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# Differential response to sulfosulfuron under different irrigation frequencies to control weeds in wheat (*Triticum aestivum*)

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## ABSTRACT

A field study was carried out during winter seasons of 1996–97 and 1997–98 for evaluating sulfosulfuron against weeds in wheat (*Triticum aestivum* L. emend. Fiori & Paol.) grown under different irrigation frequencies. The frequency of irrigation did not influence the weed biomass, whereas application of sulfosulfuron reduced it significantly. Yield attributes and yield of wheat were significantly more with 4 or 6 irrigations over 2 irrigations. Application of sulfosulfuron increased the grain yield significantly through the improvement in yield attributes compared with weedy check. An increase of 23.5, 26.0 and 21.1% in wheat yield with the use of 20, 40 and 60 g a.i./ha sulfosulfuron, respectively, compared with the control was noticed in pooled analysis.

***Key words :*** Irrigation frequency, Wheat, Sulfosulfuron, Weed control

Frequent irrigation increases density and dry weight of weeds (Choubey *et al.*, 1998), whereas limited watering restricts the nutrient supply and effectiveness of herbicide (Rehman and James, 1991). The present study was therefore carried out to evaluate sulfosulfuron to control weeds in wheat under different irrigation frequencies.

## MATERIALS AND METHODS

The field experiment was conducted at agronomy research farm, Hisar, during winter seasons of 1996–97 and 1997–98. The soil of the experimental field was sandy loam in texture having poor available nitrogen (157 kg/ha), medium available phosphorus (31 kg/ha) and high available potash (321 kg/ha) with an alkaline reaction. Treatments consisting of 3 irrigation frequencies (2, 4 and 6) in main plot and levels of sulfosulfuron (0, 20, 40 and 60 ga.i./ha) in subplots were replicated 6 times in split-plot design. Wheat 'WH 542' was drilled on 30 November in 1996-97 and on 8 December in 1997-98, by using 100 and 150 kg seeds/ha, respectively, and was harvested on 20 and 29 April in the respective

years. The whole quantity of phosphorus and one-third of nitrogen were applied at the time of sowing, while remaining N was top-dressed in 2 splits, at CRI and boot stages, during both the years. The irrigations applied at 22 and 85 days after sowing; at 22, 45, 85 and 105 days; and at 22, 45, 65, 85, 105 and 120 days under 2, 4 and 6 frequencies of irrigation. The herbicide was sprayed 35 days after sowing with a manually operated knapsack sprayer with spray volume equivalent to 500 litres/ha. The total rains received during the crop period was 119.4 and 105.9 mm in 1996–97 and 1997–98 respectively. The water-holding capacity, field capacity, and permanent wilting point of the experimental field were 40, 17 and 6% respectively. The moisture content in the soil at the time of sowing was 15 and 16.5% in 1996–97 and 1997–98 respectively.

## RESULTS AND DISCUSSION

### *Weed biomass*

Averaged over year, the infestation was 5.3, 35.9, 12.0, 12.4, 21.8, 10.8 and 39.5% in respect to *Phalaris minor* Retz., *Chenopodium album* L., *Melilotus indica* All., *Anagallis arvensis* L., *Rumex maritimus* L., *Polygonum plebejun* R. Br. and *Coronus didymus* L. respectively. Weeds biomass observed at 90 days was not altered significantly due to different irrigation frequency in any of the years. However, weed biomass was 4.7 and 7.8% higher under 4 and 6 irrigations, respectively, compared with 2 irrigations.

Application of sulfosulfuron at each level significantly lowered the biomass of weeds compared with weedy check during both the years (Table 1). The use of sulfosulfuron @ 60 g a.i./ha was found significantly superior to 20 g a.i./ha in reducing weed biomass in 1996–97, while differences between different rates (20 to 60 g) of its application were non-significant in 1997–98. Dixit *et al.* (1998) reduced dry weight of weeds by the use of sulfosulfuron in wheat. Highest weed-control efficiency was calculated with 60 g a.i./ha sulfosulfuron with an increased margin of 3.41 and 1.11% over 20 and 40 g a.i./ha respectively.

### *Yield attributes and yield*

Irrigation frequency of 4 or 6 to wheat produced significantly higher number of grains/spike, more ear length and 1,000-grain weight than irrigation frequency of 2 and spikes m in 1996–97 only (Table 2). The difference between irrigation frequency for spikes/m in 1997–98 was non-significant. Increased irrigation frequency from 4 to 6 failed to bring significant improvement in different yield attributes in wheat in any of the years. Improved yield attributes in wheat with 4 or 6 irrigations over 2 might be attributed to sufficient moisture supply, which avoided competition between weeds and crop plants for moisture. Furthermore, timely moisture supply through higher irrigation frequency might have also enhanced the nutrient intake by plants as reflected in better growth and development of yield attributes (Table 2). More spikes/m, grains/spike and 1,000-grain weight at high moisture level was also recorded by Choubey *et al.* (1998). Lesser number and smaller size of grains in 1997–98 was because of the rise in temperature at grain formation and development stages.

**Table 1**. Yield of wheat, weeds dry weight and weed-control efficiency as affected by irrigation and sulfosulfuron

| Treatment | Grain yield (q/ha) | | | Straw yield (q/ha) | | Weed dry weight ($g/m^2$) | | Weed-control efficiency | |
|---|---|---|---|---|---|---|---|---|---|
| | 1996–97 | 1997–98 | Pooled | 1996–97 | 1997–98 | 1996–97 | 1997–98 | 1996–97 | 1997–98 |
| ***Irrigation frequency*** | | | | | | | | | |
| 2 | 44.79 | 44.04 | 42.42 | 51.54 | 47.24 | 12.92 (166.0) | 10.26 (104.3) | | |
| 4 | 56.96 | 41.71 | 49.34 | 63.24 | 48.70 | 13.19 (173.1) | 10.53 (109.8) | | |
| 6 | 58.00 | 42.27 | 50.14 | 64.26 | 49.24 | 14.41 (178.8) | 10.65 (112.5) | | |
| CD (P=0.05) | 3.58 | NS | 2.0 | 3.92 | NS | NS ( - ) | NS ( - ) | | |
| ***Sulfosulfuron (g/ha)*** | | | | | | | | | |
| 0 | 45.94 | 34.48 | 40.21 | 52.34 | 43.84 | 28.84 (831.0) | 17.74 (313.7) | | |
| 20 | 55.94 | 43.38 | 49.66 | 62.29 | 49.73 | 4.74 (21.4) | 6.94 (47.2) | 96.7 | 85.0 |
| 40 | 56.86 | 44.32 | 50.65 | 62.82 | 51.14 | 3.38 (10.4) | 6.36 (39.5) | 98.4 | 87.4 |
| 60 | 54.29 | 43.19 | 48.74 | 61.14 | 48.86 | 2.72 (6.4) | 6.0 (35.1) | 99.0 | 88.8 |
| CD (P=0.05) | 3.16 | 3.75 | 2.00 | 2.69 | 4.46 | 1.53 (-) | 1.36 (-) | | |

Values in parentheses are original which were transformed by $\sqrt{x+1}$

Unpronounced effect of 6 irrigations was ascribed to shallow underground water-table of experimental plot.

Application of sulfosulfuron @ 20, 40 and 60 g a.i./ha significantly increased spikes/m, grains/spike and length of ear compared with weedy check. The 1,000, grain weight was also increased significantly at all the rates of sulfosulfuron over weedy check, but in 1997–98 only. Sulfosulfuron applied @ 60 g a.i./ha produced significantly bolder grains than applied @ 20 or 40 g a.i./ha which were at par with each other. The differences between rates of sulfosulfuron were, however, remained non-significant in 1996–97. The competition for natural resources was reduced to the maximum by timely and effective weed control due to herbicide and its effect was reflected into better yield attributes (Table 2) was also reported by Royela *et al.* (1990) and Patrick *et al.* (1998).

### *Grain and straw yield*

The grain yield of wheat was 28.8% higher in 1996–97 compared with the yield in 1997–98. It was due to better development of yield attributes (Table 2) because of favourable weather conditions prevailed in this year. On the other hand, early rains after sowing in 1997–98 adversely affected the growth at early stages and rise in temperature at later stages of crop lowered the yield attributes of wheat and ultimately the yield.

Irrigation frequency of 4 or 6 resulted in significantly higher yield of wheat than 2 irrigations in 1996–97 and in pooled analysis of data. However, frequency increased to 6 did not show significant improvement in yield over 4 irrigations. The differences in yield due to different irrigation frequencies in 1997–98 were remained non-significant. Pannu *et al.* (1996) also observed similar type of response at higher level of irrigation in Hisar soils. On an average 4

**Table 2.** Yield attributes of wheat as affected by irrigation and sulfosulfuron

| Treatment | Spikes/m row length | | Ear length (cm) | | Grains/ spike | | 1,000-grain weight (g) | |
|---|---|---|---|---|---|---|---|---|
| | 1996–97 | 1997–98 | 1996–97 | 1997–98 | 1996–97 | 1997–98 | 1996–97 | 1997–98 |
| *No. of irrigation* | | | | | | | | |
| 2 | 86.58 | 88.88 | 9.62 | 8.20 | 45.27 | 41.75 | 37.22 | 34.70 |
| 4 | 98.83 | 91.08 | 10.08 | 9.00 | 49.54 | 46.10 | 39.78 | 36.58 |
| 6 | 99.58 | 91.70 | 10.17 | 9.15 | 49.83 | 46.25 | 40.03 | 37.00 |
| CD (P=0.05) | 7.94 | NS | 0.36 | 0.31 | 1.98 | 2.17 | 2.09 | 0.44 |
| *Sulfosulfuron (g a.i./ha)* | | | | | | | | |
| 0 | 87.17 | 81.39 | 9.53 | 8.11 | 45.39 | 36.86 | 37.77 | 34.61 |
| 20 | 97.72 | 92.16 | 9.97 | 8.97 | 48.54 | 45.88 | 39.22 | 36.00 |
| 40 | 98.25 | 94.72 | 10.16 | 9.00 | 49.46 | 47.39 | 39.50 | 36.28 |
| 60 | 97.05 | 93.94 | 10.16 | 9.05 | 49.46 | 48.67 | 39.58 | 37.50 |
| CD (P=0.05) | 4.98 | 4.82 | 0.42 | 0.54 | 2.04 | 2.84 | NS | 1.12 |

and 6 irrigations resulted in 16.3 and 18.2% more yield, respectively, than 2 irrigations due to better yield attributes under these treatments (Table 2). The results confirm the findings. Amal and Puste (1997) and Das and Yaduraju (1999).

All the rates of sulfosulfuron used, increased significantly the grain yield of wheat compared with weedy check. However, the differences among them were found to be non-significant. Based on the pooled analysis, increase in yield was 23.5, 26.0 and 21.2% at 20, 40 and 60 g a.i./ha of sulfosulfuron, respectively, compared with weedy check. Higher yield in treated plots was the contribution of improved yield attributes owing to timely and effective weed control with compared weedy check (Table 2). Rabert and William (1998) and Patrick *et al.* (1998) also reported the similar results.

Application of 4 or 6 irrigations being at par increased the straw yield of wheat significantly over 2 irrigations in 1996–97 only. Sulfosulfuron @ 20, 40 and 60 g a.i./ha improved significantly the straw yield compared with weedy check, however, differences among rates were found non-significant. Higher straw yield under treated plots was attributed to better plant growth and dry matter. The similar findings were reported by Dixit *et al.* (1998).

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