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Effect of new wheat (*Triticum aestivum* L.) varieties at different dates of sowing under irrigated conditions

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Abstract
The present field experiment was conducted at Agricultural Research Farm of Raja Balwant Singh College, Bichpuri Agra, during *Rabi* season of 2023-24 to evaluate the "Effect of new wheat (*Triticum aestivum* L.) varieties at different dates of sowing under irrigated conditions" to fulfill the requirement of objectives of the investigation field experiment was conducted during *Rabi* season. The Variables involved in this study were two dates of sowing in main plots *viz*., D_1 (10/11/2023), D_2 (10/12/2023) and eight varieties in sub plots *viz*., V_1 (HD-2967), V_2 (HI-1668), V_3 (HD-3386), V_4 (HD-3471), V_5 (DBW-222), V_6 (DBW-187), V_7 (DBW-386) and V_8 (PBW-826). Thus, in all 16 treatment combinations were compared in "split plot design" with three replications. The soil of experimental field was sandy loam in texture with a pH 8.50. The soil was low in available nitrogen (176.28 Kg ha^{-1}), medium in available phosphorus (26.89 $P_2 0_5$ ha^{-1}) and potash (273.49 kg K_2O ha^{-1}). Studies were made during the investigation *viz*., Growth and development (germination counts at 15 DAS and crop stand $metre^{-1}$ row length, plant height (cm), dry matter accumulation (g), days to 75% spike emergence and days to maturity; yield attributes *viz*., crop stand count m^{-2}, number of spike m^{-2}, no. of grain $spike^{-1}$, weight of grains $spike^{-1}$ (g) and test weight (g); per hectare studies *viz*., Biological, grain, straw yield (q ha^{-1}) and harvest index (%); qualitative studies *viz*., N, P K content (%) and uptake (kg ha^{-1}); economics *viz*., Gross returns, net returns (₹ ha^{-1}) and B: C ratio. Timely sowing date (10/11/2023) was found higher productivity and quality for different varieties of wheat under irrigated conditions, different wheat varieties tested, variety DBW-222 (V_5) gave better results followed by DBW-386 (V_7) in respect of productivity and quality and the basis of maximum net returns (₹ 143027, 141345 and 139135 ha^{-1}) and B:C ratio (3.11, 3.07 and 3.02) with wheat varieties DBW-222 (V_5), DBW-386 (V_7) and PBW-826 (V_8) respectively, sown on 10/11/2023 (Net returns ₹ 139421 ha^{-1} and B:C ratio, 3.03) should be recommended for the farmers of NWPZ.

Keywords: Wheat varieties, *Triticum aestivum* L., productivity and quality

Introduction
Wheat (*Triticum aestivum* L.) is a most widely consumed cereal crop in the world. It undergoes widespread cultivation on a global scale, with India assuming a pivotal role as a primary region where it serves as an indispensable staple food. In the prevailing circumstances, high temperatures have been identified as a foremost determinant in the reduction of wheat yield. Predictable wheat yield nearly suffers from 6 to 10 percent per one °C increase in temperature at the grain-filling stage. The central zone of India is determined as the most heat-prone area. Nearly 42%, wheat cultivating area has suffered by heat stress in the central zone of India. The yield of wheat is reduced with delay in sowing and the reduction cannot be averted by manipulations in the management practices. Sowing time needs to be so adjusted that the seed germinates well and soil moisture stored in the soil profile is utilized efficiently for initial growth and development of the crop. India is blessed with both the rich land and extremely suitable weather climate for crop production. Therefore, the rate of wheat production is second highest in the world. There are still many factors, which are responsible for low average yield of wheat in this country. One of such environmental factors is untimely planting which affects the yield of wheat crop considerably. Another important aspect is lack of improved varieties which are having short maturity and suitable under late sown condition due to relatively shorter

growing period available to the crop. Moreover, varieties also vary both in yield and nutrient uptake under late sown condition. In India's production of wheat during 2022-23 is estimated at record 1105.54 lakh tonnes. It is higher by 28.12 lakh tonnes than previous year's wheat production of 1077.42 lakh tonnes and by 48.23 lakh tonnes than the average wheat production of 1057.31 lakh tonnes (Ministry of Agriculture & Farmers Welfare, P.I.B., 2022-23) [7]. Area under wheat crop 341.57 lakh ha area (2023-24) coverage has been reported compared to 339.20 lakh ha (2022-23) during the corresponding period of last year. Thus 2.37 lakh ha more area has been covered compared to last year during the corresponding period (Ministry of Agriculture & Farmers Welfare, 2023-24) [6]. Uttar Pradesh contributed 32.42% & 97.46 lakh ha, Madhya Pradesh contributed 16.08% & 86.30 lakh ha and Punjab produced 15.65% & 35.18 lakh ha of the total wheat production and area respectively, in India (Ministry of Agriculture & Farmers Welfare, 2022-23) [7]. As per Indian Council of Agricultural Research, the demand for wheat in the country will reach 140 million tonnes by 2050. Most of this demand in production will have to manage by increasing productivity as the land area under wheat is not expected to expand. Therefore, in view of the above consideration the present investigation was conducted to find out the suitable sowing date for different wheat varieties under irrigated conditions, to find out the best variety out of the varieties tested, to work out the economic feasibility of different treatments.

Methodology

The present field experiment entitled "Effect of new wheat (*Triticum aestivum* L.) varieties at different dates of sowing under irrigated conditions" was conducted during *Rabi* season of 2023-2024 at Agricultural Research Farm, R.B.S. College, Bichpuri, Agra. The wheat crop was grown experimentally in the *Rabi* season at the Agricultural Research Farm, Raja Balwant Singh College, Bichpuri, Agra, which is situated at an elevation of 163.4 meters above mean sea level at 27.20^0 North and 77.90^0 East. The research farm is about 11 kilometers west of Agra city on the Agra-Bharatpur Road and this area is in the south-western semi-arid zone of Uttar Pradesh. The soil in the experimental field was Gangetic alluvial, with a calcareous layer at a depth of 1.5 to 2.0 meters and good drainage. A composite soil sample from a depth of 0 to 30 cm was taken shortly before seeding and subjected to a number of mechanical and chemical investigations in order to determine the fertility status and other physico-chemical characteristics of the soil in the experimental region. To fulfill the requirement of objectives of the investigation, field experiment was conducted during *Rabi* season of 2023-24. A "Split plot design" with two dates of sowing (main plots) and eight varieties (sub plots) replicated three times was adopted. Other detail about treatments is given below:

S. No.	Treatments	Notations
A.	**Main plots- Dates of sowing**	
1.	Timely (10/11/2023)	D_1
2.	Late (10/12/2023)	D_2
B.	**Sub plots- Varieties of wheat**	
1.	HD-2967	V_1
2.	HI-1668	V_2
3.	HD-3386	V_3
4.	HD-3471	V_4
5.	DBW-222	V_5
6.	DBW-187	V_6
7.	DBW-386	V_7
8.	PBW-826	V_8

Results

The results of various study carried out the course of investigation entitled "Effect of new wheat (*Triticum aestivum* L.) varieties at different dates of sowing under irrigated conditions" on the growth and development, yield and yield attributes and quality of wheat crop are presented in this chapter and expressed by the helps of suitable tables.

Growth and Development

Germination count at 15 DAS and no. of shoots metre^{-1} row length

Effect of dates of sowing

The data presented in Table-1 indicate that dates of sowing exert significant effect on germination count. Germination count decreased significantly with every delay in the timely sowing date. Germination count was significantly higher with timely sowing date D_1 (10/11/2023) by 14.96 percent late sown D_2 (10/12/2023). Number of shoots metre^{-1} row length was significantly affected due to dates of sowing at various stages of crop growth.

Table 1: Germination count at 15 DAS and number of shoots metre^{-1} row length at successive stages of crop growth as influenced by dates of sowing and varieties

Treatments		Germination count	Number of shoots metre^{-1} row length				
		15 DAS	30 DAS	60 DAS	90 DAS	120 DAS	At harvest
A. Main plots- Dates of sowing							
Timely (10/11/2023)	D_1	56.23	85.69	94.64	109.73	101.02	90.64
Late (10/12/2023)	D_2	48.91	77.04	84.99	86.57	86.57	76.94
SE(m) ±		0.15	0.69	0.36	0.42	0.45	0.42
C.D. (p=0.05)		0.56	2.09	1.19	1.35	1.39	1.28
B. Sub plots- Varieties of wheat							
HD-2967	V_1	49.58	78.57	87.48	99.15	91.03	79.69
HI-1668	V_2	51.70	80.69	89.60	101.27	93.15	81.81
HD-3386	V_3	50.50	79.49	88.40	100.07	91.95	80.61
HD-3471	V_4	51.70	80.73	90.56	101.82	93.98	81.94
DBW-222	V_5	54.90	83.61	94.89	104.31	96.82	86.11
DBW-187	V_6	52.52	71.32	89.76	101.18	93.21	81.89
DBW-386	V_7	54.28	83.57	93.39	103.52	95.48	84.89
PBW-826	V_8	53.15	81.69	89.72	102.15	94.32	83.19
SE(m) ±		0.24	0.68	0.70	0.62	0.59	0.52
C.D. (p=0.05)		0.83	1.97	2.11	1.87	1.76	1.54

The maximum number of shoots metre^{-1} row length was recorded with timely sowing D_1 (10/11/2023) at all the stages of crop growth and it was significantly higher over the late D_2 (10/12/2023). At harvest, the magnitude of increase in number of shoots metre^{-1} row length with timely date of sowing D_1 (10/11/2023) was to the tune of 17.80 percent, over the late sown D_2 (10/12/2023) of wheat.

Effect of varieties

Variety DBW-222 (V_5) were significantly superior over rest of the varieties under test at 15 DAS with respect to germination count and it were also significantly superior over rest of the varieties under test at all the stages of crop growth with respect to germination count and number of shoots metre^{-1} row length. Variety HI-1668 (V_2) was found at par with DBW-187 (V_6) and DBW-187 (V_6) was found at par with PBW-826 (V_8) in terms of germination count at 15 DAS. Variety PBW-826 (V_8) was found at par with DBW-386 (V_7) and HI-1668 (V_2), HD-3471(V_4) and DBW-187 (V_6) were found at par with PBW-826 (V_8) in terms of number of shoots metre^{-1} row length at harvest. At harvest, the magnitude of increase in number of shoots metre^{-1} row length with DBW-222 (V_5) was to the tune of 1.32, 3.51, 5.15, 5.08, 5.25 and 6.82 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3), respectively. Lowest, number of shoots metre^{-1} row length was recorded with (79.69) variety HD-2967 (V_1).

Plant height (cm)

Effect of dates of sowing

At every stage of crop growth, the dates of sowing had a substantial impact on shoot height (cm), according to the data in Table-2. The shoot height (cm) decreased dramatically as the sowing date was postponed. Thus, the lowest shoot height (cm) was recorded with 10/12/2023 date of sowing (D_2). At harvest, the reduction in shoot height (cm) with 10/12/2023 (D_2) sowing date was to the tune of 3.47 percent, respectively when compared with timely sowing date (10/11/2023). The highest shoot height (cm) was recorded with 10/11/2023 (D_1) date of sowing at all the stages of crop growth.

Table 2: Shoot height (cm) at successive stages of crop growth as influenced by dates of sowing and varieties

Treatments		Shoot height (cm)				
		30 DAS	60 DAS	90 DAS	120 DAS	At harvest
A. Main plots- Dates of sowing						
Timely (10/11/2023)	D_1	8.43	27.47	49.48	94.07	93.42
Late (10/12/2023)	D_2	7.70	26.32	46.30	91.29	90.17
SE(m) ±		0.11	0.12	0.52	0.71	0.68
C.D. (p=0.05)		0.35	0.39	1.53	2.14	1.97
B. Sub plots- Varieties of wheat						
HD-2967	V_1	6.03	23.64	45.37	88.50	88.05
HI-1668	V_2	7.17	25.42	46.51	89.64	89.29
HD-3386	V_3	6.75	24.13	46.09	89.12	88.77
HD-3471	V_4	7.36	25.68	47.12	90.87	90.04
DBW-222	V_5	7.52	27.41	49.47	92.88	92.77
DBW-187	V_6	7.38	25.76	47.37	91.02	90.46
DBW-386	V_7	7.43	26.10	48.96	92.57	92.54
PBW-826	V_8	7.40	25.91	47.89	91.94	91.22
SE(m) ±		0.08	0.07	0.13	0.20	0.31
C.D. (p=0.05)		NS	0.20	0.38	0.61	0.95

Effect of varieties

It is clear from the Table-2 that varieties influenced shoot height (cm) significantly at all the stages of crop growth except at 30 and 60 DAS. Variety DBW-222 (V_5) produced significantly longer shoots over all other varieties at all the stages of crop growth. Variety DBW-386 (V_7) was found at par with DBW-222 (V_5); HD-3471(V_4) was found at par with DBW-187 (V_6); HD-3386(V_3) was found at par with HI-1668 (V_2) and HD-2967 (V_1) was found at par with HD-3386 (V_3) in terms of shoot height (cm) at harvest. At harvest, the increase in shoot height (cm) with DBW-222 (V_5) was to the tune of 0.16, 1.69, 2.55, 3.03, 3.89 and 4.50 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3), respectively. Lowest, shoot height (cm) was recorded with (88.05 cm) variety HD-2967 (V_1).

Dry matter accumulation (g)

Effect of dates of sowing

An examination of the data presented in Table-3 indicate that the effect of dates of sowing on dry matter accumulation (g) in plants of 25 cm row length was statistically significant at all the stages of crop growth. The dry matter accumulation in plants of 25 cm row length was significantly reduced with delay in sowing, thus, The maximum dry matter accumulation in plants of 25 cm row length was recorded with timely sowing D_1 (10/11/2023) at all the stages of crop growth and it was significantly higher over the late D_2 (10/12/2023).At harvest, the magnitude of increase in dry matter accumulation in plants of 25 cm row length with timely date of sowing (D_1-10/11/2023) was to the tune of 6.36 percent, over the late sown (D_2-10/12/2023) of wheat.

Table 3: Dry matter accumulation (g) at successive stages of crop growth as influenced by dates of sowing and varieties

Treatments		Dry matter accumulation (g)				
		30 DAS	60 DAS	90 DAS	120 DAS	At harvest
A. Main plots- Dates of sowing						
Timely (10/11/2023)	D_1	8.43	27.47	49.48	94.07	93.42
Late (10/12/2023)	D_2	7.70	26.32	46.30	91.29	90.17
SE(m) ±		0.11	0.12	0.52	0.71	0.68
C.D. (p=0.05)		0.35	0.39	1.53	2.14	1.97
B. Sub plots- Varieties of wheat						
HD-2967	V_1	6.03	23.64	45.37	88.50	88.05
HI-1668	V_2	7.17	25.42	46.51	89.64	89.29
HD-3386	V_3	6.75	24.13	46.09	89.12	88.77
HD-3471	V_4	7.36	25.68	47.12	90.87	90.04
DBW-222	V_5	7.52	27.41	49.47	92.88	92.77
DBW-187	V_6	7.38	25.76	47.37	91.02	90.46
DBW-386	V_7	7.43	26.10	48.96	92.57	92.54
PBW-826	V_8	7.40	25.91	47.89	91.94	91.22
SE(m) ±		0.08	0.07	0.13	0.20	0.31
C.D. (p=0.05)		NS	0.20	0.38	0.61	0.95

Effect of varieties

Variety DBW-222 (V_5) produced significantly dry matter accumulation (g) in plants of 25 cm row length over all other varieties at all the stages of crop growth. Variety DBW-386 (V_7) and PBW-826 (V_8) were found at par with DBW-222 (V_5); HD-2967 (V_1), HI-1668 (V_2), HD-3386 (V_3) and HD-3471 (V_4) were found at par with DBW-187 (V_6) in terms of dry matter accumulation (g) in plants of 25 cm row length at harvest. At harvest, the increase in dry matter accumulation (g) in plants of 25 cm row length with DBW-222 (V_5) was to the tune of 1.70, 2.07, 3.23, 3.34, 4.61 and 5.03 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3), respectively. Lowest, dry matter accumulation (g) in plants of 25 cm row length was recorded with (130.42 g) variety HD-2967 (V_1).

Day to 75% spike emergence and days to physiological maturity

Effect of dates of sowing

The maximum day to 75 percent spike emergence and days to physiological maturity were recorded with timely sowing D_1 (10/11/2023) and it was significantly higher over the late D_2 (10/12/2023) at 75 percent spike emergence. At harvest, the magnitude of increase in day to 75 percent spike emergence and days to physiological maturity with timely date of sowing D_1 (10/11/2023) was to the tune of 8.02 and 10.30 days, over the late sown D_2 (10/12/2023) of wheat.

Effect of varieties

Variety DBW-386 (V_7) was found at par with DBW-222 (V_5); HI-1668 (V_2), HD-3386 (V_3), HD-3471 (V_4) and DBW-187 (V_6) were found at par with PBW-826 (V_8) in terms of days to 75 percent spike emergence and days to maturity. The increment in days to 75 percent spike emergence and days to maturity with DBW-222 (V_5) was to the tune of 0.22, 3.0, 3.22, 3.86, 4.12, 5.46 days and 2.47, 6.50, 6.69, 6.87, 8.26, 9.60 days over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3), respectively. Lowest, days to 75 percent spike emergence and days to maturity was recorded (77.35 and 138.74 days) with variety HD-2967 (V_1).

Yield attributes

Effect of dates of sowing

The crop stand count metre^{-2} decreased significantly with every delay in the sowing date from timely sowing. The maximum stand count metre^{-2} was recorded with timely sowing D_1 (10/11/2023) at harvest and it was significantly higher over the late sowing D_2 (10/12/2023). At harvest, the magnitude of increase in stand count metre^{-2} with timely date of sowing D_1 (10/11/2023) was to the tune of 0.57 percent, over the late sown D_2 (10/12/2023) of wheat. The maximum number of spikes meter^{-2} were recorded with timely sowing D_1 (10/11/2023) at harvest and it was significantly higher over the late sowing D_2 (10/12/2023). At harvest, the magnitude of increase in number of spikes meter^{-2} with timely date of sowing D_1 (10/11/2023) was to the tune of 0.63 percent, over the late sown D_2 (10/12/2023) of wheat. The highest length of spike (cm) was recorded with timely sowing 10/11/2023 (D_1) at harvest and it was significantly higher over the late sowing on 10/12/2023 (D_2). At harvest, the magnitude of increase in length of spike (cm) with timely date of sowing on 10/11/2023 (D_1) was to the tune of 7.49 percent, over the late sown (D_2-10/12/2023) of wheat. A perusal of the data presented in Table-4 clearly indicates that the highest number of grains spike^{-1} was recorded with timely sowing on 10/11/2023 (D_1) at harvest and it was significantly higher over the late sowing on 10/12/2023 (D_2). The late sowing on 10/12/2023 (D_2) was found at par with timely sowing on 10/11/2023 (D_1) in terms of number of grains spike^{-1} at harvest At harvest, the magnitude of increase in number of grains spike^{-1} with timely date of sowing on 10/11/2023 (D_1) was to the tune of 2.04 percent, over the late sown on 10/12/2023 (D_2) of wheat. The highest of weight of grains spike^{-1} (g) was recorded with timely sowing on 10/11/2023 (D_1) at harvest and it was significantly higher over the late sowing on 10/12/2023 (D_2). At harvest, the magnitude of increase in weight of grains spike^{-1} (g) with timely date of sowing on 10/11/2023 (D_1) was to the tune of 14.32 percent, over the late sown on 10/12/2023 (D_2) of wheat. The data set out in Table-4 indicate that date of sowing exert significant impact on 1000-grain weight. The test weight (g) was significantly affected due to dates of sowing. The highest of test weight (g) was recorded with timely sowing on 10/11/2023 (D_1) at harvest and it was significantly higher over the late sowing on 10/12/2023 (D_2). At harvest, the magnitude of increase in test weight (g) with timely date of sowing on 10/11/2023 (D_1) was to the tune of 2.32 percent, over the late sown on 10/12/2023 (D_2) of wheat.

Effect of varieties

Table under reference further showed that variety DBW-222

(V_5) had significantly higher crop stand count meter^{-2} over all other varieties. The magnitude of increase in stand count meter^{-2} with DBW-222 (V_5) was to the tune of 0.82, 2.59, 4.29, 6.47, 7.70 and 8.10 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, crop stand count meter^{-2} was recorded with (305.41) variety HD-2967 (G_1). The magnitude of increase in number of spikes meter^{-2} with DBW-222 (V_5) was to the tune of 1.16, 2.18, 3.29, 4.39, 4.93 and 6.57 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, number of spikes meter^{-2} was recorded with (297.00) variety HD-2967 (V_1). The maximum, length of spike (cm) was recorded with (9.60 cm) variety DBW-222 (V_5). Variety HD-3471 (V_4), DBW-187 (V_6), DBW-386 (V_7), PBW-826 (V_8) were found at par with DBW-222 (V_5); HI-1668 (V_2) was found at par with DBW-187 (V_6); HD-3386 (V_3) was found at par with HD-3471(V_4); HD-3386 (V_3) and HD-2967 (V_1) were found at par with HI-1668 (V_2) in terms of length of spike (cm) at harvest. The magnitude of increase in number of spikes meter^{-2} with DBW-222 (V_5) was to the tune of 3.22, 8.22, 12.94, 15.52, 30.96 and 37.33 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, number of spikes meter^{-2} was recorded with (6.57 cm) variety HD-2967 (V_1). From the date presented in Table-4 showed that the variety DBW-222 (V_5) produced significantly higher number of grains spike^{-1} (56.83) over all other varieties. Variety DBW-386 (V_7) was found at par with DBW-222 (V_5); Variety DBW-187 (V_6) was found at par with PBW-826 (V_8); Variety HI-1668 (V_2) was found at par with HD-3471 (V_4); Variety HD-3386 (V_3) was found at par with HI-1668 (V_2) Variety HD-2967 (V_1) was found at par with HD-3386 (V_3) in terms of number of grains spike^{-1} at harvest. The magnitude of increase in number of grains spike^{-1} with DBW-222 (V_5) was to the tune of 1.71, 4.08, 5.55, 8.10, 9.01 and 10.71 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, number of grains spike^{-1} was recorded with (50.98) variety HD-2967 (V_1).

Table 4: Yield attributes at harvest of wheat as influenced by dates of sowing and varieties

Treatments		Yield attributes				
		Crop stand count m^{-2}	No. of spikes m^{-2}	No. of grains spikes^{-1}	Weight of grains spikes^{-1} (g)	Test weight (g)
A. Main plots- Dates of sowing						
Timely (10/11/2023)	D_1	320.93	308.48	53.97	4.15	41.43
Late (10/12/2023)	D_2	319.08	306.54	52.89	3.63	40.49
SE(m) ±		0.29	0.45	0.42	0.09	0.25
C.D. (p=0.05)		0.81	1.34	1.21	0.25	0.82
B. Sub plots- Varieties of wheat						
HD-2967	V_1	305.41	297.00	50.98	2.43	38.80
HI-1668	V_2	311.58	303.83	52.13	2.72	40.13
HD-3386	V_3	310.42	299.17	51.33	2.56	39.57
HD-3471	V_4	315.17	305.42	52.57	2.81	40.56
DBW-222	V_5	335.58	318.83	56.83	3.95	42.96
DBW-187	V_6	321.75	308.67	53.84	2.95	41.26
DBW-386	V_7	332.83	315.17	55.87	3.34	42.31
PBW-826	V_8	327.08	312.00	54.60	3.02	41.66
SE(m) ±		0.65	0.71	0.45	0.15	0.51
C.D. (p=0.05)		1.92	1.93	1.32	0.46	1.54

Variety DBW-222 (V_5) produced significantly higher weight of grains spike^{-1} (3.95 g) over all other varieties. Variety DBW-187 (V_6) and PBW-826 (V_8) were found at par with DBW-222 (V_5); Variety HI-1668 (V_2), HD-3386 (V_3) and HD-3471 (V_4) were found at par with DBW-187 (V_6); Varieties HD-2967 (V_1) was found at par with HD-3386 (V_3) in terms of weight of grains spike^{-1} at harvest. The magnitude of increase in weight of grains spike^{-1} (g) with DBW-222 (V_5) was to the tune of 18.26, 30.79, 33.89, 40.56, 45.22 and 54.29 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, weight of grains spike^{-1} (g) was recorded with (2.43 g) variety HD-2967 (V_1). The data summarized in Table-4 reveal that variety DBW-222 (V_5) produced significantly higher test weight (42.96 g) over all other varieties. Variety DBW-386 (V_7) and PBW-826 (V_8) were found at par with DBW-222 (V_5); Variety HI-1668 (V_2), HD-3386 (V_3), HD-3471 (V_4) and DBW-187 (V_6) were found at par with PBW-826 (V_8); Variety HD-2967 (V_1) was found at par with HI-1668 (V_2) in terms of test weight at harvest. The magnitude of increase in test weight (g) with DBW-222 (V_5) was to the tune of 1.53, 3.12, 4.12, 5.91, 7.05 and 8.56 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, test weight (g) was recorded with (38.80 g) variety HD-2967 (V_1).

Yield studies (q ha^{-1})

Biological yield (q ha^{-1})

Effect of dates of sowing

The data summarized in Table-5 revealed that biological yield (q ha^{-1}) was significantly affected due to dates of sowing. The Maximum biological yield (136.86 q ha^{-1}) was recorded with timely sowing on 10/11/2023 (D_1) at harvest and it was significantly higher over the late sowing on 10/12/2023 (D_2). At harvest, the magnitude of increase in biological yield (q ha^{-1}) with timely date of sowing on 10/11/2023 (D_1) was to the tune of 2.40 percent, over the late sown on 10/12/2023 (D_2) of wheat.

Table 5: Yield (q ha^{-1}) of wheat as influenced by dates of sowing and varieties

Treatments		Yield (q ha^{-1})			
		Biological yield	Grain yield	Straw yield	Harvest index (%)
A. Main plots- Dates of sowing					
Timely (10/11/2023)	D_1	136.86	60.66	76.20	44.32
Late (10/12/2023)	D_2	133.64	58.46	75.18	43.74
SE(m) ±		0.62	0.51	0.28	0.16
C.D. (p=0.05)		1.89	1.54	0.83	0.49
B. Sub plots- Varieties of wheat					
HD-2967	V_1	131.77	56.64	75.13	42.98
HI-1668	V_2	133.67	58.69	74.98	43.90
HD-3386	V_3	133.03	57.68	75.35	43.35
HD-3471	V_4	134.91	59.28	75.63	43.94
DBW-222	V_5	138.62	62.27	76.35	44.92
DBW-187	V_6	135.76	59.76	76.00	44.01
DBW-386	V_7	137.67	61.58	76.09	44.73
PBW-826	V_8	136.62	60.58	76.04	44.34
SE(m) ±		0.52	0.42	0.24	0.13
C.D. (p=0.05)		1.53	1.29	0.72	0.42

Effect of varieties

The data presented in Table-5 indicate variety DBW-222 (V_5) produced significantly higher biological yield (138.62 q ha^{-1}) over all other varieties. Variety DBW-386 (V_7) was found at par with DBW-222 (V_5); Variety PBW-826 (V_8) was found at par with DBW-386 (V_7); Variety DBW-187 (V_6) was found at par with PBW-826 (V_8); Variety HD-3471 (V_4) was found at par with DBW-187 (V_6); Variety HI-1668 (V_2) was found at par with HD-3471 (V_4); Variety HD-3386 (V_3) was found at par with HI-1668 (V_2) and Variety HD-2967 (V_1) was found at par with HD-3386 (V_3) in terms of biological yield at harvest. The magnitude of increase in biological yield (q ha^{-1}) with DBW-222 (V_5) was to the tune of 0.69, 1.46, 2.10, 2.74, 3.70 and 4.20 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, biological yield (131.77 q ha^{-1}) was recorded with variety HD-2967 (V_1).

Grain yield (q ha^{-1})

Effect of dates of sowing

The Maximum grain yield (60.66 q ha^{-1}) was recorded with timely sowing on 10/11/2023 (D_1) at harvest and it was significantly higher over the late sowing on 10/12/2023 (D_2). At harvest, the magnitude of increase in grain yield (q ha^{-1}) with timely date of sowing on 10/11/2023 (D_1) was to the tune of 3.76 percent, over the late sown on 10/12/2023 (D_2) of wheat.

Effect of varieties

The data presented in Table-5 revealed that variety DBW-222 (V_5) produced significantly higher grain yield (62.27 q ha^{-1}) over all other varieties. Variety DBW-386 (V_7) was found at par with DBW-222 (V_5); Variety PBW-826 (V_8) was found at par with DBW-386 (V_7); Variety DBW-187 (V_6) was found at par with PBW-826 (V_8); Variety HI-1668 (V_2) and HD-3471 (V_4) were found at par with DBW-187 (V_6); Varieties HI-1668 and HD-3386 (V_3) were found at par with HD-3471 (V_4); Variety HD-3386 (V_3) was found at par with HI-1668 (V_2) and variety HD-2967 (V_1) was found at par with HD-3386 (V_3) in terms of grain yield at harvest. The magnitude of increase in grain yield (q ha^{-1}) with DBW-222 (V_5) was to the tune of 1.12, 2.78, 5.04, 5.03, 6.09 and 7.95 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, grain yield (56.64 q ha^{-1}) was recorded with variety HD-2967 (V_1).

Straw yield (q ha^{-1})

Effect of dates of sowing

The Maximum straw yield (76.20 q ha^{-1}) was recorded with timely sowing on 10/11/2023 (D_1) at harvest and it was significantly higher over the late sowing on 10/12/2023 (D_2). At harvest, the magnitude of increase in straw yield (q ha^{-1}) with timely date of sowing on 10/11/2023 (D_1) was to the tune of 1.35 percent, over the late sown on 10/12/2023 (D_2) of wheat.

Effect of varieties

DBW-222 (V_5) produced significantly higher straw yield (76.35 q ha^{-1}) over all other varieties. Variety HD-3471 (V_4), DBW-187 (V_6), DBW-386 (V_7) and PBW-826 (V_8) were found at par with DBW-222 (V_5); Variety HD-2967 (V_1), HI-1668 (V_2) and HD-3386 (V_3) were found at par with HD-3471 (V_4) in terms of straw yield at harvest. The magnitude of increase in straw yield (q ha^{-1}) with DBW-222 (V_5) was to the tune of 0.34, 0.40, 0.46, 0.95, 1.32 and 1.62 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HD-3386 (V_3) and HD-2967 (V_1) at harvest, respectively. The minimum, straw yield (74.98 q ha^{-1}) was recorded with variety HI-1668 (V_2).

Harvest index (%)

Effect of dates of sowing

The Maximum harvest index (44.32%) was recorded with timely sowing on 10/11/2023 (D_1) at harvest and it was significantly higher over the late sowing on 10/12/2023 (D_2). At harvest, the magnitude of increase in harvest index (%) with timely date of sowing on 10/11/2023 (D_1) was to the tune of 0.58 percent, over the late sown on 10/12/2023 (D_2) of wheat.

Effect of varieties

The variation in harvest index due to variety DBW-222 (V_5) produced significantly higher harvest index (44.92%) over all other varieties. Variety DBW-386 (V_7) was found at par with DBW-222 (V_5); Variety PBW-826 (V_8) was found at par with DBW-386 (V_7); Variety HD-3471 (V_4) and DBW-187 (V_6) were found at par with PBW-826 (V_8); Variety HI-1668 (V_2) was found at par with HD-3471 (V_4) and variety HD-2967 (V_1) was found at par with HD-3386 (V_3) in terms of harvest index (%) at harvest. The magnitude of increase in harvest index (%) with DBW-222 (V_5) was to the tune of 0.19, 0.58, 0.91, 0.94, 0.98 and 1.02 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-2967 (V_1), HD-3471 (V_4) and HI-1668 (V_2) HD-3386 (V_3) at harvest, respectively. The minimum, harvest index (43.35%) was recorded with variety HD-3386 (V_3).

Qualitative studies

Nitrogen content (%) and uptake (kg ha^{-1})

Effect of dates of sowing

Different date of sowing had significant effect on nitrogen content (%) and uptake (kg ha^{-1}). The highest nitrogen content (2.39% in grain & 0.48% in straw) and uptake (144.98 kg ha^{-1} by grain & 36.58 kg ha^{-1} by grain) was recorded with timely (10/11/2023) date of sowing followed by late (10/12/2023) date of sowing. The magnitude of increase in nutrient uptake with timely date of sowing on 10/11/2023 (D_1) was to the tune of 7.36% by grain and 10.58% by grain, over the late sown on 10/12/2023 (D_2) of wheat.

Effect of varieties

Different varieties had significant effect on nitrogen content (%) and uptake (kg ha^{-1}). Variety PBW-826 (V_8) was found at par with DBW-386 (V_7); Variety DBW-187 (V_6) was found at par with PBW-826 (V_8) and variety HD-3471 (G_4) was found at par with DBW-187 (V_6) in terms of nitrogen content (%) in grain at harvest. Variety DBW-187 (V_6) was found at par with PBW-826 (V_8); Variety HD-3471 (V_4) was found at par with DBW-187 (V_6) and variety HD-3386 (V_3) was found at par with HI-1668 (V_2) in terms of nitrogen uptake by straw at harvest. The highest nitrogen content (2.40% in grain & 0.46% in straw) and uptake (149.45 kg ha^{-1} by grain & 35.12 kg ha^{-1} by grain) was recorded with DBW-222 (V_5) followed by DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3). Minimum nitrogen content (2.12% in grain & 0.35% in straw) and uptake (120.08 kg ha^{-1} by grain & 26.30 kg ha^{-1} by grain) was recorded with HD-2967 (V_1).

Table 6: Nitrogen content (%) and uptake (kg ha^{-1}) as influenced by dates of sowing and varieties

Treatments		Nitrogen content (%)		Nitrogen uptake (kg ha^{-1})	
		In grain	In straw	By grain	By straw
A. Main plots- Dates of sowing					
Timely (10/11/2023)	D_1	2.39	0.48	144.98	36.58
Late (10/12/2023)	D_2	2.31	0.44	135.04	33.08
SE(m) ±		0.010	0.005	1.42	0.91
C.D. (p=0.05)		0.029	0.015	4.21	2.72
B. Sub plots- Varieties of wheat					
HD-2967	V_1	2.12	0.34	120.08	26.30
HI-1668	V_2	2.20	0.38	129.12	28.49
HD-3386	V_3	2.16	0.36	124.59	27.88
HD-3471	V_4	2.26	0.40	133.97	30.25
DBW-222	V_5	2.40	0.46	149.45	35.12
DBW-187	V_6	2.29	0.41	136.85	31.16
DBW-386	V_7	2.34	0.44	144.10	33.48
PBW-826	V_8	2.31	0.42	139.94	31.94
SE(m) ±		0.011	0.003	1.12	0.81
C.D. (p=0.05)		0.031	0.010	2.31	1.42

Table 7: Phosphorus content (%) and uptake (kg ha^{-1}) as influenced by dates of sowing and varieties

Treatments		Phosphorus content (%)		Phosphorus uptake (kg ha^{-1})	
		In grain	In straw	By grain	By straw
A. Main plots- Dates of sowing					
Timely (10/11/2023)	D_1	0.349	0.045	21.17	3.42
Late (10/12/2023)	D_2	0.236	0.038	18.76	2.85
SE(m) ±		0.002	0.003	0.84	0.33
C.D. (p=0.05)		0.005	0.005	2.21	0.92
B. Sub plots- Varieties of wheat					
HD-2967	V_1	0.331	0.034	18.74	2.55
HI-1668	V_2	0.338	0.040	19.83	2.99
HD-3386	V_3	0.335	0.038	19.32	2.86
HD-3471	V_4	0.340	0.042	20.15	3.17
DBW-222	V_5	0.348	0.050	21.67	3.81
DBW-187	V_6	0.343	0.045	20.49	3.42
DBW-386	V_7	0.346	0.048	21.30	3.65
PBW-826	V_8	0.345	0.046	20.90	3.49
SE(m) ±		0.003	0.001	0.11	0.10
C.D. (p=0.05)		0.010	0.002	0.32	0.31

Phosphorus content (%) and uptake (kg ha^{-1})

Effect of dates of sowing

Different date of sowing had significant effect on phosphorus content (%) and uptake (kg ha^{-1}). The highest phosphorus content (0.349% in grain & 0.045% in straw) and uptake (21.170 kg ha^{-1} by grain & 3.429 kg ha^{-1} by grain) was recorded with

timely (10/11/2023) date of sowing followed by late (10/12/2023) date of sowing. The magnitude of increase in nutrient uptake with timely date of sowing on 10/11/2023 (D_1) was to the tune of 12.81% by grain and 20.02% by grain, over the late sown on 10/12/2023 (D_2) of wheat.

Effect of varieties

Different varieties had significant effect on phosphorus content (%) and uptake (kg ha^{-1}). Varieties HI-1668 (V_2), HD-3471 (V_4), DBW-187 (V_6), DBW-386 (V_7), PBW-826 (V_8) were found at par with DBW-222 (V_5) and variety HD-2967 (V_1) was found at par with HD-3386 (V_3) in terms of phosphorus content (%) in grain at harvest. Variety PBW-826 (V_8) was found at par with DBW-386 (V_7) in terms of phosphorus uptake by in grain; Variety DBW-187 (V_6) was found at par with PBW-826 (V_8) and variety HD-3386 (V_3) was found at par with HI-1668 (V_2) in terms of phosphorus uptake by straw at harvest. The highest phosphorus content (0.348% in grain & 0.050% in straw) and uptake (21.670 kg ha^{-1} by grain & 3.818 kg ha^{-1} by grain) was recorded with DBW-222 (V_5) followed by DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3). Minimum phosphorus content (0.331% in grain & 0.034% in straw) and uptake (18.748 kg ha^{-1} by grain & 2.554 kg ha^{-1} by grain) was recorded with HD-2967 (V_1).

Table 8: Potassium content (%) and uptake (kg ha^{-1}) as influenced by dates of sowing and varieties

Treatments		Potassium content (%)		Potassium uptake (kg ha^{-1})	
		In grain	In straw	By grain	By straw
A. Main plots- Dates of sowing					
Timely (10/11/2023)	D_1	0.82	2.32	49.74	176.78
Late (10/12/2023)	D_2	0.73	2.17	42.68	163.14
SE(m) ±		0.003	0.005	1.34	1.29
C.D. (p=0.05)		0.009	0.014	3.94	3.67
B. Sub plots- Varieties of wheat					
HD-2967	V_1	0.63	2.23	35.68	167.54
HI-1668	V_2	0.69	2.30	40.50	172.45
HD-3386	V_3	0.65	2.27	37.49	171.04
HD-3471	V_4	0.72	2.33	42.68	176.22
DBW-222	V_5	0.80	2.41	49.82	184.00
DBW-187	V_6	0.75	2.35	44.82	178.60
DBW-386	V_7	0.78	2.38	48.03	181.09
PBW-826	V_8	0.77	2.36	46.65	179.45
SE(m) ±		0.003	0.004	0.41	0.53
C.D. (p=0.05)		0.007	0.010	1.12	1.57

Potassium content (%) and uptake (kg ha^{-1})

Effect of dates of sowing

Different date of sowing had significant effect on potassium content (%) and uptake (kg ha^{-1}). The highest potassium content (0.82% in grain & 2.32% in straw) and uptake (49.74 kg ha^{-1} by grain & 176.78 kg ha^{-1} by grain) was recorded with timely (10/11/2023) date of sowing followed by late (10/12/2023) date of sowing. The magnitude of increase in nutrient uptake with timely date of sowing on 10/11/2023 (D_1) was to the tune of 16.54% by grain and 8.36% by grain, over the late sown on 10/12/2023 (D_2) of wheat.

Effect of varieties

Different varieties had significant effect on potassium content (%) and uptake (kg ha^{-1}). Variety DBW-187 (V_6) was found at par with PBW-826 (V_8) in terms of potassium content (%) in straw at harvest. The highest potassium content (0.80% in grain & 2.41% in straw) and uptake (49.82 kg ha^{-1} by grain & 184.0 kg ha^{-1} by grain) was recorded with DBW-222 (V_5) followed by DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3). Minimum potassium content (0.63% in grain & 2.23% in straw) and uptake (35.68 kg ha^{-1} by grain & 167.54 kg ha^{-1} by grain) was recorded with HD-2967 (V_1).

Economics

The economic feasibility of different agronomic practices is usually a deciding factor for its adoption by the farmers for commercialization of any crop production programme. It is, therefore, of common interest to calculate the effect of different treatments taken in this study on the yield of wheat.

Gross returns (₹ ha^{-1})

Effect of dates of sowing

Different dates of sowing had significant effect on was recorded with (Table-9). The highest gross returns ₹ 185276 ha^{-1} was recorded with timely sowing D_1 (10/11/2023) followed by late ₹ 179777 ha^{-1} (D_2-10/12/2023). The magnitude of increase in gross returns with timely date of sowing on 10/11/2023 (D_1) was to the tune of 3.05 percent, over the late sown on 10/12/2023 (D_2) of wheat.

Effect of varieties

Different varieties had significant effect on was recorded with (Table-9). The highest gross returns ₹ 188882 ha^{-1} were recorded with DBW-222 (V_5) which was found at par with ₹ 187200 ha^{-1} (V_7- DBW-386) and PBW-826 (V_8) at harvest, respectively. The minimum, gross returns ₹ 175783 ha^{-1} was recorded with variety HD-2967 (V_1).

Table 9: Economics (₹ ha^{-1}) of wheat as influenced by dates of sowing and varieties

Treatments		Economics (₹ ha^{-1})			
		Cost of cultivation	Gross returns	Net returns	B: C ratio
A. Main plots- Dates of sowing					
Timely (10/11/2023)	D_1	45950	185276	139421	3.03
Late (10/12/2023)	D_2	45950	179777	133922	2.91
SE(m) ±		-	1823	1649	0.03
C.D. (p=0.05)		-	5465	5368	0.10
B. Sub plots- Varieties of wheat					
HD-2967	V_1	45950	175783	129928	2.82
HI-1668	V_2	45950	180137	134282	2.92
HD-3386	V_3	45950	178199	132344	2.88
HD-3471	V_4	45950	181875	136020	2.96
DBW-222	V_5	45950	188882	143027	3.11
DBW-187	V_6	45950	183178	137323	2.98
DBW-386	V_7	45950	187200	141345	3.07
PBW-826	V_8	45950	184990	139135	3.02
SE(m) ±		-	1320	1269	0.03
C.D. (p=0.05)		-	3972	3847	0.09

Net returns (₹ ha^{-1})

Effect of dates of sowing

Different dates of sowing had significant effect on was recorded with (Table-9). The highest net returns ₹ 139421 ha^{-1} was recorded with timely sowing D_1 (10/11/2023) followed by late ₹ 133922 ha^{-1} (D_2-10/12/2023). The magnitude of increase in net returns with timely date of sowing on 10/11/2023 (D_1) was to the tune of 4.10 percent, over the late sown on 10/12/2023 (D_2) of wheat.

Effect of varieties

Different varieties had significant effect on was recorded with (Table-9). The highest net returns ₹ 143027 ha^{-1} were recorded with DBW-222 (V_5) which was found at par with ₹ 141345 ha^{-1} (V_7- DBW-386) and PBW-826 (V_8) at harvest, respectively. The minimum, net returns ₹ 129928 ha^{-1} was recorded with variety HD-2967 (V_1).

B: C ratio

Effect of dates of sowing

The highest B: C ratio (3.03) was recorded with timely sowing D_1 (10/11/2023) followed by late (2.91) sown on 10/12/2023 (D_2).

Effect of varieties

Different varieties had significant effect on was recorded with (Table-9). The highest B: C ratio (3.11) were recorded with DBW-222 (V_5) which was found at par with (3.07) (V_7- DBW-386) and PBW-826 (V_8) at harvest, respectively. The minimum, B: C ratio (2.82) was recorded with varieties HD-2967 (V_1).

Discussion

The present study entitled "Effect of new wheat (*Triticum aestivum* L.) varieties at different dates of sowing under irrigated conditions" was designed mainly to determine the response of wheat varieties to dates of sowing in terms of growth, development, yield attributes, yield and quality for North-western plains zone (Agra region) of U.P. (India). This chapter attempts to explain and rationalize the potential causes and characteristics that could account for significant outcomes from field experiments. The effect of treatments on grain yield and the many contributing characteristics that affect the yield are the main topics of discussion because yield is the ultimate criterion for cultivating the effectiveness of various treatments. The study's significant findings have been examined in order to support its sound conclusions. Weather and soil conditions are two examples of environmental elements that have a significant impact on wheat crop performance and output. The amount and distribution of precipitation, temperature, the length and intensity of sunshine, soil evaporation, and leaf transpiration are the key meteorological factors that impact crop productivity. Throughout the trial, the mean maximum and minimum temperatures varied between 19.3 ^{0}C and 40.5 ^{0}C and 7.4 ^{0}C and 20.9 °C, respectively. During the germination and crop growth period, the maximum and lowest temperatures were both low, which had an impact on both processes. After January, the temperature rose, which was advantageous for the crop's growth and development. Throughout the crop season, the relative humidity fluctuated steadily with a slight *zig-zag* pattern. During the maturity period, the relative humidity decreased. There was a range of 82.6 to 91.4 percent for the maximum relative humidity and 25.6 to 75.8 percent for the minimum. The crop as a whole continued to benefit from the good relative humidity. Only 9.0 mm of rain fell overall during the crop span in November, which had a positive impact on germination. PE ranged from 1.0 to 7.0 mm day^{-1}, the highest and lowest values. Because of the winter rains, which were good for the crop, evaporation stayed rather average during the grain filling stage. In addition, during the agricultural season, the weather stayed excellent for the wheat crop.

Dates of sowing of wheat influenced the initial plant population considerably. Germination count was significantly higher with timely sowing date (D_1-10/11/2023) by 14.96 percent late sown (D_2-10/12/2023). Number of shoots metre^{-1} row length was significantly affected due to dates of sowing at various stages of crop growth. The maximum number of shoots metre^{-1} row length was recorded with timely sowing (D_1-10/11/2023) at all the stages of crop growth and it was significantly higher over the late (D_2-10/12/2023). At harvest, the magnitude of increase in number of shoots metre^{-1} row length with timely date of sowing (D_1-10/11/2023) was to the tune of 17.80 percent, over the late sown (D_2-10/12/2023) of wheat. The greater number of shoots meter^{-1} row length with timely sowing date might be attributed to its better growth under prevailing weather conditions. Khan *et al.*, (2020) [3], Upadhyay *et al.*, (2021) [14], Muhammad *et al.*, (2022) [8], Bhagat *et al.*, (2023) [1], Yadav *et al.*, (2023) [18] and Raut *et al.*, (2024) [9] have also reported similar results. The shoot height (cm) significantly reduced with delay in date of sowing. Thus, the lowest shoot height (cm) was recorded with 10/12/2023 date of sowing (D_2). At harvest, the reduction in

shoot height (cm) with 10/12/2023 (D_2) sowing date was to the tune of 3.47 percent, respectively when compared with timely sowing date (10/11/2023). The highest shoot height (cm) was recorded with 10/11/2023 (D_1) date of sowing at all the stages of crop growth. Yadav *et al.,* (2023) [18], Raut *et al.,* (2024) [9], Singh *et al.,* (2024) [12] and Vishwakarma *et al.,* (2024) [17] have also reported that delay in sowing from timely to late, considerably decreased the plant height. Up until crop harvest, dry matter buildup in 25 cm rows rose steadily and practically linearly. After 30 days following seeding, however, the rate of dry matter buildup accelerated significantly. The plant must rely mostly on the food found in the seed and the small amount of food produced by the leaves during the early stages of growth, when the roots are not yet well established and the leaves are unable to produce enough food material. This may be the cause of the extremely sluggish rate of dry matter buildup up to 30 days after sowing, during which time leaves and roots begin to grow. The accumulation of dry matter was rather significant and nearly linear up to 90 days after seeding because the plant was able to synthesize more carbohydrates and absorb more nutrients from the soil. The rate at which dry matter accumulated in the spike over the remaining growing phase was extremely high. This could be because extra dry matter was added at post-anthesis as a result of photosynthates moving to grain. The main cause of the quicker buildup of dry matter over the entire harvest plant may be the sharp rise in spike weight. The dry matter accumulation in plants of 25 cm row length was significantly reduced with delay in sowing, thus, The maximum dry matter accumulation in plants of 25 cm row length was recorded with timely sowing (D_1-10/11/2023) at all the stages of crop growth and it was significantly higher over the late sown (D_2-10/12/2023). At harvest, the magnitude of increase in dry matter accumulation in plants of 25 cm row length with timely date of sowing (D_1-10/11/2023) was to the tune of 6.36 percent, over the late sown (D_2-10/12/2023) of wheat. At every stage of crop growth, the dry matter accumulation in plants with a 25 cm row length was significantly decreased from timely planting dates to late and extremely late sowing dates (Table-3). Dry matter buildup increased at different phases of crop growth because plants sown on time benefit from soil moisture and nutrients for a longer length of time than plants sown on late or extremely late dates. Khan *et al.,* (2020) [3], Upadhyay *et al.,* (2021), [14] Muhammad *et al.,* (2022) [8], Bhagat *et al.,* (2023) [1], Yadav *et al.,* (2023) [18], Raut *et al.,* (2024) [9], Singh *et al.,* (2024) [12] and Vishwakarma *et al.,* (2024) [17] have also reported likewise.

Different varieties of wheat influenced the germination count considerably. This might be attributed due to the variation in soil moisture and temperature at sowing as well as genetic makeup of the Variety DBW-222 (V_5) were significantly superior over rest of the varieties under test at 15 DAS with respect to germination count and it were also significantly superior over rest of the varieties under test at all the stages of crop growth with respect to germination count and number of shoots metre^{-1} row length. At harvest, the magnitude of increase in number of shoots metre^{-1} row length with DBW-222 (V_5) was to the tune of 1.32, 3.51, 5.15, 5.08, 5.25 and 6.82 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3), respectively. Lowest, number of shoots metre^{-1} row length was recorded with (79.69) varieties HD-2967 (V_1). Varieties influenced shoot height (cm) significantly at all the stages of crop growth except at 30 and 60 DAS. Variety DBW-222 (V_5) produced significantly longer shoots over all other varieties at all the stages of crop growth. At harvest, the increase in shoot height (cm) with DBW-222 (V_5) was to the tune of 0.16, 1.69, 2.55, 3.03, 3.89 and 4.50 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3), respectively. Lowest, shoot height (cm) was recorded with (88.05 cm) variety HD-2967 (V_1). Different varieties had significant effect on dry matter accumulation (g) of 25 cm row length. Variety DBW-222 (V_5) produced significantly dry matter accumulation (g) in plants of 25 cm row length over all other varieties at all the stages of crop growth. At harvest, the increase in dry matter accumulation (g) in plants of 25 cm row length with DBW-222 (V_5) was to the tune of 1.70, 2.07, 3.23, 3.34, 4.61 and 5.03 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3), respectively. Lowest, dry matter accumulation (g) in plants of 25 cm row length was recorded with (130.42 g) variety HD-2967 (V_1). Variety DBW-222 (V_5) produced significantly higher dry matter over all other varieties at all the stages of crop growth and at harvest. The intricate processes of the plant system interacting with the changing environmental variables determine growth. Generally speaking, the formation of dry matter in plants is regarded as a growth indicator. Due to inadequate production of photosynthetic surfaces and canopy structure, the rate of dry matter accumulation was extremely slow from the seeding to tillering stage. However, as growth progressed, the leaves were able to synthesize more photosynthates, and frequently, roots were able to multiply and absorb more nutrients from the soil, which caused the dry matter accumulation to pick up speed later on. Faster spike development and photosynthetic translocation towards grain during the later stages of growth produced more dry matter at post-anthesis. The main cause of quicker dry matter is the sharp rise in spike weight. Gupta (2020) [2], Singh *et al.,* (2021) [13], Sarkar *et al*., (2022) [10], Singh and Verma (2023) [11] and Khan *et al.,* (2024) [4] have also reported likewise.

One of the most crucial non-monetary or non-cash inputs of what horticulture requires producing a decent yield is the time of sowing. It has had a noticeable impact on wheat productivity. Sowing too early or too late led to low yields and rendered the agriculture unprofitable. In order to harvest a greater yield of wheat varieties under the agro-climatic conditions of the North Western Plain Zone of U.P. (India), agronomic research is being conducted to determine the best time to plant. The stand count metre^{-2} decreased significantly with every delay in the sowing date from timely sowing. The maximum stand count metre^{-2} was recorded with timely sowing (D_1-10/11/2023) at harvest and it was significantly higher over the late sowing (D_2-10/12/2023). At harvest, the magnitude of increase in stand count metre^{-2} with timely date of sowing (D_1-10/11/2023) was to the tune of 0.57 percent, over the late sown (D_2-10/12/2023) of wheat. The maximum number of spikes meter^{-2} was recorded with timely sowing (D_1-10/11/2023) at harvest and it was significantly higher over the late sowing (D_2-10/12/2023). At harvest, the magnitude of increase in number of spikes meter^{-2} with timely date of sowing (D_1-10/11/2023) was to the tune of 0.63 percent, over the late sown (D_2-10/12/2023) of wheat. At harvest, the magnitude of increase in length of spike (cm) with timely date of sowing 10/11/2023 (D_1) was to the tune of 7.49 percent, over the late sown (D_2-10/12/2023) of wheat. Highest number of grains spike^{-1} was recorded with timely sowing on 10/11/2023 (D_1) at harvest and it was significantly higher over the late sowing on 10/12/2023 (D_2). At harvest, the magnitude of increase in number of grains spike^{-1} with timely date of sowing on 10/11/2023 (D_1) was to the tune of 2.04 percent, over the late sown on 10/12/2023 (D_2) of wheat. At harvest, the magnitude of increase in weight of grains spike^{-1} (g) with timely date of

sowing on 10/11/2023 (D_1) was to the tune of 14.32 percent, over the late sown on 10/12/2023 (D_2) of wheat. The test weight (g) was significantly affected due to dates of sowing. The highest of test weight (g) was recorded with timely sowing on 10/11/2023 (D_1) at harvest and it was significantly higher over the late sowing on 10/12/2023 (D_2). At harvest, the magnitude of increase in test weight (g) with timely date of sowing on 10/11/2023 (D_1) was to the tune of 2.32 percent, over the late sown on 10/12/2023 (D_2) of wheat. One or more characters among length of spike, number and weight of grains spike^{-1} and 1000 grains weight were appreciable improved with timely sowing over delayed sowings have also been reported by Upadhyay *et al.,* (2021) [14], Muhammad *et al.,* (2022) [8], Bhagat *et al.,* (2023) [1], Yadav *et al.,* (2023) [18], Raut *et al.,* (2024) [9], Singh *et al.,* (2024) [12].

Maximum biological yield (136.86 q ha^{-1}) was recorded with timely sowing on 10/11/2023 (D_1) at harvest and it was significantly higher over the late sowing on 10/12/2023 (D_2). At harvest, the magnitude of increase in biological yield (q ha^{-1}) with timely date of sowing on 10/11/2023 (D_1) was to the tune of 2.40 percent, over the late sown on 10/12/2023 (D_2) of wheat. Characteristics that contribute to yield, such as the number of shoots meter^{-1}, row length, shoot height (cm) and dry matter accumulation in plants, showed patterns that were comparable to those of total biological yield, which may be the cause of higher biological output ha^{-1}. The results thus obtained are in close proximity of the results observed by Bhagat *et al.,* (2023) [1], Yadav *et al.,* (2023) [18], Raut *et al.,* (2024) [9], Singh *et al.,* (2024) [12] and Vishwakarma *et al.,* (2024) [17].

The Maximum grain yield (60.66 q ha^{-1}) was recorded with timely sowing on 10/11/2023 (D_1) at harvest and it was significantly higher over the late sowing on 10/12/2023 (D_2). At harvest, the magnitude of increase in grain yield (q ha^{-1}) with timely date of sowing on 10/11/2023 (D_1) was to the tune of 3.76 percent, over the late sown on 10/12/2023 (D_2) of wheat. Grain yield contributing characters *i.e.* number and weight of grains spike^{-1} and 1000 grains weight due to dates of sowing had similar trends to that recorded in grain yield ha^{-1}, which might be held responsible for higher grain yield ha^{-1} with timely date of sowing on 10/11/2023 (D_1). These results are close conformity with the findings of Bhagat *et al.,* (2023) [1], Yadav *et al.,* (2023) [18], Raut *et al.,* (2024) [9] and Singh *et al.,* (2024) [12].

The magnitude of increase in stand count meter^{-2} with DBW-222 (V_5) was to the tune of 0.82, 2.59, 4.29, 6.47, 7.70 and 8.10 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, stand count meter^{-2} was recorded with (305.41) variety HD-2967 (G_1). The magnitude of increase in number of spikes meter^{-2} with DBW-222 (V_5) was to the tune of 1.16, 2.18, 3.29, 4.39, 4.93 and 6.57 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The maximum, length of spike (cm) was recorded with (9.60 cm) variety DBW-222 (V_5). The magnitude of increase in number of spikes meter^{-2} with DBW-222 (V_5) was to the tune of 3.22, 8.22, 12.94, 15.52, 30.96 and 37.33 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, number of spikes meter^{-2} was recorded with (6.57 cm) variety HD-2967 (V_1). Variety DBW-222 (V_5) produced significantly higher number of grains spike^{-1} (56.83) over all other varieties. The magnitude of increase in number of grains spike^{-1} with DBW-222 (V_5) was to the tune of 1.71, 4.08, 5.55, 8.10, 9.01 and 10.71 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, number of grains spike^{-1} was recorded with (50.98) variety HD-2967 (V_1). The magnitude of increase in weight of grains spike^{-1} (g) with DBW-222 (V_5) was to the tune of 18.26, 30.79, 33.89, 40.56, 45.22 and 54.29 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. Variety DBW-222 (V_5) produced significantly higher test weight (42.96 g) over all other varieties. The magnitude of increase in test weight (g) with DBW-222 (V_5) was to the tune of 1.53, 3.12, 4.12, 5.91, 7.05 and 8.56 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, test weight (g) was recorded with (38.80 g) variety HD-2967 (V_1). Similar findings have also been reported by Singh *et al.,* (2021) [13], Sarkar *et al.,* (2022) [10], Singh and Verma (2023) [11] and Khan *et al.,* (2024) [4].

The data presented in Table-5 indicate variety DBW-222 (V_5) produced significantly higher biological yield (138.62 q ha^{-1}) over all other varieties. The magnitude of increase in biological yield (q ha^{-1}) with DBW-222 (V_5) was to the tune of 0.69, 1.46, 2.10, 2.74, 3.70 and 4.20 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The minimum, biological yield (131.77 q ha^{-1}) was recorded with variety HD-2967 (V_1). Higher biological yield with indicated varieties may be attributed to growth features. Characteristics that contribute to grain yield may be held accountable for these outcomes. The magnitude of increase in grain yield (q ha^{-1}) with DBW-222 (V_5) was to the tune of 1.12, 2.78, 5.04, 5.03, 6.09 and 7.95 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3) at harvest, respectively. The results of straw yield were similar to that recorded in biological yield. Growth attributes such as number of shoots metre^{-1} row length and shoot height might be held responsible for such results. DBW-222 (V_5) produced significantly higher straw yield (76.35 q ha^{-1}) over all other varieties. The magnitude of increase in straw yield (q ha^{-1}) with DBW-222 (V_5) was to the tune of 0.34, 0.40, 0.46, 0.95, 1.32 and 1.62 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HD-3386 (V_3) and HD-2967 (V_1) at harvest, respectively. The variation in harvest index due to variety DBW-222 (V_5) produced significantly higher harvest index (44.92%) over all other varieties. The magnitude of increase in harvest index (%) with DBW-222 (V_5) was to the tune of 0.19, 0.58, 0.91, 0.94, 0.98 and 1.02 percent, over DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-2967 (V_1), HD-3471 (V_4) and HI-1668 (V_2) HD-3386 (V_3) at harvest, respectively. The minimum, harvest index (43.35%) was recorded with variety HD-3386 (V_3). These results are in close conformity with those reported by Verma *et al.,* (2019) [16], Gupta (2020) [2], Singh *et al.,* (2021) [13], Sarkar *et al.,* (2022) [10], Singh and Verma (2023) [11] and Khan *et al.,* (2024) [4].

The highest nitrogen content (2.39% in grain & 0.48% in straw) and uptake (144.98 kg ha^{-1} by grain & 36.58 kg ha^{-1} by grain) was recorded with timely (10/11/2023) date of sowing followed by late (10/12/2023) date of sowing. The magnitude of increase in nutrient uptake with timely date of sowing on 10/11/2023 (D_1) was to the tune of 7.36% by grain and 10.58% by grain, over the late sown on 10/12/2023 (D_2) of wheat. The highest phosphorus content (0.349% in grain & 0.045% in straw) and uptake (21.170 kg ha^{-1} by grain & 3.429 kg ha^{-1} by grain) was recorded with timely (10/11/2023) date of sowing followed by late (10/12/2023) date of sowing. The magnitude of increase in

nutrient uptake with timely date of sowing on 10/11/2023 (D_1) was to the tune of 12.81% by grain and 20.02% by grain, over the late sown on 10/12/2023 (D_2) of wheat. The highest potassium content (0.82% in grain & 2.32% in straw) and uptake (49.74 kg ha^{-1} by grain & 176.78 kg ha^{-1} by grain) was recorded with timely (10/11/2023) date of sowing followed by late (10/12/2023) date of sowing. The magnitude of increase in nutrient uptake with timely date of sowing on 10/11/2023 (D_1) was to the tune of 16.54% by grain and 8.36% by grain, over the late sown on 10/12/2023 (D_2) of wheat. These results are in close conformity with those reported by Raut *et al.,* (2024) [9], Singh *et al.,* (2024) [12] and Vishwakarma *et al.,* (2024) [17].

The highest nitrogen content (2.40% in grain & 0.46% in straw) and uptake (149.45 kg ha^{-1} by grain & 35.12 kg ha^{-1} by grain) was recorded with DBW-222 (V_5) followed by DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3). Minimum nitrogen content (2.12% in grain & 0.35% in straw) and uptake (120.08 kg ha^{-1} by grain & 26.30 kg ha^{-1} by grain) was recorded with HD-2967 (V_1). The highest phosphorus content (0.348% in grain & 0.050% in straw) and uptake (21.670 kg ha^{-1} by grain & 3.818 kg ha^{-1} by grain) was recorded with DBW-222 (V_5) followed by DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3). Minimum phosphorus content (0.331% in grain & 0.034% in straw) and uptake (18.748 kg ha^{-1} by grain & 2.554 kg ha^{-1} by grain) was recorded with HD-2967 (V_1). The highest potassium content (0.80% in grain & 2.41% in straw) and uptake (49.82 kg ha^{-1} by grain & 184.0 kg ha^{-1} by grain) was recorded with DBW-222 (V_5) followed by DBW-386 (V_7), PBW-826 (V_8), DBW-187 (V_6), HD-3471 (V_4), HI-1668 (V_2) and HD-3386 (V_3). Minimum potassium content (0.63% in grain & 2.23% in straw) and uptake (35.68 kg ha^{-1} by grain & 167.54 kg ha^{-1} by grain) was recorded with HD-2967 (V_1). These results are in close conformity with those reported by Utpal *et al.,* (2018) [15], Gupta (2020) [2], Singh *et al.,* (2021) [13], Sarkar *et al.,* (2022) [10], Singh and Verma (2023) [11] and Khan *et al.,* (2024) [4].

Different dates of sowing had significant effect on was recorded with (Table-9). The highest gross returns ₹ 185276 ha^{-1} was recorded with timely sowing D_1 (10/11/2023) followed by late ₹ 179777 ha^{-1} (D_2-10/12/2023). The magnitude of increase in gross returns with timely date of sowing on 10/11/2023 (D_1) was to the tune of 3.05 percent, over the late sown 10/12/2023 (D_2) of wheat. The highest net returns ₹ 139421 ha^{-1} was recorded with timely sowing D_1 (10/11/2023) followed by late ₹ 133922 ha^{-1} (D_2-10/12/2023). The magnitude of increase in net returns with timely date of sowing on 10/11/2023 (D_1) was to the tune of 4.10 percent, over the late sown on 10/12/2023 (D_2) of wheat. The highest B: C ratio (3.03) was recorded with timely sowing D_1 (10/11/2023) followed by late (2.91) sown on 10/12/2023 These results are in close conformity with those reported by Muhammad *et al.,* (2022) [8], Bhagat *et al.,* (2023) [1], Yadav *et al.,* (2023) [18], Raut *et al.,* (2024) [9], Singh *et al.,* (2024) [12] and Vishwakarma *et al.,* (2024) [17].

Different varieties had significant effect on was recorded with (Table-9). The highest gross returns ₹ 188882 ha^{-1} were recorded with DBW-222 (V_5) which was found at with ₹ 187200 ha^{-1} (V_7- DBW-386) and PBW-826 (V_8) at harvest, respectively. The minimum, gross returns ₹ 175783 ha^{-1} was recorded with variety HD-2967 (V_1). The highest net returns ₹ 143027 ha^{-1} were recorded with DBW-222 (V_5) which was found at with ₹ 141345 ha^{-1} (V_7- DBW-386) and PBW-826 (V_8) at harvest, respectively. The minimum, net returns ₹ 129928 ha^{-1} was recorded with variety HD-2967 (V_1). The highest B: C ratio (3.11) were recorded with DBW-222 (V_5) which was found at with (3.07) (V_7- DBW-386) and PBW-826 (V_8) at harvest, respectively. The minimum, B: C ratio (2.82) was recorded with variety HD-2967 (V_1). These results are in close conformity with those reported by Kumar *et al.,* (2017) [5], Utpal *et al.,* (2018) [15], Verma *et al.,* (2019) [16], Gupta (2020) [2], Singh *et al.,* (2021) [13], Sarkar *et al.,* (2022) [10], Singh and Verma (2023) [11] and Khan *et al.,* (2024) [4].

Conclusion

Timely sowing date (10/11/2023) was found higher productivity and quality for different varieties of wheat under irrigated conditions. Different wheat varieties tested, variety DBW-222 (V_5) gave better results followed by DBW-386 (V_7) in respect of productivity and quality. On the basis of maximum net returns (₹143027, 141345 and 139135 ha^{-1}) and B: C ratio (3.11, 3.07 and 3.02) with wheat varieties DBW-222 (V_5), DBW-386 (V_7) and PBW-826 (V_8) respectively, sown on 10/11/2023 (Net returns ₹ 139421 and B: C ratio, 3.03) should be recommended for the farmers of NWPZ.

References

1. Bhagat RK, Mahanand S, Dev N, Dhurve R, Porte DP, Narayan S. Effect of varying sowing date and fertilizer rates on growth and yield of wheat (*Triticum aestivum* L.). Pharm Innov J. 2023;12(10):2377-2380.
2. Gupta AJ. Effect of varieties and phenylmercuric acetate on yield and economics of wheat (*Triticum aestivum* L.) under receding soil moisture conditions. Indian J Agron. 2020;77(2):87-89.
3. Khan SA, Marak HC, Gupta A, Kushal S. Effects of dates of sowing on phenology, thermal and radiation regimes, and yield of wheat (*Triticum aestivum* L.). J Agrometeorol. 2020;12(1):53-57.
4. Khan S, Agrawal HP, Pandey D, Agrawal AP, Chaure NK, Sharma G, *et al.* Performance of wheat (*Triticum aestivum* L.) varieties at different dates of sowing under Chhattisgarh plain. Int J Chem Stud. 2024;12(4):60-63.
5. Kumar S, Singh H, Kumar R, Singh BP. Performance of macaroni wheat (*Triticum durum* L.) under nitrogen, phosphorus, and sowing dates. Indian J Agric Sci. 2017;69(2):242-244.
6. Ministry of Agriculture & Farmers Welfare. Agricultural Data for Crops [Internet]. 2023-24. Available from: https://agriwelfare.gov.in/Documents/CWWGDATA/Crops_(38)_0.pdf
7. Ministry of Agriculture & Farmers Welfare, P.I.B. [Internet]. 2022-23. Available from: https://pib.gov.in/PressReleasePage.aspx
8. Muhammad T, Ali A, Nadeem MA, Hussain A, Khalid F. Effect of different sowing dates on growth and yield of wheat (*Triticum aestivum* L.) varieties in district Jhang, Pakistan. Pak J Life Soc Sci. 2022;7(1):66-69.
9. Raut RD, Shirale ST, Vaidya PH, Chikshe SV, Kuthumbare RS, Aundhkar SG. Effect of foliar application of nitrogenous fertilizers on growth attributes, soil properties, quality and productivity of wheat (*Triticum aestivum* L.). Int J Res Agron. 2024;SP-7(11):111-115.
10. Sarkar AK, Gulati JML, Mishra B. Promising wheat (*Triticum aestivum* L.) varieties for late sowing in Orissa. Indian J Agron. 2022;32(3):277-278.
11. Singh K, Verma HD. Response of wheat (*Triticum aestivum* L.) varieties to sowing dates and fertility levels. Indian J Agron. 2023;36(4):42-45.

12. Singh P, Mishra SR, Singh AK, Singh AK, Singh B, Aryan RK. Effect of different sowing dates and varieties of wheat (*Triticum aestivum* L.) crop grown under agro-climatic conditions of Eastern Uttar Pradesh. Afr J Bio Sci. 2024;6(15):3201-3221.
13. Singh RP, Shahiman SD, Sharma HC. Performance of wheat (*Triticum aestivum* L.) varieties under limited water supply. Indian J Agron. 2021;25(2):259-263.
14. Upadhyay RG, Ranjan R, Negi PS. Influence of sowing dates and varieties on productivity of wheat (*Triticum aestivum* L.) under mid Himalayan region of Uttarakhand. Int J Trop Agric. 2021;33(2):1905-1909.
15. Utpal M, Begum M, Salam A, Sarkar SK. Influence of sowing date on the growth and yield performance of wheat (*Triticum aestivum* L.) varieties. Arch Agric Environ Sci. 2018;3(1):89-94.
16. Verma UF, Singh DG, Singh K, Kumar KM. Effect of planting date on performance of wheat (*Triticum aestivum*) varieties. Indian J Agric Sci. 2019;76(2):107-110.
17. Vishwakarma D, Kumar A, Singh O, Kumar R, Kumar S, Dwarka. Different dates of sowing effect on growth and yield of wheat (*Triticum aestivum* L.) crops. Int J Adv Biochem Res. 2024;8(8):584-586.
18. Yadav DD, Verma VK, Kumar B, Kumar P, Singh OP. Studies on production potential of wheat (*Triticum aestivum* L.) under varying dates of sowing. Plant Arch. 2023;8(2):937-939.