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Alekh Kumar Sharma
Department of Agronomy, Institute of agricultural Sciences Banaras Hindu University, Varanasi, Uttar Pradesh, India

JP Singh
Department of Agronomy, Institute of agricultural Sciences Banaras Hindu University, Varanasi, Uttar Pradesh, India

Rajesh Kumar Singh
Department of Agronomy, Institute of agricultural Sciences Banaras Hindu University, Varanasi, Uttar Pradesh, India

SK Verma
Department of Agronomy, Institute of agricultural Sciences Banaras Hindu University, Varanasi, Uttar Pradesh, India

RK Singh
Department of Agronomy, Institute of agricultural Sciences Banaras Hindu University, Varanasi, Uttar Pradesh, India

Corresponding Author:
Alekh Kumar Sharma
Department of Agronomy, Institute of agricultural Sciences Banaras Hindu University, Varanasi, Uttar Pradesh, India

Effect of crop establishment, mulching and irrigation scheduling on growth and yield attribute of wheat (*Triticum aestivum* L.)

Alekh Kumar Sharma, JP Singh, Rajesh Kumar Singh, SK Verma and RK Singh

Abstract
The current study, titled "Effect of crop establishment method, mulching, and irrigation scheduling on yield and water productivity of wheat (*Triticum aestivum* L.)," was carried out at the Agricultural Research Farm, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, during two consecutive rabi seasons in 2018-19 and 2019-20, respectively. The experiment was set up in a split plot design with three replications, combining two crop establishment methods, S_1: Conventional sowing, S_2: Raised bed sowing and two mulching practices i.e. M_0: No mulch, M_1: Straw mulch @ 5 t ha^{-1} in main plot and four irrigation scheduling practises, I_1: CRI only, I_2: CRI + 100 mm CPE, I_3: CRI + 150 mm CPE, and I_4: CRI + 200 mm in sub plot. Among the main plot treatment, S_2 (raised bed sowing) and M_1 (straw mulch @ 5 t ha^{-1}) had a significant influence on crop growth (plant height) and yield attributes (ear length and test weight) during both the years. In case of irrigation scheduling treatments, irrigation at CRI + 100 mm CPE (I_0) exerted significantly higher plant height, ear length and test weight during both the years. It can be recommended that raised bed sown wheat with straw mulch @ 5 t/ha in and irrigation scheduling based on CRI+100 mm CPE should be practiced to achieve better crop growth and yield attributes of wheat in Varanasi region of eastern Uttar Pradesh.

Keywords: Indian mustard, path coefficient analysis

Introduction
One of the oldest and most significant cereal crops, including in India, wheat is farmed all over the world. Wheat comes second in India after rice in terms of area, i.e., 31.36 million hectares, with a production of 107.86 million metric tonnes in 2020–21 (USDA, 2022). Wheat also ranks first in the globe in terms of area (220.83 million hectares) and production (775 million metric tonnes) (USDA, 2022). After the harvest of kharif crops in India, wheat is often planted in succession throughout the Rabi season. Because the rice-wheat farming system is the most significant and dominant system in these regions, the majority of the rice crop is harvested in the kharif season in eastern India and eastern Uttar Pradesh. Traditional methods of growing rice have negative effects on the wheat crop, including deteriorated soil quality and delayed sowing. Farmers engage in extensive tillage work to plant wheat on flat terrain after the rice crop is harvested. Due to the delayed wheat sowing and high labour, input, energy, and resource costs, as well as the crop's exposure to drought, terminal heat stress, and lodging, low productivity and profitability are the result. This is also required to prevent natural resource depletion (Verma *et al*., 2022) [7-8]. Raised-bed planting is one of the most effective strategies for increasing WUE. This planting system outperforms flat planting in three ways: first, it saves a significant amount of irrigation water, resulting in higher water-use efficiency (Singh *et al*., 2011) [4]; second, the soil physical status is greatly improved (Jat *et al*., 2013) [1]; and third, the microclimate within the cropped area is improved due to better arrangement of the wheat plants on the surface (Tripathi *et al*., 2005) [6]. Mulch acts as a barrier to minimise soil evaporation, to buffer soil temperature, to stimulate plant development, to discourage weed growth, to improve soil physical properties, and therefore to promote water-use efficiency. (Singh *et al*., 2011) [4]. (Ram *et al*., 2013a) [9]. Rabi crops are often irrigated using surface irrigation techniques, such as flood or check basin irrigation, where irrigation efficiencies are as low as 30–40% due to greater loss through unfavourable evapotranspiration (Rajanna *et al*., 2019) [3].

Scheduling irrigation is a key component of effective water management. Moisture stress during some of the most important growth phases might occasionally cause reduced test weight and significantly lower grain production (Kumar *et al*., 2014) [2]. One of the finest agronomic management strategies is efficient water management, which not only improves crop output but also reduces the danger of insect pest growth through correct moisture and heat control (Singh *et al*., 2012) [5]. There are various criteria, such as the critical stage approach, visual symptoms, etc., for maintaining irrigation intervals or scheduling irrigation (when to irrigate). One essential and efficient strategy in the cultivation of wheat for greater yield is irrigation scheduling based on climatological approach, or IW: CPE (irrigation water: cumulative pan evaporation). This methodology provides irrigation according on crop need, i.e. to match the crop's evapotranspiration losses, which may result in a higher yield as well as water savings and water use efficiency. One of the most crucial irrigation scheduling techniques for water conservation is the IW/CPE ratio. By using a variable irrigation water supply, irrigation may also be given at a set CPE using this method.

Materials and Methods

To obtain quantitative estimates in accordance with the objectives as mentioned above, the present study was conducted in Gangetic Alluvial soil (entisols) *i.e*. sandy clay loam in texture, having slightly alkaline in reaction, low in organic carbon and low available nitrogen, medium in available phosphorus and potassium. The present investigation was formulated and conducted during two consecutive *rabi* seasons of years 2018-19 and 2019-20, respectively at Agricultural Research Farm, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh. The experiment was laid out in split plot design with three replications combining two crop establishment methods *i.e.* S_1: conventional sowing, S_2: raised bed sowing and two mulching practices *i.e.* M_0: no mulch, M_1: straw mulch @ 5t ha^{-1} (total four treatment combination) in main plot and four irrigation scheduling practices *i.e.* I_1: CRI only, I_2: CRI + 100 mm CPE, I_3: CRI + 150 mm CPE & I_4: CRI + 200 mm CPE in sub plot. Thus a total of 16 treatment combinations were tested in the study and were replicated thrice. Wheat variety HD 2967 was used. The treatments were allocated randomly to each plot. Crop was fertilized with 150 kg N, 60 kg P_2O_5 and 60 kg K ha^{-1}. Half quantity of nitrogen and entire dose of phosphorus and potassium were applied as basal. While, the rest half dose of nitrogen was top dressed at in two equal splits after first and second irrigation. The total rainfall experienced during the crop growth season was 32.4 mm in 2018-19 and 117.1 mm in 2019-20. Irrigation was given as per treatment. Other crop management practices were followed as per the recommendation of the area. Weather parameters were more congenial for wheat crop during second year which resulted in better crop growth and yield attributes in comparison to first year.

Experimental findings

Plant height

The data clearly show that mulching and establishment techniques significantly affect height at all observational periods throughout the year. During both of the observational years, raised bed sowing with straw significantly increased plant height compared to traditional sowing and no mulch application. In terms of irrigation scheduling, irrigation at CRI+ 100 mm CPE considerably increased plant height compared to other treatments at all observational phases, with the exception of 30 DAS, over the course of the two observational years. At 30 DAS, the impact of various irrigation scheduling was non-significant. Throughout both of the experimentation years, the various treatments were unable to demonstrate an interaction impact between the main and supporting plots**.**

Ear length

During both years of the experiment, crop establishment techniques and mulching treatments failed to reach the threshold of relevance with regard to ear length. However, throughout both years of the experiment, larger values were seen in raised bed sowing with straw mulch @ 5 t ha^{-1} than in conventional sowing and no mulch, respectively. During both years of the experiment, irrigation at CRI + 100 mm CPE significantly increased the maximum ear length compared to irrigation at CRI + 150 mm CPE, CRI + 200 mm CPE, and CRI alone. However, during both study years, therapy CRI+100 mm CPE was discovered to be statistically comparable to treatment CRI+150 mm CPE.

Test weight

It was discovered that different crop establishment options significantly affected the weight of 1000 grains. Raised bed sowing of wheat produced a greater 1000 grain weight than conventional sowing among other crop establishment techniques. During both of the investigation's years, the 1000 grain weight was higher when straw mulch was applied at 5 t ha^{-1}. Examining the data showed that, throughout both years, irrigation schedule had a considerable impact on 1000 grain weight. During both years of the experiment, irrigation at CRI + 100 mm CPE over CRI + 200 mm CPE and CRI recorded the highest number of 1000 grain weights, and it was statistically comparable to irrigation at CRI + 150 mm CPE only during the first year.

Harvest index (HI)

Different crop establishment method and mulching in were failed to show significant effect on harvest index of wheat during both the years of experimentation. However, higher value of HI was observed under raised bed sowing and straw mulch @ 5 t ha^{-1} over the conventional sowing and no mulch, respectively during both the years. Irrigation scheduling at CRI + 100 mm CPE recorded significantly higher HI over rest of the irrigation treatments with the minimum HI under irrigation at CRI only during both the year of study. However, treatment irrigation at CRI+100 mm CPE was found statistically at par with irrigation at CRI + 150 mm CPE during 2018-19 and it was also statistically at par with irrigation at CRI+150 mm and CRI+200 mm CPE during 2019-20.

Table 1: Effect of establishment methods, mulching and irrigation scheduling on plant height

Treatments	Plant height (cm)							
	30 DAS		60 DAS		90 DAS		At harvest	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Establishment method								
Conventional sowing	24.79	25.02	51.40	50.47	93.17	93.34	93.79	93.86
Raised-bed sowing	26.63	26.86	54.30	55.45	98.20	98.41	98.68	98.76
SEm ±	0.30	0.31	0.62	0.60	1.13	1.09	1.14	1.09
CD (p=0.05)	1.05	1.06	2.13	2.08	3.91	3.77	3.93	3.78
Mulching								
No mulch	25.15	25.36	51.74	51.37	93.65	93.81	94.27	94.34
Straw mulch (5t ha^{-1})	26.27	26.52	53.96	54.56	97.72	97.94	98.20	98.28
SEm ±	0.30	0.31	0.62	0.60	1.13	1.09	1.14	1.09
CD (p=0.05)	1.05	1.06	2.13	2.08	3.91	3.77	3.93	3.78
Irrigation scheduling								
CRI only	25.48	25.66	50.01	51.39	91.16	91.29	91.87	91.96
CRI + 100 mm CPE	25.84	26.09	55.13	54.75	100.81	100.94	101.10	101.12
CRI + 150 mm CPE	25.78	26.03	53.96	53.16	96.83	97.08	97.29	97.40
CRI + 200 mm CPE	25.74	25.98	52.29	52.55	93.94	94.18	94.67	94.76
SEm ±	0.26	0.25	0.49	0.46	0.90	0.83	0.91	0.83
CD (p=0.05)	NS	NS	1.44	1.34	2.64	2.42	2.65	2.43

Table 2: Effect of establishment methods, mulching and irrigation scheduling on ear length, harvest index and 1000 grain weight

Treatments	Ear length (cm)		Harvest index (%)		1000 grain weight (g)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Establishment method						
Conventional sowing	8.90	8.94	40.53	40.29	37.40	37.61
Raised-bed sowing	9.21	9.28	41.82	41.19	39.29	39.66
SEm ±	0.11	0.11	0.48	0.48	0.45	0.45
CD (p=0.05)	NS	NS	NS	NS	1.56	1.57
Mulching						
No mulch	8.91	8.96	40.89	40.49	37.70	37.99
Straw mulch (5t ha^{-1})	9.20	9.26	41.46	40.99	38.99	39.28
SEm ±	0.11	0.11	0.48	0.48	0.45	0.45
CD (p=0.05)	NS	NS	NS	NS	NS	NS
Irrigation scheduling						
CRI only	8.73	8.77	39.16	39.39	36.00	36.17
CRI + 100 mm CPE	9.30	9.37	42.68	42.62	40.43	40.91
CRI + 150 mm CPE	9.16	9.22	41.71	40.50	38.95	39.21
CRI + 200 mm CPE	9.01	9.07	41.15	40.46	38.00	38.25
SEm ±	0.09	0.09	0.42	0.42	0.39	0.40
CD (p=0.05)	0.27	0.27	1.24	1.22	1.15	1.16

Conclusion

Based on the above results it can be concluded that raised bed sowing of wheat with straw mulch 5 t ha^{-1} with irrigation scheduling at CRI+100 mm CPE may be practiced to achieve maximum plant height, ear length, test weight and harvest index of wheat in eastern Uttar Pradesh.

References

1. Jat ML, Gathala MK, Saharawat YS, Tetarwal JP, Gupta R. Double no-till and permanent raised beds in maize–wheat rotation of north-western Indo-Gangetic plains of India: effects on crop yields, water productivity, profitability and soil physical properties. Field Crops Research. 2013 Aug 1;149:291-299.
2. Kumar B, Dhar S, Vyas AK, Paramesh V. Impact of irrigation schedules and nutrient management on growth, yield and root traits of wheat (*Triticum aestivum*) varieties. Indian Journal of Agronomy. 2015;60(1):87-91.
3. Rajanna GA, Dhindwal AS. Water dynamics, productivity and heat use efficiency responses in wheat (*Triticum aestivum*) to land configuration techniques and irrigation schedules. Indian Journal of Agricultural Sciences. 2019 Jun 1;89(6):912-919.
4. Singh B, Eberbach PL, Humphreys E, Kukal SS. The effect of rice straw mulch on evapotranspiration, transpiration and soil evaporation of irrigated wheat in Punjab, India. Agricultural Water Management. 2011;98(1):847-855.
5. Singh J, Mahal SS, Manhas SS. Effect of sowing methods, nitrogen levels and irrigation scheduling on yield and quality of malt barley (*Hordeum vulgare* L.). Indian Journal of Agronomy. 2012;57(3):259-264.
6. Tripathi SC, Sayre KD, Kaul JN. Planting systems on lodging behavior, yield components, and yield of irrigated spring bread wheat. Crop Science. 2005 Jul;45(4):1448-1455.
7. Verma HP, Sharma VH, OPSO, Yadav LRYL, Sharma ACSA, Meena SNMS, Ashwal SAS, Dhakad UDU. Performance of wheat as influence to irrigation scheduling and organic manures; c2022.

8. Verma HP, Sharma OP, Yadav LR, Sharma AC, Meena SN, Ashwal SAS, *et al*. Performance of wheat as influence to irrigation scheduling and organic manures (reprint); c2022.
9. Ram J, Corkindale D, Wu ML. Implementation critical success factors (CSFs) for ERP: Do they contribute to implementation success and post-implementation performance?. International journal of production economics. 2013 Jul 1;144(1):157-174.