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Effect of time and method of isoproturon application on weeds and yield of wheat (*Triticum aestivum*)

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ABSTRACT

A 2-year field experiment conducted at New Delhi revealed that pendimethalin (pre-emergence) and isoproturon (WP) applied after first irrigation were more effective against both grassy and broad-leaved weeds, whereas 2,4-D and fluroxypyr only against broad-leaved weeds in wheat (*Triticum aestivum* L. emend. Fiori & Paol.) . Isoproturon (WP) mixed with urea and soil were less effective as compared to their spray application. Hand-weeding resulted in higher grain yield in both the years, but was at par with pendimethalin and isoproturon (WP and its suspension) applied after irrigation in 1991–92, but proved superior to isoproturon (suspension) in 1992–93. No significant difference was observed between pendimethalin and isoproturon (WP and suspension) when applied after first irrigation. Increase in grain yield was up to 18 and 12 q/ha in 1991–92 and 1992–93 respectively.

Cultivation of dwarf wheat (*Triticum aestivum* L. emend. Fiori & Paol.) has led to perceptible change in weed flora. Uncomman grass weeds are rampant and cause substantial reduction in crop yield if not controlled in time (Pandey *et al.*, 1980). They defy the common method of control. Herbicide isoproturon has been found most potent killer. This is also effective against broad-leaved weeds (Ramdhama and Sandhu, 1994). Its application brings about 14.1–19.5 q/ha increase in grain yield (Pandey *et al.*, 1980), but increase in grain yield depends on time and method of herbicide application Since information is meagre on time and method of isoporturon application, the present study was conducted.

MATERIALS AND METHODS

A field experiment having 12 treatments (Table 1) was conducted in randomized block design with 3 replications in winter (*rabi*) season 1991–92 and 1992–93 at New Delhi. The soil was sandy loam (Ustochrept) having pH 7.7, organic carbon 0.41%, and available P and K 12 and 112 kg/ha respectively.

Wheat variety 'HD 2329' was sown in line, 23 cm apart on 15 and 25 November in 1991 and 1992 respectively. Herbicides were sprayed and broadcast. Spraying was done using volume spray of 600 litres/ha with the help of knap-sack sprayer fitted with flat-fan nozzle. Pre-emergence application was done a day after sowing, whereas post-emergence application was done at 25 and 35 days after sowing before and after the first irrigation respectively. The broadcasting of isoproturon mixed with urea and soil was done at 35 days after sowing. The crop was fertilized with 50 kg N, 50 kg P_2O_5 and 30 kg K_2O/ha at sowing. Another 50 kg N/ha was applied at 30-day stage. In both

Table 1. Effect of weed control of weeds, yield and yield-attributing characters of wheat

Treatment	Dose (kg ai/ha)	Weed population/ 0.5 m^2		Weed dry weight (g/0.5 m^2)		Tillers/ m^2		1,000-grain (g)		Grain yield (q/ha)	
		Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2
Control		6.1 (37.0)	7.7 (58.7)	6.8 (46.3)	7.9 (61.3)	72.33	43.7	41.90	36.87	23.02	23.35
Hand-weeding		3.6 (13)	3.6 (12.3)	3.9 (14.4)	3.6 (12.2)	113.7	74.3	42.20	42.50	41.06	35.75
Pendimethalin (pre-emergence)	1.0	3.8 (14)	4.0 (15.7)	4.0 (15.3)	5.0 (24.7)	77.3	63.3	44.20	39.27	37.52	30.60
Isoproturon (WP) (before irrigation)	1.0	5.0 (25)	3.7 (13.3)	6.0 (35.6)	3.8 (14.3)	107.7	55.3	48.4	40.5	31.24	27.42
Isoproturon (WP) (after irrigation)	1.0	4.6 (21)	3.6 (12.7)	4.7 21.4)	3.5 (11.8)	90.3	58.3	41.43	41.8	33.17	30.43
Isoproturon (suspension) (before irrigation)	1.0	4.3 (18)	4.7 (22.0)	5.8 (33.5)	3.7 (13.2)	79.0	58.7	42.10	40.3	24.47	27.00
Isoproturon (suspension) (after irrigation)	1.0	4.0 (16)	5.2 (26.3)	6.0 (36.1)	3.7 (13.5)	84.3	62.7	38.07	39.7	28.66	29.25
Isoproturon (granule) (after irrigation)	1.0	4.2 (17)	4.5 (20.0)	4.5 (19.5)	5.3 (27.6)	82.7	60.0	45.47	49.9	33.33	30.11
Isoproturon (WP) + soil	1.0	4.4 (19)	3.9 (15.0)	4.2 (16.8)	3.2 (9.6)	83.0	50.0	38.10	39.97	26.73	27.70
Isoproturon (WP) + urea	1.0	4.4 (19)		4.0 (15.7)			42.7		27.38		
2,4-D	0.6	4.4 (17)	5.2 (26.3)	6.6 (43.3)	5.8 (33.0)	74.6	50.0	41.57	39.73	28.18	31.88
Isoproturon + fluroxypyr	0.5 + 1.0	4.6 (21)	3.7 (13.0)	5.5 (29.3)	3.0 (8.2)	78.0	58.0	44.63	41.5	25.28	28.99
Fluroxypyr	0.1	(27.7)	5.3	(32.8)	5.8		61.7		40.2		27.21
CD (P = 0.05)	0.98	0.30	1.38	0.26	NS	6.69	NS	1.22	8.61	2.17	

Figures in parentheses indicate original; Y_1, 1991–92; Y_2, 1992–93

the years crop was harvested in the third week of April. The data on weed population and their dry weight were collected at 100 days after sowing from 2 random places in each plot using quadrate of 0.25 m^2, and were analysed after $\sqrt{x + 0.5}$ transformation.

RESULTS AND DISCUSSION

Effect on weeds

Important weed species recorded in the experimental field, in the descending order in intensity, were *Anagallis arvensis* L., *Melilotus indica* L., *Chenopodium album* L. and *Fumaria parviflora* Lamk. among broad-leaved weeds; and *Avena fatua* L. and *Phalaris minor* Retz. among grass weeds. Besicles, a few plants of *Convolvulus arvensis* were also observed. The total weed population was not similar in both the years. In 1992–93 *Avena fatua* and *Phalaris minor* were rampant, whereas in 1991–92 *Anagallis arvensis* and *Melilotus indica* were dominant. Population of other weed species was alike in both the years.

In both the years weed-control treatments lowered the weed population significantly over weedy check, but they differed statistically among themselves. In 1991–92 isoproturon (WP) applied before irrigation proved inferior to hand-weeding, whereas in 1992–93 it was on a par with hand-weeding. Effect of isoproturon formulations applied before or after irrigation was almost identical in both the years. Weed population was not affected due to isoproturon (WP) applied before and after irrigation or mixed with urea or soil in any year. It was more effective when applied after irrigation in 1992–93. The combined application of isoproturon and fluroxypyr resulted in better control. This may be attributed to higher efficacy of fluroxypyr against broad-leaved weeds which were prevalent in 1992–93.

The weed-control treatment lowered the dry-matter accumulation by weeds significantly (Table 1). Hand-weeding caused maximum decrease but did not prove statistically superior to isoprotuon + fluroxypyr, isoproturon (suspension) before and after irrigation, isoproturon (WP) before irrigation and 2, 4-D in 1991–92, whereas in 1992–93 combinations of isoproturon and fluroxyphyr caused maximum decrease and proved statistically superior to all other treatment except hand-weeding and isoproturon (WP) mixed with soil. This finding is in conformity with findings of Kaur and Chemma (1989).

Grain yield

Effect of weed-control treatments was not alike in both the years (Table 1). During 1991–92 hand-weeding, pendimethalin and isoproturon (WP and suspension) applied after irrigation were statistically at par, but first treatment proved significantly superior to the rest of the treatments during 1992–93. Superiority of hand-weeding may be attributed to decrease in weed population, dry weight of weed and higher number of effective tillers. Pendimethalin resulted in better control of *Phalaris minor*, whereas isoproturon (suspension) that of *Avena fatua*. Besides this, they also lowered the total weed population and dry weight markedly. This might be the reason of higher yield in these treatments. Spray of isoproturon (WP) was superior to mixing it with urea or soil.

In 1992–93 effect of weed-control treatment was palpable. They effected significant increase in grain yield. Hand-weeding caused maximum increase and proved statistically superior to all other treatments. Increase may be attributed to significant in-

crease in number of litters/m^2 and lower dry-matter accumalation by weeds.

Pendimethalin, 2, 4-D and isoproturon (WP, granule) applied after irrigation caused identical increase in grain yield and proved statistically superior to isoproturon suspension applied before irrigation and isoprotruon (WP, wettable powder) applied mixed with soil after irrigation. Kaur and Cheema (1989) also observed isoproturon application after irrigation very effective. Isoproturon applied mixed with soil and urea resulted in lower increase owing to crop injury due to uneven distribution. Fluroxypyr 0.1 kg/ha lowered the population of broad-leaved weeds but favoured luxuriantly growth of grass weeds. The preponderance of latter resulted in poor crop growth and yield (Yaduraju *et al.*, 1992). Similar was the observation of Pandey and Singh (1994). Isoproturon applied after first irrigation gave good control of grassy as well as broad-leaved weeds and caused increase in grain yield.

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