

## Effect of low doses of atrazine and metribuzin on *Phalaris minor* and yield of wheat (*Triticum aestivum*)

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### ABSTRACT

A study was conducted during the winter (*rabi*) season of 2000–2002 to find out the optimum dose of atrazine and metribuzin and their effect on canary grass (*Phalaris minor* Retz.) and yield of wheat (*Triticum aestivum* L. emend. Fiori & Paol.). Canary grass lowered the crop yield by 57.6% but their control by atrazine lessened yield loss up to 53%. Atrazine at 50 and 75 g/ha completely ceased the growth of canary grass till the end of crop growth and resulted in significantly higher increase in productive tillers, yield attributes and grain yield compared to metribuzin. The latter caused higher decrease in canary grass and sweet clover (*Melilotus* spp.) population, but with its increasing dose the yield decreased significantly. Hand-weeding resulted in the highest increase, being significantly superior to all other treatments.

**Key words :** Atrazine, Metribuzin, Herbicides, *Triticum aestivum*, *Phalaris minor*

Wheat is a major cereal crop in India. A major production problem is the severe weed competition due to change in morphological structure of varieties and shift in sowing paradigm. A weed species, canary grass, is rampant and alone divests the crop of 42.2 kg N, 6.5 kg P and 71.6 kg K/ha (Walia and Gill, 1985) and lowers crop yield by 30–50% (Pandey and Singh, 1997). Other weed species which offered nominal competition are also posing serious problem. Control of these weed species is formidable one. Though herbicides have been reported effective against these weeds, most of them are narrow in selectivity and give partial control. Isoproturon, a widely used herbicide is ineffective against canary grass due to emergence of resistance biotypes. Atrazine and metribuzin are very effective against these weeds (Pandey 2002, Pandey *et al.*, 2002). As information on their optimum dose is scanty in literature the present study was undertaken.

### MATERIALS AND METHODS

An experiment having 3 dose each of atrazine (50, 75 and 100 g a.i./ha) and metribuzin (100, 150 and 250 g a.i./ha) along with hand-weeding and weedy check was conducted in randomized block design with 3 replications at the Indian Agricultural Research Institute, New Delhi, during winter (*rabi*) season of 2000–2001 and 2001–2002. Wheat variety 'HD 2285' was sown in the first week of December and harvested in the third week of April each year. Crop was fertilized with 100 kg N, 40 kg P and 40 kg K/ha through urea, single superphosphate and muriate of

potash respectively. Half dose of nitrogen and full dose of P and K were applied at the time of sowing, while remaining nitrogen was applied at the first irrigation.

The soil of the experimental plot was sandy clay loam, having pH 8.1, organic carbon 0.6, available P 19.5 kg/ha and available K 181 kg/ha.

Herbicides were applied 35 days after sowing with the help of knap-sack sprayer fitted with flat-fan nozzle using a volume spray of 600 litres water/ha. Hand-weeding was done 20 and 40 days after sowing. Weed data were transformed  $\sqrt{x+0.5}$  before statistical analysis.

### RESULTS AND DISCUSSION

#### Weed dynamics

Competition between wheat and canary grass (120 plants/m<sup>2</sup>) was intense. Other weed species which infested the crop were sweet clover, *Melilotus* spp. (20/m<sup>2</sup>), swine cross *Coronopus didymus* L. (6/m<sup>2</sup>) and wood sorrel *Oxalis acetosella* L. (0.5/m<sup>2</sup>). Competition by these species was inconsequential, as their population/m<sup>2</sup> was thin and they were quelled by canary grass due to its preponderance and luxuriant growth. Crop-weed competition was markedly brought down by weed-control treatments, as evident by significant reduction in population and weed biomass (Table 1). Hand-weeding resulted in significantly more decrease of weeds compared to other treatments except metribuzin 200 g/ha. With each increasing doses of metribuzin and atrazine significant decrease occurred in population and weed dry-matter accumulation but effect

of former was conspicuous. The effect of both the herbicides was not alike on weed species. Metribuzin resulted in lower population of canary grass and sweet clover compared to atrazine but their effect on swin cross and wood sorrel was almost identical. Canary grass plant after a week of its spray started withering and died after a month whereas after the atrazine spray plant growth completely ceased. Plants became thin but remained stunted and green till the crop was green. Similar effect of atrazine and metribuzin was reported Pandey (2002) and Pandey *et al.* (2002).

### Growth attributes

No phytotoxic effect of atrazine on crop at 50 and 75 g/ha was observed but crop colour changed to dark green while at 100 g/ha it changed to slightly pale yellow. After metribuzin application crop colour changed to pale yellow and growth ceased for about 20 to 30 days; thereafter crop revived from initial set-back. Weed-control treatments resulted in significant increase in plant height, productive tillers, grains/ear, ear weight, and 1,000-grain weight (Table 2). Hand-weeding resulted in the maximum increase and proved significantly superior to all other treatments. Atrazine brought about higher increase in all

the yield attributes compared to metribuzin. Significantly lower productive tillers were recorded at the highest dose. Cease of growth of canary grass at lower rates and gradual death at slightly higher dose of metribuzin and atrazine may be attributed to a deficiency of photosynthate necessary for growth resulting due to blockage of photosynthesis. Atrazine inhibits the formation of photosynthates (Gramlich and Frans, 1964; Ashton *et al.*, 1966).

### Grain yield

Canary grass with 120 plants/m<sup>2</sup> lowered the crop yield by 57.3% and its control by herbicide checked the yield loss up to 53%. Weed-control treatments resulted in significant increase in grain yield. Hand-weeding showed the highest increase which was significantly superior to all other treatments. This may be ascribed to marked decrease in population and weed dry weight and thereby better crop growth and increase in productive tillers and yield attributes. Similar results were reported by Pandey and Singh (1997) and Pandey (2002). Atrazine at the lowest (50 g/m<sup>2</sup>) and medium dose (75/m<sup>2</sup>) caused identical increase but remarkably higher than its highest dose (100 g/ha) and all the doses of metribuzin. This may be attributed to complete cease of growth of canary grass, lower biom-

**Table 1.** Effect of weed-control treatments on weeds (pooled means, 65 days after sowing)

Treatment	Dose (a.i. g/ha)	Weed population (No./0.50 m <sup>2</sup> )	Weed dry weight (g/0.50 m <sup>2</sup> )	Weed species (%) decrease			
				<i>P. minor</i>	<i>M. indica</i>	<i>C. didymus</i>	<i>Rumex sp.</i>
Weedy check		8.76	8.54				
Hand-weeding		2.48	1.12	96	84	86	88
Metribuzin	100	3.37	1.75	88	67	100	85
Metribuzin	150	2.50	1.35	75	88	100	90
Metribuzin	200	1.63	1.01	98	97	100	100
Atrazine	50	3.65	2.06	50	88	80	65
Atrazine	75	3.35	1.64	73	90	93	85
Atrazine	100	3.19	1.40	75	98	96	100
CD (P=0.05)		0.59	0.19				

*P. Phalaris; M, Melilotus; C, Coronopus*

**Table 2.** Effect of weed-control treatments on plant height, yield attributes and yield of wheat (pooled mean)

Treatment	Dose (a.i. g/ha)	Plant height (cm)	Productive tillers*	Ear weight (g)	Grain (g)	1,000-grain weight	Grain yield (q/ha)
Weedy check		78.1	85.2	1.45	33.87	35.6	18.0
Hand-weeding		94.8	113.6	2.29	57.3	42.2	44.8
Metribuzin	100	87.8	93.0	1.92	45.8	40.8	38.6
Metribuzin	150	85.1	91.0	1.84	42.7	38.8	35.2
Metribuzin	200	82.3	85.1	1.74	40.7	38.6	33.5
Atrazine	50	87.5	102.3	2.08	48.5	41.1	41.2
Atrazine	75	86.6	99.9	2.08	48.5	40.7	40.9
Atrazine	100	84.3	96.3	1.91	43.1	40.0	37.6
CD (P=0.05)		2.4	3.1	0.03	1.2	0.4	2.0

\*Per metre row length

ass accumulation by it and substantial increase in productive tillers and yield attributes. Metribuzin at the lowest level (100 g/ha) brought about significant increase compared to medium (150 g/ha) and the highest level (200 g/ha). Markedly lower yield was recorded at the highest dose (200 g/ha). Significant decrease with increasing levels of metribuzin despite excellent control of canary grass may be assigned to marked decrease in productive tillers and yield attributes. Pandey (1999) and Pandey *et al.* (2002) also reported similar findings.

Thus, atrazine at lower dose (50–75 g/ha) gave good control of canary grass and augmented crop productivity similar to hand-weeding but significantly higher than metribuzine. The latter at higher doses (150 and 200 g/ha) showed marked decrease in canary grass population but lowered crop yield.

#### REFERENCES

- Ashton, F.M., Bisalputa, T. and Risley, E.B. 1966. Effect of atrazine on *Chlorella vulgaris*. *American Journal of Botany* **53** : 217–219.
- Gramlich, J.V. and Frans, R.E. 1964. Kinetics of chlorella inhibition by herbicides. *Weeds* **12** : 184–189.
- Pandey, J. 1999. *Annual Report* (1998–99) Division of Agronomy, Indian Agricultural Research Institute, New Delhi, pp. 44–45.
- Pandey, J. 2002. Effect of dose and mode of metribuzin application on *Phalaris minor* and yield of wheat. *Indian Journal of Agricultural Sciences* **72** : 11–13.
- Pandey, J., Gopinath, K.A. and Verma, A.K. 2002. Investigation on low doses of atrazine, metribuzin and pendimethalin on weeds and yield of wheat. *Acta Agronomica Hungarica* **50**(4) : 956–960.
- Pandey, J. and Singh, R.P. 1997. Weed control is key on weed control in wheat (*Triticum aestivum*). *Indian Farming* **47** : 4–7.
- Walia, U.S. and Gill H.S. 1985. Influence of nitrogen and substituted urea, herbicides on the uptake of N, P and K by *Phalaris minor* Retz. and wheat. *Indian Journal of Weed Science* **17** : 12–17.