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# Response of wheat (*Triticum aestivum*) and associated weeds to irrigation schedule and pendimethalin

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## ABSTRACT

An investigation was conducted during the winter season of 1997–98 and 1998–99 at Morena, to study the effect of irrigation schedule and weed control with pendimethalin at variable doses on weed control and plant growth and yield of wheat (*Triticum aestivum* L. emend. Fiori & Paol.). An adverse effect on the yield attributes and finally on yields was observed on delaying or withholding first irrigation. Higher values of yield attributes and yield of wheat were noted when first irrigation was applied at 20 or 25 days after sowing (DAS) compared with 30 days after sowing. All these parameters were higher under the application of pendimethalin granules as pre-emergence @ 2.0 kg/ha. Weed density was not influenced by the irrigation schedules, but weed biomass reduced under delayed irrigation at 30 DAS during 1998–99 only. Pendimethalin @ 2.0 kg/ha pre-emergence reduced the weed density and weed biomass significantly.

***Key words :*** Wheat, Weeds, irrigation, Pendimethalin

With the introduction of high-yielding dwarf wheat varieties coupled with increased use of fertilizer and irrigation, the weed problems have increased tremendously. Slow growth of wheat plant at early stage and high fertilizer application during the successive period encourage rapid growth of weeds making the problem more serious. Yield loss of 15–35% due to weed competition in wheat (Singh and Ghosh 1992). Delaying or withholding the first irrigation reduces the yield of wheat (Pandey *et al.*, 1997). Thus, irrigation and herbicide may interact each other in reducing dry-matter production of weeds and in increasing the grain yield of wheat. Keeping this in view, an experiment was conducted to determine the influence of delaying the first irrigation and application of pendimethalin herbicide granules at variable doses on weeds, and growth and yield of wheat crop.

## MATERIALS AND METHODS

The experiment was conducted during the winter (*rabi*) season of 1997 and 1998 at Morena, Madhya Pradesh. The soil was sandy loam and having pH 7.3, organic

carbon 0.16%, available N 198.2 kg/ha, available P 42.7 kg/ha and available K 402 kg/ha. The number of irrigation ranged from 4 to 5 in $I_1$ and $I_2$ treatments while it was 3–4 in $I_3$ treatment. At each irrigation 70 mm water was applied. The experiment was laid out in split-plot design including 3 schedules of first irrigation (20,25 and 30 days after sowing) in main plot and 4 weed-control schedules ($W_1$, $W_2$, $W_3$ and $W_4$) involving weedy check ($W_1$), pendimethalin granules 10% @ 1 kg/ha as pre-emergence (P.E) ($W_2$), pendimethalin granules @ 1.5 kg/ha ($W_3$) and pendimethalin granules @ 2.0 kg/ha ($W_4$) in subplot with 4 replications. 'HI 8381' ('Malawshri') wheat was sown on 20 and 16 November and harvested on 3 and 1 April during 1997–98 and 1998–99 respectively. A uniform fertilizer dose of 100 kg N, 60 kg $P_2O_5$ and 40 kg $K_2O$/ha was applied. Half of N and full dose of P and K were applied at sowing and remaining N in 2 equal splits, viz. at first and second irrigation after sowing. Total rainfall received during crop-growth period was 85 and 57 mm during 1997–98 and 1998–99 respectively. The plot size of 20.9 $m^2$ was under each treatment. Weed density and weed dry weight were recorded 90 days after sowing using 1 m × 1 m random quadrate at 2 places in each plot. The weed-control efficiency and weed index were worked out as per Angrias *et al.* (1991) and Gill and Kumar (1969) respectively.

## RESULTS AND DISCUSSION

*Phalaris minor* and *Avena fatua* were the dominant grassy weeds, constituting 43.4 and 21.35% respectively. While *Chenopodium album, Anagallis arvensis, Convolvulus arvensis* and *Melitolus alba* were the major broad, level weeds, representing 35.25% of the total weed population.

**Table 1.** Effect of irrigation and pendimethalin on yield-attributing characters of wheat crop

| Treatment | Tillers/plant | | Grains/ear | | 1,000-grain weight (g) | |
|---|---|---|---|---|---|---|
| | 1997-98 | 1998-99 | 1997-98 | 1998-99 | 1997-98 | 1998-99 |
| *Irrigation schedule* | | | | | | |
| $I_1$, 20 days* | 4.66 | 5.40 | 28.57 | 28.83 | 36.83 | 35.64 |
| $I_2$, 25 days* | 4.60 | 5.04 | 28.40 | 27.66 | 36.70 | 36.50 |
| $I_3$, 30 days* | 4.55 | 4.79 | 28.10 | 26.35 | 36.66 | 35.73 |
| CD (P=0.05) | NS | 0.60 | NS | 01.40 | NS | NS |
| *Pendimethalin (granules) (kg ai/ha)* | | | | | | |
| $W_1$ weedy check | 3.69 | 4.06 | 25.89 | 25.68 | 35.26 | 32.59 |
| $W_2$, 1.00 kg | 4.81 | 4.63 | 28.46 | 26.95 | 36.53 | 36.18 |
| $W_3$, 1.50 kg | 5.08 | 5.63 | 29.42 | 28.10 | 37.17 | 37.11 |
| $W_4$, 2.00 kg | 5.82 | 5.98 | 31.19 | 29.92 | 39.97 | 37.94 |
| CD (P=0.05) | 2.14 | 0.53 | 0.42 | 01.83 | 01.20 | NS |

*After first irrigation remaining irrigations were scheduled at 20-25 days interval

### *Irrigation schedule*

The pooled data showed that crop productivity decreased with delay in first irrigation (Table 2). The crop receiving first irrigation at 20 days after sowing ($I_1$) had advantage by increasing 4.7 and 12.7% yield over the crop receiving first irrigation at 25 days ($I_2$) and 30 days ($I_3$) after sowing respectively. Also, the crop receiving first irrigation 25 days after sowing showed an advantage over the first irrigation applied 30 days after sowing. However, grain yields under treatments $I_1$ and $I_2$ were at par. Sharma and Bhardwaj (1983) also suggested that delay in first irrigation caused a remarkable reduction in yields.

Significant reduction in weed dry matter was observed due to $I_3$ compared with $I_1$ during the second year, while during the first year the differences were insignificant (Table 2), however weed index was lowest during both the years under $I_1$ treatment.

### *Pendimethalin*

Pendimethalin granules @ 2.0 kg/ha as pre-emergence ($W_4$) was significantly superior to its lower doses of 1.0 kg ($W_2$) and 1.5 kg/ha ($W_3$) and weedy control ($W_1$) for increasing most of the plant growth and yield-attributing characters during both the years, except 1,000-grain weight during 1998–99 (Table 1). The significant effect of $W_4$ was visible on grain yields (Table 2). On an average, 43.2, 9.9, and 3.9% higher grain yield was obtained under $W_4$ as than $W_1$, $W_2$ and $W_3$ respectively. The increase

**Table 2.** Effect of irrigation and pendimethalin application on weed parameters, grain yield and economic of wheat crop

| Treatment | Weed dry matter production (q/ha) | | Weed index (%) | | Pooled data of 2 years | | |
|---|---|---|---|---|---|---|---|
| | 1997-98 | 1998-99 | 1997-98 | 1998-99 | Gain yield (q/ha) | Net return (Rs/ha) | Benefit : cost ratio |
| *Irrigation schedule* | | | | | | | |
| $I_1$, 20 days | 4.14 | 5.40 | 07.64 | 03.96 | 42.07 | 22,669 | 1:4.37 |
| $I_2$, 25 days | 4.29 | 4.72 | 04.57 | 08.05 | 40.28 | 21,397 | 1:4.18 |
| $I_3$, 30 days | 4.49 | 4.44 | 15.55 | 17.32 | 37.33 | 19,677 | 1:3.89 |
| CD (P = 0.05) | NS | 0.80 | | | 2.35 | | |
| *Pendimethalin (granules) (kg ai/ha)* | | | | | | | |
| $W_1$, Weedy check | 8.65 | 8.04 | 32.57 | 27.69 | 31.20 | 15,332 | 1:3.28 |
| $W_2$, 1.00 kg | 3.66 | 4.47 | 09.80 | 08.00 | 40.66 | 21,312 | 1:3.99 |
| $W_3$, 1.50 kg | 2.62 | 3.85 | 04.00 | 03.45 | 43.00 | 22,604 | 1:4.08 |
| $W_4$, 2.00 kg | 2.31 | 2.66 | | | 44.67 | 23,587 | 1:4.13 |
| CD (P = 0.05) | 1.45 | 1.69 | | | 0.86 | | |

Cost (Rs/ha) : 1 irrigation, 250; cost of pendimethalin (granules) ai/ha (Rs) : for 1 kg 1.5 and 2.0 kg, 400, 600 and 800 respectively

Cost of produce (Rs/ha) : Grain, 550; straw, 100

in yield attributes and yields of wheat under $W_4$ was attributed to the elimination of wide spectrum of weeds due to the knock-down effect of higher dose of herbicide. This helped the crop plants in increasing the availability of soil moisture and plant nutrients. The cumulative effects of yield-contributing parameters were responsible for elevating the yield of wheat with $W_4$ treatment to a commendable level than that with $W_1$, $W_2$ and $W_3$. Better efficacy of pendimethalin at higher dose was due to the fact that field was badly infested by narrow-leaved weeds, like *Phalaris minor* and *Avena fatua,* which were efficiently controlled as evident by lowest weed index and resulted in higher yield attributes. The results are in accordance with the findings of Singh and Singh (1996).

Application of pendimethalin at either of the doses caused significant reduction in dry weight of weeds compared to weed check (Table 2). The results confirm the findings of Singh and Singh (1996) and Pandey *et al.* (1997). The lowest dry matter was recorded under $W_4$ during both the years, however it was on a par with $W_2$ and $W_3$ during the first year and with $W_3$ during the second year.

### *Economics*

Net return and benefit : cost ratio were higher with $I_1$, i.e. first irrigation at 20 days after sowing, followed by $I_2$ and $I_3$. The increase in profit with $I_1$ over $I_2$ and $I_3$ was owing to higher increase in yield. Among the doses of pendimethalin, 2 kg/ha recorded the maximum net return and benefit : cost ratio.

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