

## Efficacy of Metsulfuron-methyl on Weeds in Wheat and its Residual Effects on Succeeding Soybean Crop Grown on Vertisols of Rajasthan

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### ABSTRACT

In wheat broadleaf weeds were dominant (82.87%) especially infested by *Chenopodium* spp. Application of metsulfuron-methyl was very effective against the broad-leaf weeds and did not have residual effect on succeeding soybean crop. Metsulfuron methyl at 4 g ha<sup>-1</sup> was most effective in controlling broadleaf weeds and better than 2, 4-D and farmers' practice in increasing wheat yield.

### INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important food grain crop grown in Rajasthan during the **rabi** season. Heavy infestation of weeds has become a serious problem for increasing and sustaining productivity of wheat. Some of the weeds are not controlled by the traditional herbicides and mostly regenerate after hand weeding. It is estimated that on an average weed infestation brings down the wheat yield by more than 66% (Singh and Singh, 2002). With the changing scenario of weed management, farmers need herbicides having high efficacy, low phytotoxicity and cost effective as well as no residual effects on succeeding crop. Many new herbicides have been introduced and metsulfuron-methyl (MSM) is one of them to control weeds in cereals which can be used at extremely low rate. Therefore, an experiment was conducted to evaluate metsulfuron-methyl in wheat and its residual effect on succeeding soybean crop as mostly wheat-soybean cropping sequence is followed in south-eastern Rajasthan.

### MATERIALS AND METHODS

Field experiment was conducted during **rabi** seasons of 1999-2000 and 2000-01 at Agricultural

Research Station, Kota of Maharana Pratap University of Agriculture & Technology, Udaipur. The soil of the experimental field was clay-loam (vertisol) having pH 7.96, EC 0.42 dSm<sup>-1</sup>, organic carbon 0.56%, available N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O 335, 24 and 315 kg ha<sup>-1</sup>, respectively. Treatments consisted of metsulfuron-methyl (MSM) at 3.0, 4.0 and 5.0 g ha<sup>-1</sup>, 2, 4-D at 750 g ha<sup>-1</sup> as post-emergence applied at 30 days after sowing (DAS), two hand weeding (2 HW) at 35 and 55 days, farmer's practice (FP, one hand weeding at 40 DAS) and weedy check. The treatments were laid out with three replications in randomized block design. Metsulfuron-methyl was sprayed with surfactant (500 ml ha<sup>-1</sup>) using spray volume of 500 l ha<sup>-1</sup>. The wheat variety Raj 3765 was sown 22.5 cm apart in lines with tractor mounted seed drill on December 10, 1999 and on December 3, 2000 and harvested in the second week of April. All the recommended package of practices other than weed control were followed to raise the crops. Weed species and their dry matter at 90 days stage of crop growth were recorded from two randomly selected quadrates (0.25 m<sup>2</sup>) in each plot and expressed as number and g m<sup>-2</sup>. The treatments were applied only in wheat and evaluated for their residual effects in succeeding soybean crop grown on same site using variety JS-335 with the onset of monsoon.

## RESULTS AND DISCUSSION

### Effect on Weeds

Major weed flora observed in the experimental field were : *Chenopodium album*, *Chenopodium murale*, *Lathyrus aphaca*, *Angallis arvensis*, *Melilotus alba*, *Rumex dentatus*, *Convolvulus arvensis*, *Vicia hirsuta*, *Medicago denticulata* among broadleaf weeds and *Avena ludoviciana*, *Cynodon dactylon*, *Cyperus rotundus* were among grasses and sedges. The field was mainly dominated and colonized of broadleaf weeds (82.87%) especially by *Chenopodium* spp. (34.5%), whereas grasses and sedges contributed to 13-18%. The population of *A. ludoviciana* was sparse.

Metsulfuron-methyl gave excellent control of broad-leaved weed species and better than 2, 4-D, farmer's practice (one hand weeding) and weedy check (Table 1). Metsulfuron-methyl at 4 g ha<sup>-1</sup> was found very effective but either of the doses i. e. 3, 4 and 5 g ha<sup>-1</sup> did not prove effective against grasses and had only little suppressing effects on sedges. Weed control efficiency by metsulfuron-methyl at 3, 4 and 5 g ha<sup>-1</sup> was 78.2, 82.9 and 80.5%, respectively, at 90 days.

### Effect on Yield

Metsulfuron-methyl at 4 g ha<sup>-1</sup> caused higher increase in yield than 2, 4-D and farmer's practice. The number of spikes, spike length, number of seeds per spike and 1000-grain weight were influenced significantly being highest in two hand weedings closely followed by metsulfuron-methyl applied at 4 and 5 g ha<sup>-1</sup> and were minimum in weedy check elucidating the effect of competing weeds. The highest grain yield of 4556 kg ha<sup>-1</sup> was recorded under two hand weedings being at par with metsulfuron-methyl at 4 and 5 g ha<sup>-1</sup>. Metsulfuron methyl at 4 g ha<sup>-1</sup> was found effective and was significantly superior to 3 g ha<sup>-1</sup> and at par with 5 g ha<sup>-1</sup> recording grain yield of 4425 and 4470 kg ha<sup>-1</sup>, respectively (Table 2). Unweeded control had recorded significantly lowest grain as well as straw yields (2655 and 3153 kg ha<sup>-1</sup>), respectively. The increase in crop yield was due to increase in productive tillers, number of grains per spike and 1000-grain weight owing to decrease in crop-weed competition due to better control of weeds. Pandey *et al.* (2001) have also reported better weed control and increase in wheat yield due to metsulfuron methyl (4 g ha<sup>-1</sup>).

Table 1. Weed density and weed dry weight as influenced by metsulfuron-methyl in wheat

Treatment	Dose (g ha <sup>-1</sup> )	Weed density (No. m <sup>-2</sup> ) 90 DAS						Weed dry weight (g m <sup>-2</sup> ) 90 DAS					
		Broad-leaved weeds			Total			Broad-leaved weeds			Total		
		1999- 2000	2000- 01	Mean	1999- 2000	2000- 01	Mean	1999- 2000	2000- 01	Mean	1999- 2000	2000- 01	Mean
Metsulfuron-methyl	3.0	11	9	10	23	16	20	13.6	10.5	12.0	22.7	18.7	20.7
Metsulfuron-methyl	4.0	7	5	6	17	12	14	8.7	6.2	7.5	16.7	14.2	15.4
Metsulfuron-methyl	5.0	7	4	5	24	18	21	7.7	8.4	8.1	21.4	15.5	18.5
2, 4-D	750	13	12	12	25	21	23	19.3	16.2	17.8	30.6	24.5	27.5
Hand weedings (35 & 55 DAS)		6	5	5	6	6	6	5.6	4.9	5.3	8.4	8.9	8.7
Farmer's practice (1 Hand weeding 40 DAS)		29	25	27	30	26	28	49.3	43.5	66.4	54.3	53.4	53.9
Weedy		93	89	91	88	89	88	85.7	76.8	81.3	97.0	91.5	94.3
LSD (P=0.05)		1.6	1.9	-	-	-	-	2.1	2.4	-	-	-	-

Table 2. Effect of metsulfuron methyl on wheat and succeeding crop of soybean

Treatment	Dose		Wheat						Soybean									
	(g ha <sup>-1</sup> )		No. of shoots m <sup>-2</sup> row length	1000-grain weight (g)		Straw yield (kg ha <sup>-1</sup> )	Grain yield (kg ha <sup>-1</sup> )	Plant stand (No. m <sup>-2</sup> ) 20 DAS	Crop dry matter (g plant <sup>-1</sup> ) 60 DAS		Seed yield (kg ha <sup>-1</sup> )							
	1999- 2000	2000- 01		1999- 2000	2000- 01				1999- 2000	2000- 01	2000	2001	2000	2001	2000	2001		
Metsulfuron-methyl	3.0	69.3	111	115	43.6	46.0	3520	3710	3615	3466	3750	3608	41	41	33.6	38.7	2120	2050
Metsulfuron-methyl	4.0	80.5	83.0	133	43.5	49.5	4350	4533	4441	4150	4696	4425	42	41	35.8	41.2	2160	2170
Metsulfuron-methyl	5.0	77.4	78.7	130	44.3	49.8	4186	4296	4541	4166	4775	4470	42	42	35.9	41.9	2175	2195
2, 4-D	750	80.2	77.0	123	44.0	46.4	3860	4056	3958	3700	4266	3983	42	41	34.8	41.5	2165	2165
Hand weeding (35 & 55 DAS)		88.4	91.7	141	45.4	47.5	4926	4650	4788	4233	4880	4556	42	42	36.0	44.7	2190	2210
Farmer's practice (1 Hand weeding 40 DAS)		69.7	67.7	93	41.7	41.9	3353	3633	3493	2933	3283	3108	42	41	34.0	40.5	2130	2150
Weedy		58.2	62.3	77	34.5	37.7	3090	3216	3153	2533	2780	2655	41	40	32.5	35.5	2075	2016
LSD (P=0.05)		6.6	7.1	7.3	8.6	1.5	0.17	160	118	132	328	233	NS	NS	NS	NS	NS	NS

DAS=Days after sowing, NS=Not Significant.

### Residual Effect on Succeeding Soybean Crop

Residual studies at same site on soybean (cv. JS-335) showed that either of the doses of metsulfuron-methyl did not leave any residual toxicity to the succeeding soybean crop. The succeeding soybean did not show any visual phytotoxic symptoms as plant stand, plant dry matter and yield were not affected due to residual effects of metsulfuron-methyl (Table 2).

### REFERENCES

- Pandey, J., B. N. Mishra and A. K. Verma, 2001. Effect of metsulfuron-methyl, 2, 4-D and their tank mix on weeds and yield of wheat (*Triticum aestivum*). *Ann. agric. Res.* **22** : 100-103.
- Singh, Govindra and Mahendra Singh, 2002. Bio-efficacy of metsulfuron-methyl in combination with isoproturon for control of grassy and non-grassy weeds in wheat. *Indian J. Weed Sci.* **34** : 9-12.