Response of oat (*Avena sativa*) varieties to irrigation schedules

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ABSTRACT

A field experiment was conducted during winter season (1998–99 and 1999–2000) to assess the effect of 4 irrigation schedules based on irrigation water : cumulative pan evaporation (IW : CPE) ratios on performance 2 oat varieties (‘JHO 822’ and ‘JHO 851’) revealed that the varieties did not differ for fodder yield and N concentration. However, based on crude protein yield (q/ha) ‘JHO 851’ (6.08) was found significantly superior to ‘JHO 822’ (5.29), whereas in respect of water-use efficiency (kg dm/ha-mm) ‘JHO 822’ (28.6) was superior to ‘JHO 851’ (20.3). Among the 4 irrigation schedules, fodder yield and water-use efficiency increased significantly with increasing IW: CPE ratio from 0.0 to 0.9 ratio.

Key words: Oat varieties, IW:CPE ratio, Irrigation schedule, Fodder, Crude protein, N, Water-use efficiency

Oat is an important winter season forage crop for north-western and central parts of India and it can be fed to animals either in the form of green crop or after converting into good-quality silage. Of late, its cultivation is spreading to non-traditional areas experiencing low winter temperatures in southern India, such as Karnataka. In these areas, the agronomic information regarding suitability of varieties and their response to soil-moisture environment is lacking. Hence the present investigation was undertaken to identify suitable varieties and moisture regimes for oat.

MATERIALS AND METHODS

An experiment was conducted during the winter seasons of 1998–99 and 1999–2000 at Dharwad research farm at Tegur. The experimental soil was sandy loam in texture with 6.9 pH, 0.69% organic carbon and 40 and 175 kg/ha of available P, and K respectively. The soil was gravelly from 35-cm depth onwards. The experiment was conducted in factorial randomized block design with 8 treatments formed by combinations of varieties (‘JHO 822’ and ‘JHO 851’) and irrigation schedules (IW : CPE ratio of 0.0, 0.60, 0.90 and 1.20 with an IW of 60 mm) and were replicated thrice. The moisture content of soil in 0–30 cm layer at field capacity and permanent wilting point were 24 and 8% respectively. The crop was sown in 30 cm rows using 100 kg seed/ha on 21 and 14 November during 1998–99 and 1999–2000 respectively. The variety ‘JHO 822’ received a fertilizer dose (kg/ha) of 120, 40 and 40 kg/ha, whereas ‘JHO 851’ received 180, 60 and 40 kg/ha of N, P, and K. Urea, single superphosphate and muriate of potash were source of N, P and K respectively. Entire P and K along with 20 kg N/ha were applied basal. Of the remaining N, 40 kg was applied 2 days after sowing (DAS) coinciding with crown-root-initiation (CRI) stage along with last common irrigation. After every cut, 60 kg N was applied (2 times in ‘JHO 851’ after first and second cut and once in ‘JHO 822’ after the first cut). First cut was taken 60 days after sowing and later cut (s) at 30 days interval. Two and three cuts were taken in ‘JHO 822’ and ‘JHO 851’ respectively. There was no rainfall during the crop-growth period. In ‘JHO 822’ 0, 3, 6 and 6 irrigations were given during 1998–99 and 0, 2, 3 and 4 irrigation during 1999–2000 whereas in ‘JHO 851’ 0, 4, 8 and 9 irrigations during 1998–99 and 0, 3, 5, and 7 irrigations during 1999–2000 at 0.0, 0.6, 0.9 and 1.2 IW: CPE ratios of irrigation respectively. Irrigation water-use efficiency was worked as ratio of dry fodder yield (kg): irrigation water applied (mm) and is reported as kg dm/ha-mm.

RESULTS AND DISCUSSION

As results showed same trend during both the years, pooled analysis was done and the same data are presented.

Varieties

The varieties differed significantly for yield attributes, crude protein yield and water-use efficiency (Table 1). Between the 2 varieties (‘JHO 822’ and ‘JHO 851’) the former produced significantly taller plants (60.4 cm),
whereas the later more number of tillers (196.2) and leaf:stem ratio (1.65) than the other variety. Despite significant differences in yield attributes, the varieties did not differ for yield, as the plant height and tiller number, the yield contributing characters were present in 2 different varieties. However, ‘JHO 851’ produced 1.2 (0.35) tonnes/ha more green (dry) fodder than ‘JHO 822’. The crude protein yield of ‘JHO 851’ was significantly more than that of ‘JHO 822’. The high crude protein yield of ‘JHO 851’ was attributed to high N concentration (1.03%) and dry-fodder yield over ‘JHO 822’. The irrigation water-use efficiency was more in ‘JHO 822’ (mean 28.3) by about 41% than ‘JHO 851’ (mean 20.3) due to short duration (by a month) than ‘JHO 851’ and thus required less number and quantity of irrigation. Menhi Lal and Shukla (1996) reported similar varietal differences for yield in oat.

**Irrigation**

The irrigation schedules had significant influence on yield attributes, N concentration, fodder, crude protein yield and water-use efficiency (Table 1). The plant height and tiller number increased significantly with increasing IW:CPE ratio from 0.0 to 0.9. This increase in plant height and tiller number resulted in higher fodder yield with 0.9 ratio. The mean green (dry) fodder yield at 0.9 IW:CPE ratio was 33.1 (8.41) tonnes/ha. The N concentration (%) of oat increased significantly with increasing IW:CPE ratio from 0.0 to (0.76%) to 1.2 ratio (1.01%). However, the N concentration of 0.0 ratio was on a par with 0.6 and 0.9 ratio. The low N concentration of oat at 0.0 IW:CPE ratio is attributed to deficiency of soil moisture for N uptake from soil. The crude protein yield increased significantly with increase in IW:CPE ratio from 0.0 to 1.2 ratio. The crude protein yield (q/ha) based on pooled analysis was highest in 1.2 irrigation ratio (8.9 q/ha). The increase in crude protein yield with increasing IW:CPE ratio was due to favourable soil moisture for uptake of native and applied nutrients. Menhi Lal and Shukla (1996) reported a similar increase in crude protein yield due to increasing levels of irrigation. The irrigation water-use efficiency was the highest with 0.9 IW:CPE ratio (25.5) of irrigation. The increase in irrigation water-use efficiency with increasing IW:CPE ratio was attributed to increasing fodder yield. A further increase in IW:CPE ratio beyond 0.9 resulted in decline in water-use efficiency. This was due to law of diminishing returns, as evident from the yield data. The increase in IW:CPE ratio from 0.0 to 0.6 enhanced the green (dry) fodder yield by 210% (238%), while the increase in IW:CPE ratio from 0.6 to 0.9 has resulted in enhancement of green (dry) fodder yield by 189% (197%). Further increase in the IW:CPE ratio from 0.9 to 1.2 is not useful, as it resulted in only 4.8% (5.0%) increase in green (dry) fodder yield. Hukkeri et al. (1977) and Gill and Malik (1983) observed similar effects of irrigation schedules on oat. The effect of variety x irrigation schedules on oat growth and yield was found not significant.

Based on irrigation water-use efficiency, double-cut variety ‘JHO 822’ is suitable over multi-cut variety ‘JHO 851’ of oat. Irrigation at IW:CPE ratio of 0.9 was found ideal for higher yield and water-use efficiency for oat crop.

**REFERENCES**

