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IMPACT OF IRRIGATION METHODS, MANURE AND FERTILIZER ON GROWTH AND STRAW YIELD OF BARLEY (*HORDEUM VULGARE* L.)

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SUMMARY

A field experiment was conducted during *Rabi* 2021-22 to assess the impact of irrigation methods, manure and fertilizer on growth and straw yield of barley at CCS Haryana Agricultural University, Hisar. The experiment was conducted in a split-plot design with vermicompost level @ 1.5 t/ha and 3.0 t/ha, irrigation method *i.e.*, every furrow irrigation and alternate furrow irrigation assisted in the main plot and three fertilizer levels at $N_{40}P_{20}$, $N_{60}P_{30}$ and $N_{80}P_{40}$ kg/ha in subplot with three replications. Irrigation method, vermicompost as well as fertilizer levels had significant effect on growth parameters, harvest index, B : C and straw yield of barley.

Key words: Irrigation methods, vermicompost, fertilizer and barley

Barley (*Hordeum vulgare* L.) is considered as poor man's crop mainly grown on poor to marginal soils under rainfed or limited irrigation condition because of its low input requirement and better adaptability to harsh environments like drought, salinity, alkalinity and marginal lands. It contains 12.5% moisture, 11.5% albumoids, 74% carbohydrates, 1.3% fat, 3.9% crude fibre and 1.5% ash along with water soluble fibre (B-Glucans) and oil compounds (tocotrinol) which is best effective in lowering of cholesterol level of blood. Manure alone cannot produce the sufficient food for present population hence, integrated use of organic manures with inorganic fertilizer has shown best results not only in sustaining the productivity of crop but have also proved effective in maintaining soil health and improved nutrient use efficiency (Chesti *et al.,* 2013). Increment in water demand due to climate change, rapid population growth and agricultural land expansion causes global water scarcity and it is the main constraint for crop production (Kumar *et al.,* 2022 and Rajanna *et al*., 2017). Moreover, increasing urbanization and changing food habits in recent years have shown significant increase in imports and cultivation of barley. On the other hand, the good quality water resources have started depleting which has been continuing in agriculture for many years resulting into fall in water table and this is likely to continue in the future. It is therefore imperative to carefully examine every potential solution that can contribute to savings in water in modern agriculture.

MATERIALS AND METHODS

The field experiment was conducted at the Agronomy Research Farm, CCS Haryana Agricultural University, Hisar, which is located at 29°10' N latitude and 75°46' E longitude, at an elevation of 215.2 m above mean sea level in the subtropical region of Haryana in India. The experiment was conducted in a split-plot design with vermicompost level. @ 1.5 t/ha and 3.0 t/ha, irrigation method *i.e.*, every furrow irrigation and alternate irrigation method as the main plot treatments and three fertilizer levels at $N_{40}P_{20}$, $N_{60}P_{30}$ and $N_{80}P_{40}$ kg/ha as subplot treatments replicated thrice. The soil was sandy loam in texture, having pH value of 8.1, low in available N (125.5 kg/ha), medium in P (32 kg/ha) and rich in K (243 kg/ha). The soil of the experimental field had no salinity or drainage problem, and the water table was more than 3 m deep; thus, it did not interfere in the root-zone of the crops. The pre-sowing irrigation was applied through canal water, and the seed bed was prepared at field capacity. In this study, Barley variety BH-946 was sown on 24th November 2021 using standard agricultural practices. The vermicompost (N – 2.8%, P_2O_5 – 0.9%, and K_2O

TABLE 1

Growth parameters and straw yield of barley as influenced by vermicompost, fertilizer and irrigation methods

Treatments	Plant height (cm)				Dry matter accumulation (g/m^2)				Straw yield (kg/ha)	Harvest index (%)	B:C
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest			
Vermicompost levels											
Vermicompost @ 1.5 t/ha	17.3	35.2	67.9	80.1	84.0	306.0	936.6	1118.4	5456	43.9	2.08
Vermicompost @ 3.0 t/ha	19.3	39.3	76.5	88.1	96.0	353.4	1032.6	1198.2	6032	44.0	2.11
CD (p=0.05)	1.5	2.7	5.2	7.0	7.8	24.6	60.6	64.2	441	1.1	-
Irrigation methods											
Every furrow irrigation	19.5	39.2	76.1	88.7	94.8	349.2	1030.2	1191.6	6406	43.1	2.24
Alternate furrow irrigation	17.1	35.3	68.2	79.6	85.8	310.2	939.0	1125.0	5081	44.9	1.95
CD (p=0.05)	1. 5	2.7	5.2	7.0	7.8	24.6	60.6	64.2	441	1.1	-
Fertilizer levels (kg/ha)											
$N_{40}P_{20}$	17.1	34.5	67.1	78.1	81.0	292.2	921.6	1096.2	5165	44.8	1.98
$N_{60}P_{30}$	18.5	37.6	73.5	86.4	93.0	342.0	1000.8	1176.0	5968	43.5	2.13
$N_{80}P_{40}$	19.3	39.6	75.9	87.8	96.6	355.8	1031.4	1203.0	6098	43.7	2.18
CD (p=0.05)	0.9	2.7	5.2	6.3	5.4	14.4	49.2	66.0	251	1.0	-

- 1.3%) was applied 15 days before sowing as per treatment. Full dose of phosphorus and half of nitrogen, as per treatments, were applied at the time of sowing and remaining half of the nitrogen was top-dressed as per recommendation. The recommended N and P were applied through urea and SSP, respectively. Harvest index was computed as percentage by dividing the economic or grain yield by the total biological yield or total biomass and multiplying by 100. (Donald 1962).

$$\text{Harvest index (\%)} = \frac{\text{Economical yield}}{\text{Biological yield(Grain+Straw)}} \times 100$$

The benefit-to-cost ratio was calculated using the following formula:

$$B : C = \frac{\text{Gross returns (Rs./ha)}}{\text{Cost of cultivation (Rs./ha)}}$$

The mean weekly maximum and minimum temperature ranged between 14 to 41.1 ºC and 3.3 to 19.8 ºC, respectively. The mean weekly values for morning and evening relative humidity ranged between 68 to 99 per cent and 17 to 79 per cent, respectively. While sunshine hours ranged between 0.7 to 8.8 hours during the crop season. The total rainfall was recorded to be 71 mm during the crop seasons. The growth parameters were recorded at 30 days interval till crop maturity. Data on growth parameters and straw yield were recorded by using standard procedure. The recorded data on growth parameters and straw yield collected during study year were analysed statistically for split-plot design and presented at 5% significant level ($P \leq 0.05$). The data were subjected to analysis of variance using online statistical analysis package of OPSTAT (Sheoran *et al.,* 1998).

RESULTS AND DISCUSSION

Growth parameters and growth indices *viz,* plant height, dry matter accumulation, CGR and RGR of barley was affected significantly by different vermicompost levels, irrigation methods and fertilizer levels at different days after sowing and at harvest. Taller plants and higher dry matter accumulation of barley was recorded with higher levels of vermicompost and fertilizer over lower levels. Similarly, every furrow irrigation method produced taller plants and higher dry matter accumulation as compared to alternate furrow irrigation methods (Table 1). Similar trend was observed in respect of CGR and RGR (Fig. 1 and 2). The vermicompost incorporation and higher soil moisture availability results in an increase in leaf area and chlorophyll content, which are considered the main determinants of dry matter production., indicating that vermicompost plays a vital role in promoting plant growth by enriching soil nutrients and enhancing enzymatic activity. Application of fertilizers at $N_{80}P_{40}$ level being remained at par with $N_{60}P_{30}$ level, resulted in significantly taller plants and higher dry matter accumulation at 30, 60, 90 DAS and at harvest as

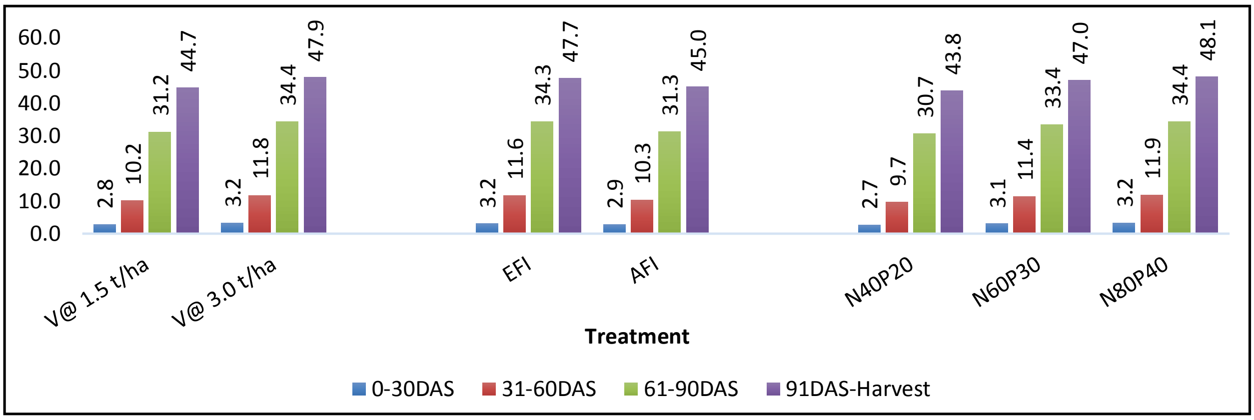

Fig. 1. Crop Growth Rate (g/m^2/day).

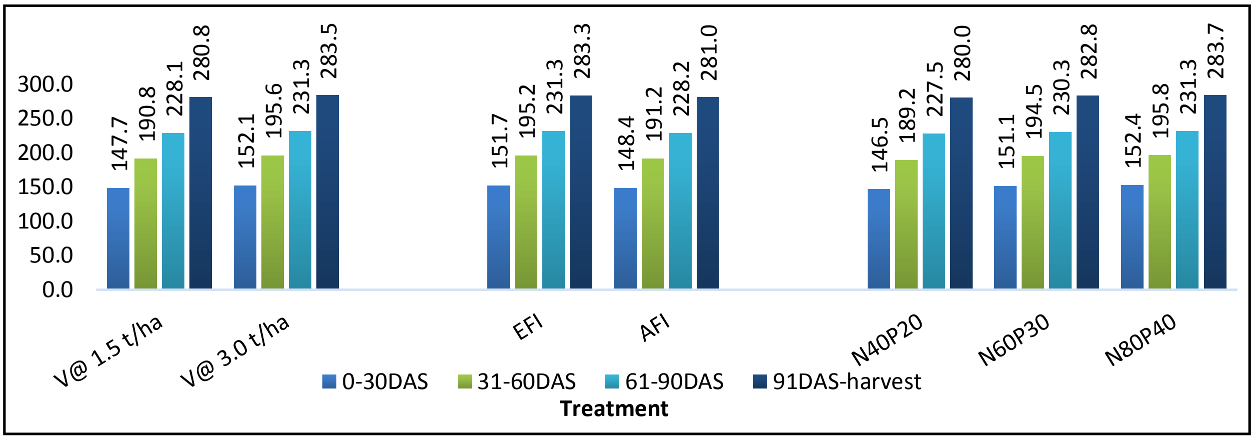

Fig. 2. Relative Growth Rate (mg/g/day).

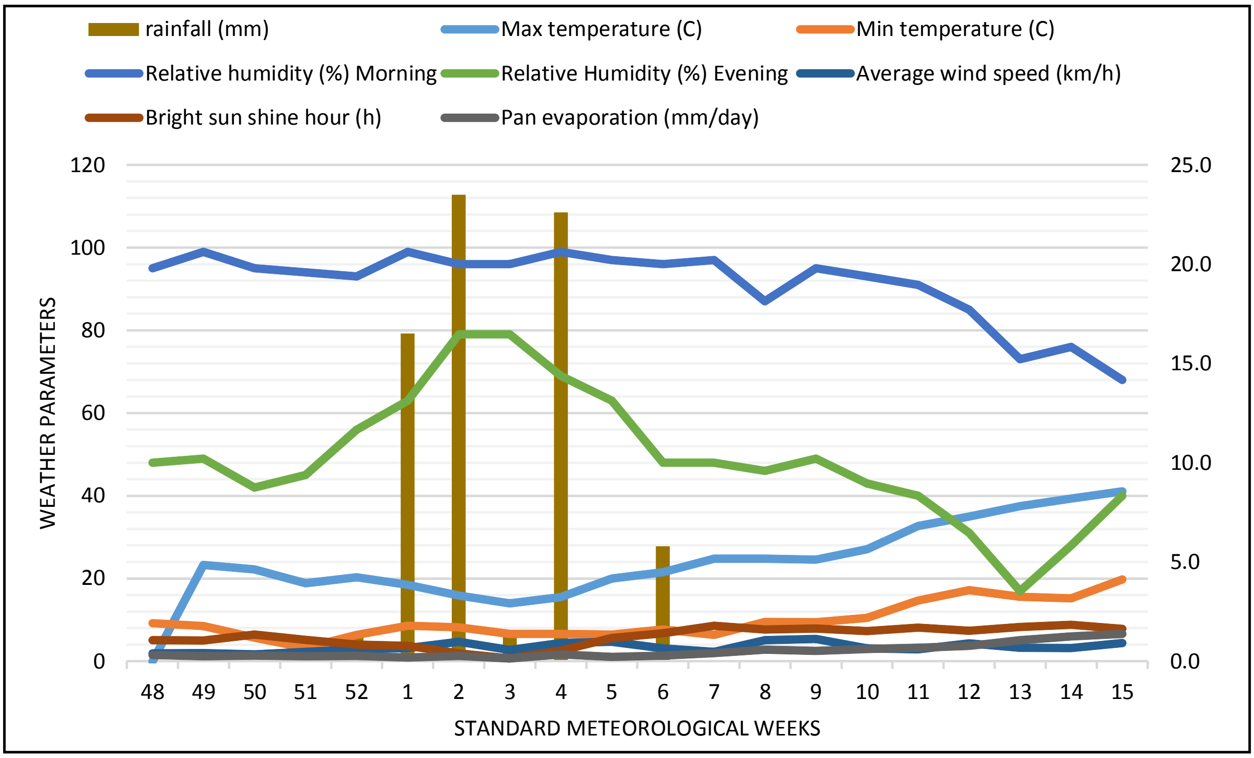

Fig. 3. Mean weekly weather parameters during crop season of 2021-22.

compared to application of fertilizers at $N_{40}P_{20}$ level. The significant increase in straw yield was recorded with the application higher vermicompost and fertilizer levels with every furrow irrigation method. The increase in straw yield could be partly attributed to its direct influence on dry matter production of each vegetative part and indirectly through increased morphological parameters of growth (plant height and number of tillers. No significant variation was found in harvest index with vermicompost, irrigation method, and fertilizer levels. However, numerical differences were observed. The highest harvest index values (44.00, 44.90, and 44.80) were recorded with vermicompost @ 3.0 t/ha, alternate furrow irrigation, and N80P40 fertilizer. The lowest harvest index values (43.90, 43.10, and 43.50) were observed with vermicompost @ 1.5 t/ha, every furrow irrigation, and N60P30 fertilizer. Application of $N_{40}P_{20}$ also achieved the highest B:C ratio (2.18), surpassing $N_{40}P_{20}$ by 10.10%, respectively. The results are in close agreement with the finding of Singh *et al.* (2018) and Kassa *et al.* (2018).

CONCLUSION

In conclusion, applying vermicompost at 3.0 t/ha improved barley growth attributes, yield and economics. The combination of vermicompost at 3.0 t/ha with every furrow irrigation and $N_{80}P_{40}$ showed significantly higher growth parameters, straw yield and B:C ratio. Notably, $N_{60}P_{30}$ fertilizer performed similarly to $N_{80}P_{40}$ in terms of growth indices and straw yield under every furrow irrigation.

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REFERENCES

Chesti, M.H., A. Kohli and A.K. Sharma, 2013 : Effect of Integrated nutrient Management on yield and nutrient uptake by wheat (*Triticum aestivum*) and soil properties under intermediate zone of Jammu and Kashmir. *Journal of the Indian society of soil science*, **6**(1) : 1-6.

Kassa, M., K. Kebede and W. Haile, 2018: Effect of Nutrient Supply on Nutrient Use Efficiency and Yield of Barley (*Hordeum vulgare* L.) in Wolaita, Southern Ethiopia. *International Journal of Current Research and Academic Review*, **6**(12): 48-58.

Kumar P., A. Kumar, R. Kumar and M. Sewhag, 2022: Productivity and input efficiencies of FIRB planted wheat as influenced by nitrogen levels under deficit irrigation. *Journal of Soil and Water Conservation,* **21**(3): 318-325.

Rajanna, G.A., A.S. Dhindwal and R.K., Nanwal, 2017: Effect of irrigation schedules on plant – water relations, root, grain yield and water productivity of wheat (*Triticum aestivum*) under various crop establishment techniques. *Cereal Research Communications,* **45**(1): 166-177.

Singh, T., N.B. Singh, P. Kumar and S. Singh, 2018 : Effect of different irrigation and fertility levels on dynamic growth and yield of late sown wheat (*Triticum aestivum* L.*). International Journal of Chemical Studies*, **6**(1): 1523-1528.

Sheoran, O.P., D.S. Tonk, L.S. Kaushik, R.C. Hasija, and R.S. Pannu, 1998 : Statistical Software Package for Agricultural Research Workers. Recent advances in information theory, statistics and computer application by DS Hooda and RC Hasija, Department of mathematics statistics, CCS HAU, Hisar.