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Standardization of dose of sulfosulforun (MON 37503) in controlling weeds of rainfed wheat (*Triticum aestivum*) under mid-hill conditions of Himachal Pradesh

J.P. SAINI AND N.N. ANGIRAS

Department of Agronomy, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur 176 062

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ABSTRACT

A field experiment was conducted during the winter (*rabi*) seasons of 1998–99 and 1999–2000 at Palampur, Himachal Pradesh, to find out the optimum dose of sulfosulfuron for controlling weeds in rainfed wheat *(Triticum aestivum* L. emend. Fiori & Paol.). Sulfosulfouron 30.0 g a.i./ha being at par with sulfosulfuron 30.0 g a.i./ha + surfactant and sulfosulfuron 37.5 g a.i./ha with and without surfactant resulted in significantly lower weed dry weight and higher yield attributes and yield of wheat when compared with the lower doses during both the years. However, during the first year diclofopmethyl 0.75 kg/ha being at par with isoproturon 1.0 kg ai/ha + surfactant resulted in significantly higher grain yield over other treatments, whereas during the second year dichlofop-methyl performed comparatively poor probably because of poor control of *Phalaris minor* Retz. which was the dominating weed this year. Isoproturon 1.0 kg/ha + surfactant was as effective as sulfosulfuron 37.5 g ai/ha + surfactant and hand-weeding twice during both the years and also with sulfosulfuron 37.5 g/ha without surfactant and sulfosulfuron 30.0 g ai/ha with and without surfactant during the second year of study.

Key words: Wheat, Sulfosulfuron, Surfactant, *Phalaris minor, Avena fatua.*

Wheat is an important winter (*rabi*) and weed infestation is one of the major constraints in its cultivation in Himachal Pradesh. Wheat fields, many times are infested with both grass and borad leaf weeds, thus more than one herbicides are required to control the mixed flora. Tank mixed application of isoproturon and 2, 4-D has been in practice for the control of mixed weed population in wheat for the last many years (Kumar and Singh, 1994; Kumawat *et al.,* 1998).

At present some new herbicides are available for weed control in wheat which are broad-spectrum and control both grass and broad leaf weeds more effectively. Among these herbicides, sulfosulfuron is of great importance. However, it needs to be standardized for its dose under varying agro-climatic conditions of the state. Therefore, present investigation was undertaken.

MATERIALS AND METHODS

A field experiment was conducted under rainfed conditions during the winter seasons of 1998–99 and 1999–2000 at the Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur.

The soil of the experimental field was clay loam in texture, acidic in reaction, medium in available nitrogen and phosphorus and high in available potassium. The experiment was laid out in randomized block design with 3 replications and 12 tretments. The treatments consisted of 4 doses of sulfosulfuron (15.0, 22.5, 30.0 and 37.5 g a.i./ha) with and without surfactant 0.5%, isoproturon 1.0 kg/ha + surfactant 0.5 % diclofop-methyl 0.75 kg/ha, hand-weeding (40 and 70 days after sowing and weedy check. Wheat variety 'Surbhi' ('HPW 89') was sown using seed rate 100 kg/ha in the first week of November following all recommended packagte of practices. Sulfosulfuron was sprayed 35 days after sowing of the crop. Weed population and weed dry weight were recorded 120 days after sowing using 50 cm × 50 cm quadrate.

RESULTS AND DISCUSSION

Effect on weeds

Weed flora: The weed flora of experimental field consisted of *Avena fatua, Phalaris minor* and *Lolium temulentum* among grasses; and *Coronopus didymus, Anagallis arvensis, Stellaria media* and *Vicia sp. (V. sativa* and *V. hirsute*) among broad leaf weeds. *Avena fatua, Phalaris minor, Lolium temulentum* and broad leaf weeds consistuted 42.96, 25.20, 15.15 and 16.88% of total weed flora during the first year and 19.10, 42.14, 15.85 and 22.75% during the second year respectively.

Species-wise and total weed population: All weed-con-

Table 1. Effect of treatments on species-wise and total weed population

Treatment	Species-wise weed population/m²								Total weed population/m²	
	P. minor		*A. fatua*		*L. temulentum*		Broad-leaf weeds			
	1998–99	1999–2000	1998–99	1999–2000	1998–99	1999–2000	1998–99	1999–2000	1998–99	1999–2000
Sulfosulfuron 15.0 g ai/ha	6.9 (46.8)	9.5 (88.4)	8.5 (72.3)	7.6 (54.7)	5.0 (24.5)	5.4 (27.4)	4.6 (19.4)	5.5 (27.5)	12.9 (163.0)	14.1 (198.0)
Sulfosulfuron 22.5 g ai/ha	6.3 (38.6)	8.6 (74.6)	6.4 (42.5)	7.1 (50.6)	5.2 (25.8)	4.5 (19.4)	3.1 (8.6)	2.5 (5.6)	10.7 (115.5)	12.4 (150.2)
Sulfosulfuron 30.0 g ai/ha	5.7 (32.8)	5.4 (27.4)	5.2 (28.3)	4.6 (21.8)	4.5 (18.9)	4.9 (23.0)	1.0 (0.0)	1.0 (0.0)	9.0 (80.0)	8.4 (72.2)
Sulfosulfuron 37.5 g ai/ha	5.1 (24.7)	4.7 (20.3)	5.3 (26.7)	4.3 (17.6)	3.7 (13.5	3.2 (9.1)	1.0 (0.0)	1.0 (0.0)	8.1 (64.9)	6.9 (47.0)
Sulfosulfuron 15.0 g ai/ha + surfactant 0.5%	7.1 (49.3)	8.9 (79.4)	8.1 (67.3)	6.3 (38.8)	4.6 (21.2)	4.9 (23.7)	2.5 (6.2)	2.3 (4.8)	12.0 (144.0)	12.2 (146.7)
Sulfosulfuron 22.5 g ai/ha + surfactant 0.5%	6.8 (45.8)	8.0 (64.5)	7.9 (64.7)	5.7 (32.3)	4.4 (18.6)	5.1 (24.2)	1.0 (0.0)	1.0 (0.0)	11.3 (129.0)	11.0 (121.0)
Sulfosulfuron 30.0 g ai/ha + surfactant 0.5%	5.2 (26.9)	4.8 (23.4)	6.0 (35.3)	4.0 (20.6)	3.3 (9.8)	2.9 (7.2)	1.0 (0.0)	1.0 (0.0)	8.6 (72.0)	7.2 (51.2)
Sulfosulfuron 37.5 g ai/ha + surfactant 0.5%	5.4 (27.5)	4.4 (17.6)	5.2 (27.7)	4.1 (16.8)	3.5 (11.1)	2.7 (6.5)	1.0 (0.0)	1.0 (0.0)	8.3 (66.3)	6.5 (40.8)
Isoproturon 1.0 kg/ha + surfactant 0.5%	4.6 (19.8)	5.0 (34.3)	5.9 (24.3)	5.2 (26.2)	4.8 (21.4)	4.6 (19.5)	4.9 (23.4)	4.3 (18.9)	10.0 (98.9)	9.5 (90.0)
Diclofop-methyl 0.75 kg/ha	6.1 (37.1)	7.1 (49.3)	3.5 (11.1)	2.8 (6.8)	4.3 (17.4)	3.9 (14.3)	5.4 (28.9)	6.4 (40.2)	9.7 (93.4)	10.6 (111.6)
Hand-weeding (40, 70 DAS)	4.7 (20.4)	5.3 (27.8)	3.8 (15.1)	1.9 (2.6)	3.6 (12.3)	3.3 (9.9)	2.6 (5.8)	1.9 (2.8)	7.5 (53.6)	7.8 (57.5)
Weedy check	7.1 (49.4)	9.3 (85.6)	9.2 (84.2)	6.3 (38.8)	5.5 (29.7)	5.9 (32.2)	5.8 (32.7)	6.9 (46.2)	13.9 (196.0)	14.5 (202.8)
CD (P=0.05)	0.82	1.02	1.10	0.9	1.04	0.96	1.03	0.99	1.74	1.95

DAS, Days after sowing; $\sqrt{x+1}$ transformation used; figures in the parentheses are the means of original values

trol treatments resulted in significantly lower species-wise and total weed population compared with weedy check (Table 1). Sulfosulfuron 30.0 and 37.5 g ai/ha both with and without surfactant, being at par with each other and also with isoproturon 1.0 kg/ha + surfactant and hand-weeding twice, resulted in significantly lower population of *Phalaris minor, Avena fatua* and *Lolium temulentum* over its lower doses. These results are in conformity partially with those of Sharma *et al.* (1999), who reported an excellent control of *Phalaris minor* with sulfosulfuron 33.3 g/ha. Diclofop-methyl 0.75 kg ai/ha controlled *Avena fatua* effectively but showed comparatively poor control of *Phalaris minor* compared to the best treatments mentioned above. Singh *et al.* (1998) also reported poor control of *Phalaris minor* with diclofop 88.0 g/ha. Broad leaf weeds were completely controlled with sulfosulfuron 30.0 and 37.5 g ai/ha with and without surfactant and 22.5 g/ha with surfactant. Sulfosulfuron 20 g/ha with surfactant and 30 g/ha without surfactant and hand-weeding twice were the next best treatments in controlling braod-leaf weeds. These results are similar to those reported by Singh *et al.* (1998) and Balyan (1999), who observed satisfactory control of broad leaf weeds with sulfosulfuron 33.3 g/ha and sulfosulfuron 25 g/ha + surfactant 0.5% respectively.

Sulfosulfuron 37.5 and 30.0 g ai/ha with and without surfactant and hand-weeding twice resulted in significant lower total weed population compared with the other treatments during both years, however, during the first year this was also at par with isoproturon 1.0 kg/ha + surfactant and diclofop-methyl 0.75 kg/ha.

Weed dry weight

The weed-control treatments resulted in significantly lower total weed dry weight compared to weedy check

Table 2. Effect of weed-control treatments on weed dry weight, yield attributes and yield of wheat

Treatment	Weed dry weight (g/m²)		Effective tillers/m row		Spikelets/ spike		Grains/ spike		1,000-grain weight (g)		Grain yield (q/ha)	
	1998–99	1999–2000	1998–99	1999–2000	1998–99	1999–2000	1998–99	1999–2000	1998–99	1999–2000	1998–99	1999–2000
Sulfosulfuron 15.0 g ai/ha	108.4	180.6	46.4	51.2	10.4	12.2	30.2	32.4	44.7	45.2	16.5	14.4
Sulfosulfuron 22.5 g ai/ha	64.7	104.5	44.9	56.2	12.3	11.5	31.7	31.1	45.3	44.8	20.2	19.8
Sulfosulfuron 30.0 g ai/ha	51.0	34.6	60.9	70.1	14.8	15.1	35.4	33.0	47.1	48.8	22.5	27.5
Sulfosulfuron 37.5 g ai/ha	44.6	22.7	64.1	72.7	16.7	15.6	40.1	37.8	48.7	52.6	23.8	29.7
Sulfosulfuron 15.0 g ai/ha +	98.8	168.6	51.3	59.6	11.1	10.6	29.8	31.0	45.0	43.8	18.7	16.3
Sulfosulfuron 22.5 g ai/ha +	65.2	105.9	54.0	61.2	12.4	13.1	32.6	32.5	43.6	44.1	21.0	18.9
Sulfosulfuron 30.0 g ai/ha +	48.5	27.6	60.78	71.3	15.8	14.9	41.6	37.9	50.8	477.6	21.9	28.2
Sulfosulfuron 37.5 g ai/ha +	35.7	18.4	64.7	70.9	16.2	15.8	43.4	40.8	52.2	50.6	24.3	30.5
Isoproturon 1.0 kg/ha +	32.6	40.7	71.0	69.5	16.4	15.5	45.1	42.7	51.4	52.3	26.5	28.0
Hand-weeding (40, 70 DAS)	34.5	10.8	69.6	67.1	15.9	16.4	45.6	42.4	51.0	52.6	24.7	31.2
Weedy check	132.6	184.3	40.3	36.6	9.4	10.2	26.2	29.3	42.0	44.4	14.5	12.8
CD (P=0.05)	6.8	14.2	5.8	4.7	1.4	1.1	3.5	2.1	4.2	3.8	2.6	3.2

DAS, Days after sowing; +=0.5% surfactant

(Table 2). Though sulfosulfuron 37.5 g ai/ha + surfactant being at par with hand-weeding resulted in significantly lower weed weight during both the years, it was statistically at par with isoproturon 1.0 kg/ha + surfactant and diclofop-methyl 0.75 kg/ha during the first year and sulfosulfuron 30.0 g+ surfactant and sulfosulfuron 37.5 g ai/ha without surfactant during the second year of study. Sulfosulfuron 30.0 g + surfactant and sulfosulfuron 37.5 g/ha without surfactant during the first year and sulfosulfuron 30.0 g ai/ha with and without surfactant during the second year were the next best treatments. Diclofop-methyl 0.75 kg/ha during the second year performed poorly and resulted in signifiantly higher weed dry weight over sulfosulfuron 30 and 37.5 g ai/ha with and without surfactant, isoproturon 1.0 kg/ha + surfactant and hand-weeding twice which may be attributed to poor control of *Phalaris minor* and broad leaf weeds which were dominating this year (Table 1).

Effect on crop

The weed-control treatments resulted in significantly higher yield attributes and yield of wheat over weedy check (Table 2). Sulfosulfuron 30.0 and 37.5 g ai/ha with and without surfactant being statistically at par with each other resulted in significantly higher number of effective tillers/m row length, spikelets/spike, grains/spike, 1,000-grain weight and hence significantly higher wheat grain yield over its lower doses. However, during the first year diclofop-methyl 0.75 kg/ha being at par with isoproturon 1.0 kg/ha + surfactant was significantly superior to sulfosulfuron 30.0 and 37.5 g ai/ha, as it showed higher values of almost all yield attributes and hence higher wheat yield. This may be attributed to the reason that during the first year *Avena fatua* and during the second year *Phalaris minor* were present in maximum number. *Avena fatua* was effectively controlled, whereas *Phalaris minor* was poorly controlled with the application of diclofop-methyl 0.75 kg/ha which ultimately resulted in lower total weed dry weight during the first year and higher during the second year. Isoproturon 1.0 kg/ha + surfactant was as effective as sulfosulfuron 37.5 and 30.0 g/ha in giving higher grain yield. These results corroborate the findings of Singh *et al.* (1998), who reported that sulfosulfuron 33.3 g/ha resulted in maximum grain yield of wheat and it was statistically at par with isoproturon 1.0 kg/ha.

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