

## Evaluation of Chlorsulfuron against Weeds in Wheat (*Triticum aestivum* L.) Grown with Different Irrigations

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### Abstract

The field experiment was conducted during *rabi* of 1999-2000 and 2000-01 to evaluate efficacy of chlorsulfuron against weeds in wheat crop under different irrigation levels. Population of individual weeds was not affected by number of irrigations except *Phalaris minor*. Grain yield of wheat increased significantly with increase in number of irrigations from three to five during both years. Chlorsulfuron at 30 g/ha resulted in weed control efficiency of 71% during both years and exhibited complete control of all weed species except *Phalaris minor* consequently resulting in grain yield of wheat as 4,536 and 4,723 kg/ha during first and second year, respectively, which was statistically at par with 40 and 50 g/ha.

**Key words :** Chlorsulfuron, Weeds, Wheat, *Triticum aestivum* L. Irrigation.

With dwarf genotypes of wheat, the second most important crop in India after rice, now grown extensively under intensive cropping systems, grasses and broad-leaved weeds flourish because of the abundant availability of moisture and nutrients. In general, competition from weeds decreases wheat yields by at least 15—40%, the actual losses depending on factors including the composition of the weed flora, the crop cultivars and various agronomic practices. Higher irrigation frequencies promote the density and dry weight of weeds (1, 2). The herbicides 2, 4-D and isoproturon were used against broad-leaved weeds and *Phalaris minor*, respectively in wheat until resistance to isoproturon evolved in *P. minor*. This paper reports an evaluation of chlorsulfuron as a possible alternative herbicide against mixed weed flora in wheat under different irrigation regimes.

### Methods

The two year experimentation conducted at the Agronomy Research Farm of CCS Haryana Agricultural University in the *rabi* seasons of 1999-2000 and 2000-01. The soil was a sandy loam in texture, low in available nitrogen, medium in available phosphorus and rich in available potash with slightly alkaline in reaction (pH 8.1). The experiment was laid out in split plot design with three replications. The main plots were assigned to three irrigation treatments (3, 4 and

5 applications) and sub-plots (6 m × 5 m sub-plots) were assigned to chlorsulfuron at six doses 0 (check treatment), 10, 20, 30, 40 or 50 g a.i./ha. Chlorsulfuron (glean 75% WP) manufactured by Dupont was applied with the help of knap sack sprayer fitted with flat fan nozzle in 650 liters of water. This was applied on 4 January 2000 and 13 January 2001 in respective years. The wheat variety WH-283 was drilled on 1 December 1999 and 8 December 2000 at 100 kg/ha with the help of seed drill in rows 18 cm apart in each sub-plot. All agronomic practices except irrigation and weed control were as used in local commercial cropping. The irrigation treatments were applied with canal water by flooding method : 25, 65 and 105 days after sowing (DAS); 25, 45, 65 and 105 DAS; 25, 45, 65, 85 and 105 DAS. Chlorsulfuron was applied 35 DAS in both trials with a knapsack sprayer fitted with a flat fan nozzle. The numbers of plants of individual weed species were recorded at 60, 90 and 120 DAS in four randomly-placed, 50 cm × 50 cm quadrats in each sub-plot. All weeds in each quadrat on every sampling date were uprooted and oven dried at 65C for 48 hours to obtain the cumulative dry weights and of weed control efficiency (WCE) was computed using the formula :

$$\text{WCE\%} = \frac{\text{Dry wt of weeds in control check plots} - \text{dry wt of weeds in treated plot} \times 100}{\text{Dry wt of weeds in control check plots}}$$

The crop was harvested on April 20, 2000 in first year and on April 23, 2001 in second year, respectively. The harvesting was done manually by cutting the plant from ground level with the help of sickle. The wheat yields for each plot in each treatment were estimated by harvesting each sub-plot separately. One row from both sides and half meter length at each end of plot across the rows was harvested separately to avoid the border effect and bundled separately. The numbers of ears on each plant and the numbers of grains/ear were recorded and 1,000-grains weight was calculated. The plot yields (kg/ha) were converted into yields per hectare and statistically analyzed.

## Results

### Weed Studies

The experimental field was infested with the natural population of *Phalaris minor* Retz., *Chenopodium album* L., *Melilotus alba* Medic., *Anagallis arvensis* L., and some other weeds present in small number were categorized as "other weeds" were *lathyrus aphaca* L., *Fumaria parviflora* Lamk., *Convolvulus arvensis* L., *Rumex retroflexus* L. Irrigation had no effect on population of any of broad leaf weeds during both years. However, the population of *Phalaris minor* was significantly increased as the number of irrigations increased from three to five. Chlorsulfuron

**Table 1.** Effect of irrigation and chlorsulfuron on weed density, WCE yield attributing characters and grain yield of wheat. Parentheses contain original values, which were subjected to square root transformation  $x + 1$  before analysis.

| Treatments                       | <i>P. minor</i> | Weed density at 120 DAS (Number/m <sup>2</sup> ) |                |                    |              | Other weeds |
|----------------------------------|-----------------|--|----------------|--------------------|--------------|-------------|
|                                  |                 | <i>C. album</i>                                  | <i>M. alba</i> | <i>A. arvensis</i> |              |             |
| 1999-2000                        |                 |  |                |                    |              |             |
| <b>Number of Irrigations</b>     |                 |  |                |                    |              |             |
| 3                                | 4.89 (22.91)    | 1.89 (2.57)                                      | 2.63 (3.91)    | 1.99 (2.92)        | 2.05 (3.20)  |             |
| 4                                | 4.91 (23.10)    | 1.91 (2.64)                                      | 2.64 (5.96)    | 2.00 (3.00)        | 2.06 (3.24)  |             |
| 5                                | 5.02 (24.20)    | 1.92 (2.68)                                      | 2.73 (6.45)    | 2.02 (3.08)        | 2.08 (3.32)  |             |
| LSD ( $P=0.05$ )                 | 0.02            | NS   | NS             | NS                 | NS           |             |
| <b>Chlorsulfuron Dose (g/ha)</b> |                 |  |                |                    |              |             |
| 0                                | 5.48 (29.03)    | 6.47 (40.86)                                     | 10.91 (118.02) | 7.02 (48.28)       | 7.43 (54.20) |             |
| 10                               | 5.45 (28.70)    | 4.53 (19.52)                                     | 7.64 (57.36)   | 5.05 (24.50)       | 1 (0)        |             |
| 20                               | 5.39 (28.05)    | 1.49 (1.22)                                      | 2.95 (7.70)    | 1.89 (2.57)        | 1 (0)        |             |
| 30                               | 4.63 (20.43)    | 1 (0)  | 1 (0)          | 1 (0)              | 1 (0)        |             |
| 40                               | 4.41 (18.44)    | 1 (0)  | 1 (0)          | 1 (0)              | 1 (0)        |             |
| 50                               | 4.28 (17.31)    | 1 (0)  | 1 (0)          | 1 (0)              | 1 (0)        |             |
| LSD ( $P=0.05$ )                 | 0.10            | 0.10   | 0.13           | 0.32               | 0.15         |             |
| 2000—2001                        |                 |  |                |                    |              |             |
| <b>Number of Irrigations</b>     |                 |  |                |                    |              |             |
| 3                                | 4.45 (18.80)    | 1.58 (1.49)                                      | 1.73 (1.99)    | 2.10 (3.41)        | 1.64 (1.69)  |             |
| 4                                | 4.45 (18.80)    | 1.59 (1.52)                                      | 1.75 (2.06)    | 2.11 (3.45)        | 1.65 (1.72)  |             |
| 5                                | 4.55 (19.70)    | 1.60 (1.56)                                      | 1.76 (2.09)    | 2.13 (3.53)        | 1.66 (1.75)  |             |
| LSD ( $P=0.05$ )                 | 0.03            | NS   | NS             | NS                 | NS           |             |
| <b>Chlorsulfuron Dose (g/ha)</b> |                 |  |                |                    |              |             |
| 0                                | 4.82 (22.23)    | 4.57 (19.88)                                     | 5.50 (29.25)   | 7.70 (58.29)       | 4.92 (23.20) |             |
| 10                               | 4.81 (22.13)    | 3.38 (10.42)                                     | 4.07 (15.56)   | 5.54 (29.69)       | 1 (0)        |             |
| 20                               | 4.74 (21.46)    | 1.19 (0.41)                                      | 1.48 (1.19)    | 2.00 (3.00)        | 1 (0)        |             |
| 30                               | 4.42 (18.53)    | 1 (0)  | 1(0)           | 1(0)               | 1 (0)        |             |
| 40                               | 4.14 (16.13)    | 1 (0)  | 1(0)           | 1 (0)              | 1 (0)        |             |
| 50                               | 3.97 (14.78)    | 1 (0)  | 1 (0)          | 1 (0)              | 1 (0)        |             |
| LSD ( $P=0.05$ )                 | 0.13            | 0.09   | 0.12           | 0.09               | 0.06         |             |

Table 1. Continued.

| Treatments                       | WCE (%) | No. of earheads mrl | No. of grains/earhead<br>1999-2000 | 1000-grain weight (g) | Grain yield (kg/ha) |
|----------------------------------|---------|---------------------|------------------------------------|-----------------------|---------------------|
| <b>Number of Irrigation</b>      |         |                     |                                    |                       |                     |
| 3                                | 53.36   | 77.7                | 38.4                               | 42.7                  | 3966                |
| 4                                | 53.20   | 80.9                | 41.1                               | 44.8                  | 4385                |
| 5                                | 53.02   | 86.2                | 46.6                               | 46.7                  | 4657                |
| LSD ( $P=0.05$ )                 | NS      | 0.48                | 3.5                                | 2.21                  | 255                 |
| <b>Chlorsulfuron Dose (g/ha)</b> |         |                     |                                    |                       |                     |
| 0                                | 0       | 72.3                | 36.8                               | 39.2                  | 3815                |
| 10                               | 33.24   | 79.5                | 39.9                               | 44.2                  | 4174                |
| 20                               | 59.50   | 82.3                | 41.9                               | 44.7                  | 4342                |
| 30                               | 71.15   | 85.1                | 44.1                               | 46.5                  | 4536                |
| 40                               | 76.79   | 85.1                | 44.3                               | 46.8                  | 4563                |
| 50                               | 78.53   | 85.3                | 45.1                               | 47.0                  | 4588                |
| LSD ( $P=0.05$ )                 | 1.40    | 0.23                | 0.43                               | 0.58                  | 64                  |
| 2000—2001                        |         |                     |                                    |                       |                     |
| <b>Number of Irrigation</b>      |         |                     |                                    |                       |                     |
| 3                                | 53.76   | 81.6                | 41.2                               | 46.1                  | 4196                |
| 4                                | 53.18   | 84.8                | 43.9                               | 48.3                  | 4574                |
| 5                                | 52.95   | 90.0                | 49.1                               | 50.9                  | 4829                |
| LSD ( $P=0.05$ )                 | 0.50    | 0.63                | 3.75                               | 2.9                   | 185                 |
| <b>Chlorsulfuron Dose (g/ha)</b> |         |                     |                                    |                       |                     |
| 0                                | 0.00    | 75.7                | 39.6                               | 45.0                  | 4070                |
| 10                               | 36.42   | 83.4                | 42.7                               | 48.0                  | 4362                |
| 20                               | 51.23   | 86.5                | 44.6                               | 48.6                  | 4549                |
| 30                               | 71.05   | 89.0                | 46.8                               | 49.5                  | 4723                |
| 40                               | 78.96   | 89.1                | 46.9                               | 49.6                  | 4738                |
| 50                               | 82.15   | 89.2                | 47.8                               | 49.9                  | 4756                |
| LSD ( $P=0.05$ )                 | 2.66    | 0.37                | 0.51                               | 0.47                  | 59                  |

caused significant reduction in population of *P. minor* at 30 g/ha and higher doses in comparison to untreated control during both years. The population of all broad leaf weeds and other weeds was significantly reduced with 10 and 20 g/ha chlorsulfuron and beyond 20 g there was complete control of these weeds. Weed control efficiency increased with increasing dose of chlorsulfuron. At 30 g/ha, WCE of 71.15 and 71.05 was observed in first and second year, respectively.

#### Crop Studies

All the yield attributing characters and grain yield

of wheat were significantly increased with increase in irrigation levels from three to five. Higher number of earheads per metre row length (90.0), number of grains per earhead (49.1) and 1000-grain weight (50.9 g) and grain yield 4829 kg/ha were recorded with five irrigations during 2000-01. Increasing dose of chlorsulfuron resulted into increasing values of yield attributing characters and grain yield of wheat. The grain yield of wheat was increased only up to 30g/ha during both years and beyond that no significant increase was observed. Chlorsulfuron at 30 g/ha resulted into 4536 and 4723 kg/ha grain yield during first and second year, respectively. A similar effect

was observed on yield attributing characters.

### Discussion

Increase in number of irrigations caused significant increase in population of *P. minor*, while density of all other weeds was not significantly affected by increasing number of irrigations (Table 1). Effect of chlorsulfuron against *P. minor* was poor (3, 4) but excellent against broad leaf weeds. All weeds except *P. minor*, which infested the experimental field, were completely controlled with chlorsulfuron at 20 g/ha and at higher doses. Chlorsulfuron at 25 and 30 g/ha provided 97-99% control of broad leaf weeds (3). In present study weed control efficiency of 71% was observed at 30 g/ha during both years. The lower weed control efficiency could be attributed to complex weed flora. The yield and yield attributing characters of wheat were significantly increased as number of irrigations increased from three to five during both years. The relative increase in number of earheads per metre row length, number of grains per earhead, 1000 grain weight and grain yield of wheat under five irrigations over three irrigations treatment was about 11, 21, 9 and 17% in 1999-2000 and 10, 19, 10 and 21%, respectively, in 2000-01 (Table 1). Four irrigations produced significantly higher grain yield of wheat as compared to three or two irrigations (5). Similarly Hooda et al. (6) also reported increase in

grain yield of wheat with increasing number of irrigations. Application of chlorsulfuron increased grain yield and yield attributing characters of wheat during both years. The grain yield of wheat increased significantly up to 30 g/ha chlorsulfuron and beyond that increase in yield was insignificant.

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