to 30.69 in herbicide treatments over unweeded control at harvest. Increase in the dose of sulfosulfuron and mesosulfuron+iodosulfuron reduced dry weight of weeds in the decreasing trend over weedy check due to varied concentrations. The studies revealed that all doses of sulfosulfuron (25, 37.5 and 50 q/ha) and mesosulfuron+iodosulfuron (12, 18 and 24 q/ha) were at par with each other in terms of yield of wheat as these herbicides gave an effective kill of weeds.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most extensively grown cereal crops of the world. In India, it is the second most important source of staple food after rice which occupies 26 million hectares of area in the country. The availability and the recommendations of selective herbicides including metoxuron, methabenzthiazuron, isoproturon, diclofopmethyl (Anonymous, 1989) made it possible to realize the potential yield of this crop in the past two decades. The sole application of isoproturon over a period of 10-12 years posed the problem of its resistance in *Phalaris minor* as it started defying the killing potential of this herbicide even at its higher rates (Malik and Singh, 1993; Walia *et al.*, 1997). The use of new alternate herbicides including sulfosulfuron, mesosulfuron and iodosulfuron was recommended which provided a great relief to the wheat crop from the resistant population of *P. minor* (Malik and Singh, 1995). The present study was, therefore, planned to evaluate the effect of ready mix of mesosulfuron+iodosulfuron and sulfosulfuron against complex weed flora of wheat.

MATERIALS AND METHODS

Field experiment was laid out in a randomized block design at the Research Farm of the Department of Agronomy, Agrometeorology and Forestry, Punjab Agricultural University, Ludhiana during **rabi** 2003-04 and 2004-05. The herbicide treatments included sulfosulfuron at 25, 37.5 and 50 g/ha and mesosulfuron+iodosulfuron at 12, 18 and 24 g/ha and unsprayed control. The mechanical analysis showed that textural class of the experimental field was loamy sand, while the chemical analysis indicated that the soil reaction (7.4) and electrical conductivity were normal (0.20 dS/m). The soil was found to be low in organic carbon (0.25%) and available nitrogen (172.1 kg/ha). However, it was high in available phosphorus (25.7 kg/ha) and medium in available potassium (222.3 kg/ha).

RESULTS AND DISCUSSION

Dry Matter Accumulation (DMA) by *Phalaris minor*

The perusal of data in Table 1 reveals that at harvest during both the years, DMA by *Phalaris minor* was significantly more in unsprayed control than all other herbicide treatments. DMA was at par with respect to all doses of sulfosulfuron and mesosulfuron+iodosulfuron to each other during 2003-04 but in 2004-05, mesosulfuron+iodosulfuron at 18 g/ha accumulated significantly more dry matter than sulfosulfuron at 50 g/ha, while rest all doses of two herbicides were at par in this regard. This variation may be due to the more availability of the herbicide to *P. minor* over a longer period under higher doses as indicated by the reduction in dry matter (Table 1) as the weed control efficacy was better with higher dose of herbicides (Singh *et al.*, 2002). On an average, the per cent reduction in dry matter of *P. minor* varied from 26.19 to 30.69 in herbicide treatments over unweeded control at harvest.

Singh *et al.* (2002) also reported similar results and observed that not much difference was observed in weed dry weight due to sulfosulfuron at 25, 30 and 45

Table 1. Effect of different treatments on dry matter accumulation of broadleaf weed and *Phalaris minor* (q/ha) in wheat

Treatment	Dose (g/ha)	Dry matter accumulation (Broadleaf weed)		Dry mater accumulation (*P. minor*)	
		At harvest		At harvest	
		2003-04	2004-05	2003-04	2004-05
Sulfosulfuron	25	4.40 (18.36)	3.90 (14.25)	2.93 (7.57)	2.65 (6.01)
Sulfosulfuron	37.5	4.27 (17.23)	3.91 (14.31)	2.89 (7.35)	2.66 (6.07)
Sulfosulfuron	50	4.16 (16.33)	3.67 (12.47)	2.74 (6.52)	2.66 (5.95)
Mesosulfuron+Iodosulfuron	12	4.53 (19.52)	4.18 (16.43)	2.86 (7.25)	2.63 (5.97)
Mesosulfuron+Iodosulfuron	18	4.47 (18.94)	4.14 (16.11)	2.82 (6.95)	2.51 (4.90)
Mesosulfuron+Iodosulfuron	24	4.27 (17.21)	3.90 (14.19)	2.75 (6.57)	2.48 (5.16)
Control (Unsprayed)		5.26 (26.70)	4.94 (23.38)	4.10 (15.85)	3.45 (10.89)
LSD (P=0.05)	0.13	0.30	0.23	0.16	

Figures in parentheses are means of original values, data subjected to $\sqrt{x}+1$ transformation.

g/ha. Weed control efficacy was higher with application of herbicide at higher doses (25, 30 and 45 g/ha) and was at par. Increasing the dose of mesosulfuron +iodosulfuron reduced dry weight of weeds in the decreasing trend over weedy check and also confirms the findings of Brar *et al.* (2003).

Dry Matter Accumulation (DMA) by BLB

DMA of BLB was significantly higher in unsprayed control than all other treatments during both the years. Dry matter was significantly more accumulated where mesosulfuron+iodosulfuron applied at 12 g/ha than 24 g/ha and at par with 18 g/ha. Similarly, DMA by BLB was significantly less in sulfosulfuron at 50 g/ha than 25 g/ha and at par with 37.5 g/ha during 2003-04.

Increasing in the dose of sulfosulfuron and mesosulfuron+iodosulfuron reduced dry weight of weeds in the decreasing trend over weedy check due to varied concentrations and longevity in the control potential and was also confirmed by Dixit *et al.* (1998), Singh *et al.* (2003b) and Singh and Kundra (2003). Brar *et al.* (2003) also reported that DMA by broad-leaved weeds was nearly nil (zero) in mesosulfuron+ iodosulfuron applied at 12+2.4 and 15+3 g/ha and sulfosulfuron at 25 g/ha during three years' study.

The data (Table 2) revealed that grain yield was significantly higher in all herbicide treatments as compared to unsprayed control in both the years, whereas all the herbicide treatments were at par in respect of grain yield in both the years. Higher grain yield in these herbicide treatments was due to better weed control which gave 22.64% reduction in weed dry matter compared to unweeded control thus resulting in better crop development including tillering, dry matter production and grain formation thereby favouring the

Table 2. Effect of different treatments on grain yield (kg/ha) of wheat

Treatment	Dose (g/ha)	Grain yield	
		2003-04	2004-05
Sulfosulfuron	25	5005	4707
Sulfosulfuron	37.5	4851	4646
Sulfosulfuron	50	4987	4650
Mesosulfuron+Iodosulfuron	12	5029	4853
Mesosulfuron+Iodosulfuron	18	5032	4716
Mesosulfuron+Iodosulfuron	24	5177	4760
Control (Unsprayed)	-	3643	3068
LSD (P=0.05)	-	791	843

grain yield. During 2004-05, application of herbicides maintained their superiority over unsprayed control. The higher grain yield with sulfosulfuron and mesosulfuron +iodosulfuron at all doses could be ascribed to higher dry matter accumulation by wheat at all the stages of growth and reduction in weeds.

Effect of Herbicides on Weed Population

Weed population though may not reflect the true competition but it does indicate the pressure they exert over an area. The weed flora of the experimental field consisted of grass weed *P. minor* and broadleaf weeds like *Rumex dentatus, Anagallis arvensis, Melilotus alba, Lepidium sativa, Trigonella polycerata, Malva neglecta* and *Medicago denticulata.*

Population of *Phalaris minor*

The data for periodic count of *P. minor* per square metre are presented in Table 3 which indicate that though the population was lesser at harvest but at par in all the doses of both the herbicides but unsprayed control was having significantly more weed population than all treatments during both the years. The herbicide treated plots recorded significantly lesser weed number as compared to unsprayed check at all growth stages because of good control of weeds and hence crop had better growing environment. A clear examination of data revealed that higher dose of both the herbicides proved superior to a level of 100% in the kill of *P. minor* over unsprayed control during 2004-05. The results are in line with Sharma *et al.* (1999) and Saini and Angiras (2005) who reported an excellent control of *P. minor* with sulfosulfuron. Kumar *et al.* (2003) also reported the reduced population of *P. minor* with the application of 20 and 40 g/ha sulfosulfuron compared to control. Singh *et al.* (2002) also reported that *P. minor* was effectively controlled by sulfosulfuron at 25, 30 and 45 g/ha.

Population of *Lepidium sativa*

The data in Table 3 reveal that at harvest all the herbicide doses were at par with each other during both the years. Mishra and Yaduraju (2005) also reported significant reduction in total population of weeds due to sulfosulfuron. Singh *et al.* (2002) and Saini and Angiras (2005) reported the effective control of non-grassy weeds by sulfosulfuron at 25, 30 and 45 g/ha. Similarly, Singh *et al.* (2003a) reported that all BLB were controlled effectively with mesosulfuron+idosulfuron at 9, 12 and 15 g/ha.

Population of *Malva neglecta*

The data presented in Table 3 indicate that at harvest the population was significantly more under unsprayed control than all other treatments and rest all the treatments were at par with each other during both the years.

Population of *Rumex dentatus*

The data in Table 4 show that at harvest all the doses of mesosulfuron+iodosulfuron resulted in significantly less population than sulfosulfuron at 25 and 37.5 g/ha but

Table 3. Effect of different treatments on population of weeds/m^2 in wheat

Treatment	Dose (g/ha)	Population of *Phalaris minor*		Population of *Lepidium sativa*		Population of *Malva neglecta*	
		At harvest		At harvest		At harvest	
		2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
Sulfosulfuron	25	1.50 (2.0)	1.31 (1)	3.21 (11.0)	3.85 (14.0)	1.81 (3.0)	1.31 (1)
Sulfosulfuron	37.5	1.31 (1.0)	1.62 (2)	3.55 (14.0)	2.86 (9.0)	1.31 (1.0)	1.0 (0.0)
Sulfosulfuron	50	1.31 (1.0)	1.0 (0.0)	2.55 (8.0)	2.27 (5.0)	1.31 (1.0)	1.0 (0.0)
Mesosulfuron+Iodosulfuron	12	1.65 (3.0)	1.50 (2.0)	3.18 (11.0)	3.68 (13.0)	1.0 (0.0)	1.0 (0.0)
Mesosulfuron+Iodosulfuron	18	1.50 (2.0)	1.31 (1.0)	3.08 (10.0)	3.39 (11.0)	1.0 (0.0)	1.0 (0.0)
Mesosulfuron+Iodosulfuron	24	1.50 (2.0)	1.0 (0.0)	2.70 (8.0)	3.01 (9.0)	1.0 (0.0)	1.0 (0.0)
Control (Unsprayed)		4.35 (18)	3.28 (10.0)	7.27 (52.0)	6.80 (47.0)	3.30 (10.0)	2.81 (7)
LSD (P=0.05)		1.20	0.95	2.31	1.67	0.81	0.40

Figures in parentheses are means of original values, data subjected to $\sqrt{+1}$ transformation.

at par with each other. All the doses of sulfosulfuron were at par with each other during 2003-04. In 2004-05, all doses of both the herbicides were at par with each other. The results are in line with those of Singh *et al.* (2002), Singh *et al.* (2003a) and Saini and Angiras (2005).

Population of Other Broadleaf Weeds (BLB)

The data in Table 4 show that during both the years, the population was at par with respect to all doses of two herbicides at harvest. Singh *et al.* (2002) and Saini and Angiras (2005) reported the effective control of non-grassy weeds by sulfosulfuron at 25, 30 and 45 g/ha. Similarly, sulfosulfuron has already been reported very effective for suppression of many broad-leaved weeds by Malik *et al.* (2000). Singh *et al.* (2003a) reported that all BLB were controlled effectively with mesosulfuron+iodosulfuron at 9, 12 and 15 g/ha.

Table 4. Effect of different treatments on plant population/m^2 of *Rumex dentatus* and other broadleaf weeds

Treatment	Dose (g/ha)	Population of *Rumex dentatus*		Population of other broadleaf weeds	
		At harvest		At harvest	
		2003-04	2004-05	2003-04	2004-05
Sulfosulfuron	25	3.43 (11.0)	2.93 (9.0)	1.0 (0.0)	1.31 (1.0)
Sulfosulfuron	37.5	3.37 (11.0)	3.06 (10.0)	1.31 (1.0)	1.0 (0.0)
Sulfosulfuron	50	2.58 (6.0)	2.55 (8.0)	1.0 (0.0)	1.0 (0.0)
Mesosulfuron+Iodosulfuron	12	1.62 (2.0)	2.31 (7.0)	1.62 (2.0)	1.50 (2.0)
Mesosulfuron+Iodosulfuron	18	1.31 (1.0)	1.78 (4.0)	1.62 (2.0)	1.31 (1.0)
Mesosulfuron+Iodosulfuron	24	1.0 (0.0)	1.31 (1.0)	1.0 (0.0)	1.0 (0.0)
Control (Unsprayed)		4.29 (18.0)	5.97 (36.0)	4.14 (17.0)	3.30 (10)
LSD (P=0.05)		1.03	2.32	0.94	0.81

Figures in parentheses are means of original values, data subjected to $\sqrt{x+1}$ transformation.

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