

Effect of isoproturon tank mix with metsulfuron and 2,4-D on weeds and yield of wheat (*Triticum aestivum*)

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ABSTRACT

An experiment was conducted during the winter season of 1998–99 and 1999–2000 at New Delhi, to find out the effect of isoproturon tank mix with metsulfuron and 2,4-D. A competition was recorded between wheat (*Triticum aestivum* L. emend. Fiori & Paol.) and canary grass (*Phalaris minor* Retz.), wild oat (*Avena ludoviciana*), blue pimpernel (*Anagallis arvensis* L.) and lambsquarters (*Chenopodium album* L.). Competition by these species lowered crop yield by 35%. Isoproturon and its tank mix with metsulfuron and 2,4-D gave excellent control of blue pimpernel (90 to 100%) and lambsquarters (82–97%), moderate control of canary grass (68–87%) but poor control of wild oat (16–36%). The highest increase in yield attributes and yield was under hand-weeding which was significantly superior to other treatments. The effect of tank mix of isoproturon (1,000 g/ha) and 2,4-D (500 g/ha) was consistent and it resulted in higher increase than that of tank mix of metsulfuron.

Key words : Wheat, *Triticum aestivum*, Herbicides, Isoproturon, Metsulfuron, 2,4-D, Tank mix.

In recent years, wheat cultivation is beset due to weed infestation. Weeds which invade divest the crop of half of applied nitrogen (Chasalin and Timafeera, 1974) and considerable amount of other major and micro-nutrients, thereby resulting in heavy yield reduction. Average reduction in grain yield occurs about 30% (Pandey and Singh, 1997). Yield losses increase with increasing population of grassy weeds. A most prevalent pernicious and virulent grassy weed species canary grass had developed resistance against widely used herbicide isoproturon, thereby compounding its control problem further. It is, therefore, of utmost importance to devise and modify the control techniques to minimize weed menace to ensure better crop-growth environment. Hence present study was undertaken to find out the effect of mixture of isoproturon with metasulfuron and 2,4-D on weeds and crop yields.

MATERIALS AND METHODS

An experiment was conducted at the Indian Agricultural Research Institute, New Delhi, during winter (*rabi*) season of 1998–99 and 1999–2000. The soil of the experimental plot was sandy loam with pH 8.0–8.2, organic C 0.53 to 0.66%, available P and K 10.6 and 258 kg/ha in 1999 and 11.2 and 255 kg/ha in 2000 respectively.

The experiment included 9 treatments (Table 1) and was conducted in randomized block design with 3 replications. The crop was fertilized with 100 kg N, 40 kg P₂O₅ and 60 kg K₂O/ha through urea, single superphosphate and

muriate of potash respectively. Half of N and full dose of phosphorus and potassium were applied at the time of sowing, and remaining nitrogen at first irrigation 25 days after sowing.

RESULTS AND DISCUSSION

Effect on weeds

Competition between wheat and canary grass (20 plants/m²), wild oat (15/m²), blue pimpernel (25/m²) and lambsquarters (20/m²) was keen. Besides, fumitory (*Fumaria parviflora* L.), corn spurry (*Spergula arvensis* L.), field bind weed (*Convolvulus arvensis* L.), swine cress (*Coronopus didymus*) and Canada thistle [*Cirsium arvense* (L.) Scop] also competed but their effect was insignificant, as their population was very thin. The competition effect was markedly reduced by weed-control treatments, as evident from the significant decrease in population and dry-matter accumulation (Table 1). Under hand-weeding treatment, since weeds were removed twice at critical growth stages, their population and dry-matter accumulation were lower than all other treatments. Slightly higher population and dry-matter accumulation under herbicide treatments may be ascribed to their failure to effectively control all the weed species (Table 1) and weed species which germinated and grew after their spray. Similar was the finding of Pandey and Singh (1994). Weed-control treatments had different effect on weed species. Isoproturon in combination with metsulfuron resulted in

Table 1. Effect of weed-control treatments on weeds, yield attributes and yield of wheat

Treatment	Dose	Weed population		Weed dry weight		Grains/ear		Weight of grain/ear		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
Weedy check		6.78 (92)	9.18 (168)	7.64 (11.2)	8.55(14.6)	30.42	30.90	1.39	1.40	36.17	36.57	36.07	36.05
Hand-weeding	20&40	1.68 (6)	2.12 (9)	1.74 (6)	1.87(0.7)	42.33	42.7	1.89	1.90	4.40	42.7	55.72	55.50
Isoproturon	750	1.95 (8)	3.83 (29)	2.28(10)	5.58(6.2)	39.33	41.7	1.79	1.81	41.20	41.6	41.22	43.64
Isoproturon	1000	3.00 (18)	3.46 (16)	3.46 (24)	4.06(3.3)	38.40	41.9	1.74	1.87	40.27	42.2	43.47	47.83
Isoproturon+metsulfuron	750 + 2	2.89 (16)	2.86 (27)	4.22 (3.6)	4.22(4.6)	40.70	41.0	1.83	1.88	41.33	42.0	48.30	45.71
Isoproturon+metsulfuron	1000 + 4	2.91 (17)	3.13 (20)	4.20 (3.0)	4.25(3.6)	39.93	39.5	1.73	1.75	40.17	41.4	39.29	41.71
Isoproturon+2,4-D	750 + 500	3.08 (19)	3.03 (18)	3.94 (2.1)	4.58(2.1)	38.63	40.3	1.65	1.71	40.47	41.7	40.25	43.56
Isoproturon+2,4-D	100 + 500	2.61 (14)	3.29 (22)	4.54 (4.1)	4.39(1.9)	39.00	41.9	1.75	1.82	41.17	42.7	48.14	47.99
CD (P=0.05)		0.22	0.23	0.25	0.23	1.11	0.23	0.03	0.043 *	0.55	0.45	1.59	2.90

Figures in parentheses indicate the population and weed dry weight (q/ha)

higher control of canary grass than that of its combination with 2,4-D, but alone it was as effective as its combination. Isoproturon alone or in combination was least effective against *A. ludoviciana* but most effective against *A. arvensis* and *C. album*. Its combination with 2,4-D proved more potent compared to isoproturon against the latter 2 weed species. The differential behaviour of isoproturon and its combination may be ascribed to their selectivity against different weed species.

Effect on yield attributes and yield

In both the years, weed-control treatments resulted in significant increase in yield attributes. Hand-weeding resulted in significantly higher increase in yield attributes compared to all other treatments. During 1998-99, increase in grains/ear in isoproturon 750 g/ha + metsulfuron 2/g ha was significantly higher than the rest of the treatments and in both the years. Weight of grains/ear and 1,000-grain weight were similar in isoproturon (750 g/ha) and isoproturon (1000 g/ha) + 2,4-D (500 g/ha) but higher than other treatments. The increase in these yield attributes may be assigned to effective control of weeds.

Average grain yield reduction due to weed competition

was 35%. In both the years, weeding twice at critical stages resulted in the higher yield which was significantly superior to all other treatments. The effect of isoproturon (1,000 g/ha) and 2,4-D (500 g/ha) mixture was consistent and it was superior to all the other treatments except isoproturon (750 g/ha) + metsulfuron (2 g/ha) in 1998-99 and isoproturon (750 g/ha) in 1999-2000. This higher increase in these treatments may be assigned to marked increase in yield attributes and effective control of weeds. Pandey and Singh (1997) also reported similar decrease in weed population and increase in yield due to sulfonylurea herbicides. Increase in wheat yield with mixture isoproturon + metsulfuron was recorded by Pandey and Singh (1994).

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