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Impact of different moisture regimes and sources of nitrogen on plant height and economics feasibility of wheat crop

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Abstract
An experiment was conducted at Student's "Instructional farm of Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya (U.P.) during rabi season 2019-2020. Using the wheat variety HD-2967, the experiment was set up in split plot design (SPD) with three replications. The treatments comprised of four irrigation levels *viz*. 0.6 IW/CPE ratio (I_1), 0.8 IW/CPE ratio (I_2), 1.0 IW/CPE ratio (I_3), 1.2 IW/CPE ratio (I_4), and three nitrogen sources *viz*. 100% (RDF) through urea (N_1), 50% RDF + 50% FYM (N_2), 50% RDF + 50% poultry manure (N_3). On the basis of results obtained application of 1.0 IW/CPE ratio (I3) accrued the maximum net returns (Rs 58097 ha^{-1}) with B:C ratio of 1.82.

Keywords: Wheat, moisture regimes, nitrogen sources, plant height, economics

Introduction
Wheat (*Triticum aestivum* L.) is the most universally formed crop and the chief commonly grown cereal in the world. Wheat is the most widely produced crop in the world in terms of both production and area. (Pandey *et al*., 2023) [6]. It is the second-most important grain crop in India and is essential to the food and nutritional security of the country. In terms of overall food output, it currently comes in second place after rice as the main food source for humans. (Kumar *et al*., 2023) [2]. Water is necessary for the development of wheat at every stage, from seed germination to plant maturity, in order to maximize yield potential. In addition to optimizing plant cell metabolism, availability of a sufficient amount of moisture during important stages of plant growth also boosts the crop's ability to absorb mineral nutrients. There are several methods for scheduling irrigation, including the use of soil water depletion, plant indicators or bases, climatic approaches, crucial growth stage approaches, and plant water status itself. The available soil moisture in the root zone serves as a useful factor for irrigation scheduling in the soil water depletion strategy. Irrigation is also used to restore soil moisture when it is reduced to a specific depth in the root zone (this level varies depending on the crop). Since the plant uses water, plant basis or plant indices can be used as a reference for irrigation scheduling (Kumar *et al*., 2023[c]) [4]. Organic fertilizers/Manures are readily obtainable mineral bases that have a diffident concentration of vital natural resources for plants. They have the capability to decrease problems carried on by artificial fertilizers. They minimize the requirement for common artificial fertilizer claims to maintain soil fertility. They maintain nutrient balance for the proper growth of agricultural plants and gradually release nutrients into the soil solution (Kumar *et al*., 2023b) [3]. By adding farm yard manure (FYM) and other organic materials to the soil, soil fertility and production are maintained. Moreover, it increases soil microbial activity, which is critical for crop nutrient availability, recycling, and transformation. In addition to this, does it improve the soil's structure and porosity, but it also reduces compaction and crusting and increases the soil's capacity for holding water.
For improved soil health and better yields, organic manures, crop wastes, and vermicompost are necessary in combination with inorganic fertilizers.

It is possible to enhance soil health and accelerate nutrient uptake by mixing inorganic fertilizers with organic manures, crop wastes, and biofertilizers. (Kumar *et al*., 2023[c]) [4].
Poultry manure is the major sources of macro and micro nutrients and It significantly enhanced wheat production and yield component as well as crop growth characteristics. (Jan *et al*., 2018). Wheat output is significantly impacted by the combined use of NPK fertilizers. Wheat yield is significantly affected by the timely and balanced application of NPK. Various plant species, and even different kinds within species, showed different behaviors when obtaining and using NPK for grain production. (Panhwar *et al*., 2019) [7].

Materials and Methods

Site Descriptions

The field experiment was carried out in the Rabi season of 2019–2020 at the students "Instructional farm of Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India," which is located 43 km from the district headquarters of Ayodhya. The farm is situated on the left side of the Ayodhya–Raibareli road. Located in the gangetic alluvium of eastern Uttar Pradesh, the experimental location is situated at an altitude of 113 meters above mean sea level and between 26.470 N latitude and 52.120 E longitude. These areas are covered by the alluvial sodic soil and subtropical climate of the Indo-Gangetic plains in eastern Uttar Pradesh, India. The experiment was comprised of twelve treatment combination with four moisture regime and three nitrogen sources. It was conducted in Split Plot Design with three replications. A set amount of 60 mm of water was applied to the relevant experimental plots in accordance with the irrigation schedules for the relevant treatment. Irrigation was applied uniformly to all treatments immediately after sowing, regardless of treatment, for improved crop establishment. The experiment used the wheat variety HD-2967, which is best suited for the plains of northeastern India, which includes a portion of Uttar Pradesh. It yields 40–50 quintals per hectare on average.

Results and Discussions

Impact of Moisture regimes and Nitrogen Sources on Plant Height of wheat crop

Plant height

Data pertaining to plant height of wheat recorded at various growth stages as affected by Moisture regime and sources of nitrogen have been presented in Table 1 and Depicted in Fig 1.
Plant height of wheat crop increased with increasing level of moisture regime at all growth stages of the crop. However, the taller plant (80.75cm) was obtained with significant increment at harvest stage with moisture regimes of 1.2 IW/CPE over other moisture regimes and smallest plant (70.07cm) was obtained with 0.6 IW/CPE ratio.
Considering the sources of nitrogen, the high response was obtained with N1- 100% RDF followed by N3-50% RDF+ 50% with poultry manure. The minimum was received with N2- 50% RDF+ 50% FYM-N. It might be due to maintained adequate available soil moisture (ASM) in the root zone throughout the crop growth period. The present findings are similar with the findings of Mubeen *et al.,* (2012) [5] and Singh *et al*., (2018) [8].

Table 1: Impact of Moisture regimes and Nitrogen Sources on Plant Height of wheat crop

Treatments	Plant height (cm)			
	30 DAS	60 DAS	90 DAS	At harvest
Moisture regimes				
0.6 IW/CPE ratio	21.57	45.37	60.71	70.07
0.8 IW/CPE ratio	21.77	46.83	61.04	74.62
1.0 IW/CPE ratio	22.30	50.30	65.38	79.17
1.2 IW/CPE ratio	22.57	51.50	66.88	80.75
SEm±	0.57	1.21	1.61	1.72
CD at 5%	NS	NS	NS	NS
Nitrogen sources				
100% N from urea (N1)	22.77	52.33	65.41	79.21
50% N from urea +50% N from FYM (N2)	21.30	50.53	62.16	76.59
50% N from urea + 50% N from Poultry manure (N3)	22.37	51.15	64.94	77.66
SEm±	0.57	1.26	1.71	1.74
CD at 5%	NS	NS	NS	NS

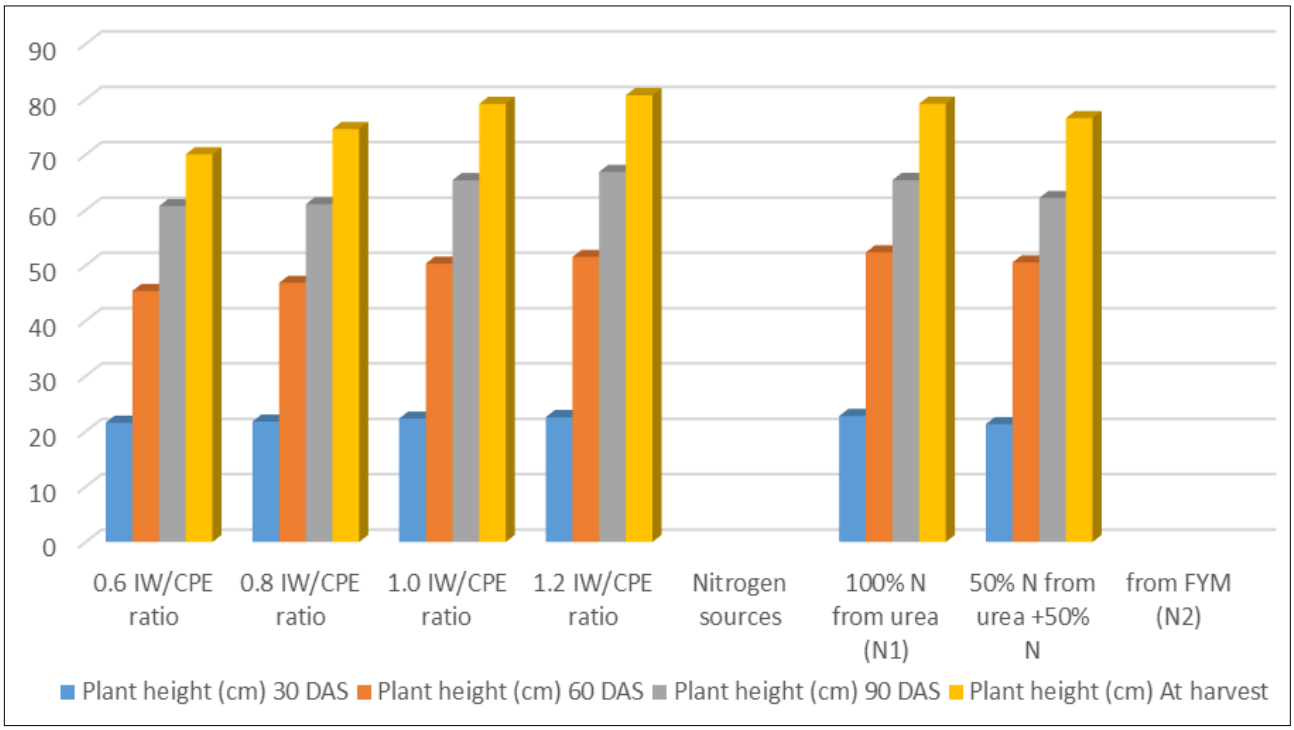

Fig 1: Impact of Moisture regimes and Nitrogen Sources on Plant Height of wheat crop

Impact of Moisture regimes and Nitrogen Sources on Economics of various treatments

Data pertaining to **Economics of various treatments** of wheat which are affected by Moisture regime and sources of nitrogen have been presented in Table 2 and Depicted in Fig 2.

Cost of cultivation

The data showed that the different moisture regimes and sources of nitrogen affected the cost of cultivation of wheat. The cost of cultivation increased with increasing level moisture regime. The highest cost of cultivation (Rs36001) was recorded with application of 1.2 IW/CPE ratio along with 50%RDF+50% N though FYM.

Gross return

The data showed that the different moisture regimes and sources of nitrogen affected the gross return of wheat. The highest value of gross return (Rs 89918) was recorded with 1.0 IW/CPE ratio 50%RDF+50%N through poultry manure and lowest value was recorded with the application of 0. 6 IW/CPE ratio along with 100%RDF.

Net return

The data showed that the different moisture regimes and sources of nitrogen affected the net return of wheat. The highest value of net return (Rs58097) was recorded with 1.0 IW/CPE ratio along with and lowest value was recorded with 0.6 IW/CPE ratio. Increased in net return were recorded with increase in level of moisture regimes.

Benefits cost ratio

The data showed that the different moisture regimes and sources of nitrogen affected the Benefits cost ratio of wheat. The highest value of Benefits cost ratio was recorded with 1.2 IW/CPE ratio and lowest value was recorded with 0.6 IW/CPE ratio. This was higher due to the increase of gross and net returns of the wheat crop. These finding are well supported by Jat *et al*. (2015) [1].

Table 2: Impact of Moisture regimes and Nitrogen Sources on Economics of various treatments

Treatments	Total cost	Gross return	Net income	B:C ratio
T1	31821	64814	32993	1.03
T2	31821	78916	47095	1.47
T3	31821	89918	58097	1.82
T4	32481	83689	51208	1.57
T5	35401	68733	33332	0.94
T6	35401	77174	41773	1.17
T7	35401	84555	49154	1.38
T8	36001	82176	46175	1.28
T9	32901	64783	31882	0.96
T10	32901	68633	35732	1.08
T11	32901	89282	56381	1.71
T12	33501	83417	49916	1.48

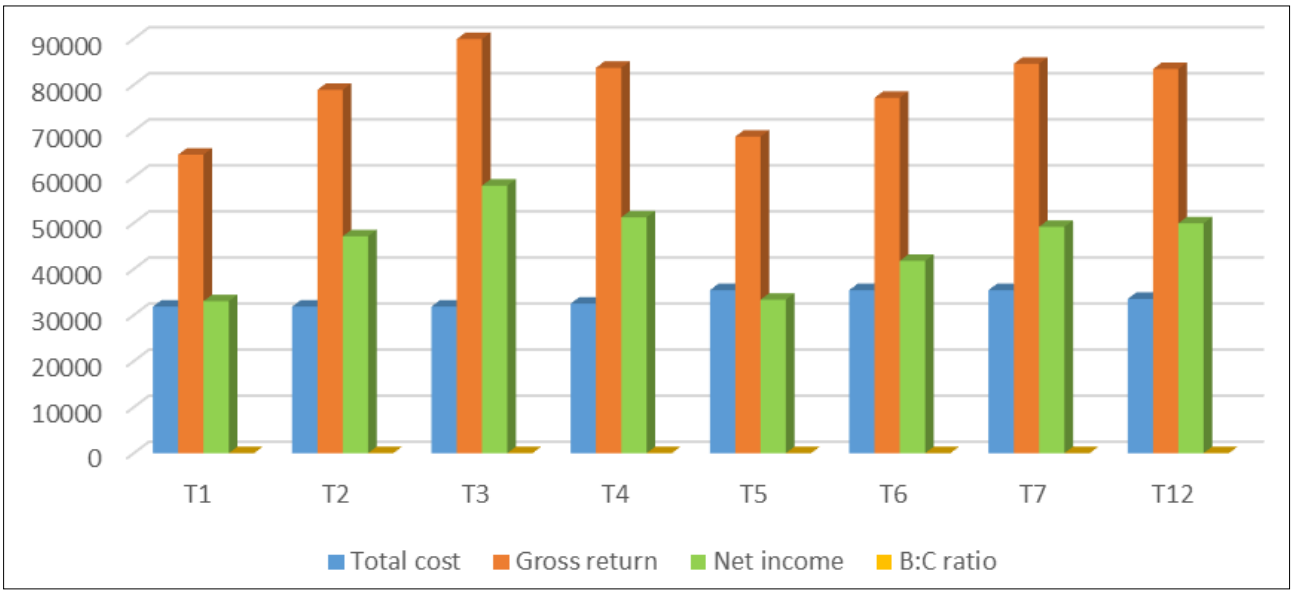

Fig 2: Impact of Moisture regimes and Nitrogen Sources on Economics of various treatments

Conclusion

On the basis of one year finding of research data it may be concluded that the Among the Moisture regimes 1.2 IW/CPE ratio was found suitable for Plant height, over the rest of other moisture regimes and Among the organic sources N_3 (50% RDF + 50% Poultry manure) was found suitable for plant height of wheat crop followed by N2 (50% RDF + 50% FYM). The highest cost of cultivation (Rs36001) was recorded with application of 1.2 IW/CPE ratio along with 50%RDF+50% N though FYM and the higher cost benefit ratio was received the application of moisture regime at 1.2 IW/CPE with 50% RDF+ 50% N through poultry manure with the investigation. The highest value of gross return (Rs 89918) was recorded with 1.0 IW/CPE ratio 50%RDF+50%N through poultry manure and lowest value was recorded with the application of 0. 6 IW/CPE ratio along with 100%RDF and the highest net return (Rs 58097) and B:C ratio (1.82) was obtained from treatment T_3 which are superior over other treatments.

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