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Gurwaan Singh
Chandra Shekhar Azad University of Agriculture and Technology Kanpur, Kanpur, Uttar Pradesh, India

Dr. SN Pandey
Chandra Shekhar Azad University of Agriculture and Technology Kanpur, Kanpur, Uttar Pradesh, India

Rahul Kumar
Chandra Shekhar Azad University of Agriculture and Technology Kanpur, Kanpur, Uttar Pradesh, India

Subhash Chandra Maurya
Chandra Shekhar Azad University of Agriculture and Technology Kanpur, Kanpur, Uttar Pradesh, India

Sunil Kumar Prajapati
Chandra Shekhar Azad University of Agriculture and Technology Kanpur, Kanpur, Uttar Pradesh, India

Corresponding Author:
Gurwaan Singh
Chandra Shekhar Azad University of Agriculture and Technology Kanpur, Kanpur, Uttar Pradesh, India

Effect of weather parameters, date of sowing on performance of wheat varieties (*Triticum aestivum* L.)

Gurwaan Singh, Dr. SN Pandey, Rahul Kumar, Subhash Chandra Maurya and Sunil Kumar Prajapati

Abstract
The field experiment was conducted at Student's Instructional Farm, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, (UP) during *Rabi* season December 2021-April 2022. In the field environment, the growth of wheat was greatly influenced by temperature changes associated with sowing dates. The field experiment laid out in split plot design (SPD) with 4 replication and 3 different date of sowing (30th Nov, 15 Dec and 30 Dec) in main plot against 4 varieties of wheat crop (HD-2733, K-307, K-9107 and HD-2967) in sub plot. Growth parameters were higher in early sown crops as compared with late sown wheat crops. Among varieties HD-2967 sown on 30th Nov obtain highest growth parameters as compare to HD-2733, K-9107 and K-307. It may be concluded that optimum sowing time of wheat crop is 30th Nov as compare to late sown wheat. Among the most promising variety.
The sowing on 30th November recorded better growth, yield attributes and grain yield (44.94 q ha^{-1}) and harvest index (39.05%) of wheat crop. Among wheat varieties tested HD-2967 exhibited maximum grain yield (42.30 q ha^{-1}) and harvest index (39.34 %) compared to other varieties.

Keywords: Productivity, sowing dates, varieties, wheat

Introduction
Wheat (*Triticum aestivum* L.) is known as the "king of cereals" and one of the world's most significant staple food crops, being grown in at least 43 nations. Wheat provides sustenance to around 35 percent of the world's population, and it accounts for about 20% of the world's protein supply. Wheat kernels contain approximately 12 percent water, with carbohydrates (65-80 percent) primarily as starch, protein (8-15 percent) containing adequate amounts of all essential amino acids (except lysine, tryptophan, and methionine), fats (1.5- 2 percent), minerals (1.5-2 percent), vitamins (such as B complex and vitamin E), and crude fibres (2.2 percent). Wheat straw is used for cattle bedding and feed.
Other industrial uses of wheat grain include starch for paste, alcohol oil, and glut in straw. The main wheat-growing area is in India's northern region. During the growing season of the wheat crop, the optimum temperature regime is 20-22 °C at sowing, 16-22 °C at tillering until grain filling, and gradually climbs to 40 °C at harvesting (Sharma, 2000). Sowing takes place between the first week of October and the latter week of December. Delayed sowing exposes crops to adverse conditions such as low temperatures during vegetative growth, resulting in a low germination rate, poor tillering ability, and low plant population. Delayed sowing exposes the crop to adverse conditions such as low temperature during vegetative growth, resulting in a low germination rate, poor tillering ability and low plant population. The wheat sown on the normal date of sowing (25th November) attained 15 days late physiological maturity as compared to late sown condition. Delayed sowing also increases the possibility of crops exposure to high temperature during the grain filling stage, which is harmful to leaf photosynthesis, grain filling, and final yield formation. Early sowing enhanced germination unit $area^{-1}$, plant height, spikelets $spike^{-1}$, grains $spike^{-1}$ and 1000- grain weight over late sowing. The effect of date of sowing on the growth of wheat was assessed on a stand counts per m^{-2}, plant height at various stages (cm), leaf area index at different stages, dry matter accumulation and number of tillers $m^{-2}$and yield attributes *viz*. test weight, number of grains ear $head^{-1}$, ear head m^{-2}, length of the ear (cm). Fatima *et al*., reported that number of different adaptation strategies based on early sowing,

irrigation and a combination of sowing and irrigation adaptations were examined to recover the potential losses that would occur due to climate change. To feed the ever-growing population, the country would need to produce 101.7 million tonnes by 2025 (Ganesh *et al*., 2012). Under changing climate temperature stress, which is one of the most serious environmental hazards to agriculture, it is a huge issue. According to the 3rd Advance Estimates for 2020-21, overall food grain output in the country would reach a new high of 308.65 million tonnes. Food grain production is 29.77 million tonnes more than the average food grain production of the last five years. Wheat production is expected to reach a new high of 109.52 million tonnes in 2021- 22.It is higher by 9.10 million tonns than the average wheat production of 100.42 million in 2020-21. Department of Agriculture, Cooperation, and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, 4rd Advance Estimates 2020-21).

Methods and Materials

An experiment was carried out during the year 2021-22(November-April) on Students' Instructional Farm (SIF) at Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, (UP) Geo-graphically, Kanpur is situated in the central part of Uttar Pradesh and the sub-tropical semi-arid tract of North India. The Kanpur-city district lies between 26 0 29` 35'' North latitude and 80018`25`` East longitude and is located on an elevation of about 125.9 meters above mean sea level in Gangetic plain. The weekly maximum and minimum temperature during experiment were 41.8ºC and 4.9 ºC, respectively. The mean annual rainfall is about 1194 mm. The soil was found clay loam having slightly alkaline p^H and Organic carbon with a value of 0.49.

The experiment was setup according to the split-plot design with four replication, Three main plot treatments (30th November, 15th December and 30th December and four sub plot [HD-2733 (V_1)], [K-307 (V_2)], [K-9107 (V_3) and [HD- 2967 (V_4).Five irrigation including pre- sown were applied to the experiments. 48 plots were made for the experiments each with a gross size of 8m x 3 m = 24.0 m.

The row to row distance of 22.5 cm. To achieve accurate precision, the appropriate sampling techniques were implied for the proper balance in sampling at minimum cost. For biometric observation, plants were selected randomly in each plot to assess the possible relationship between various growth attributes and variability in climate. The observation were recorded at 30, 45, 60, 90, 105 and maturity in the marked area of plots. The land was prepared as per the requirement of the experiment.

Result and Discussion

Effect of treatments on growth characters

The results revealed that growth characters *viz*. plant height, number of tillers, fresh weight, and dry weight of plant illustrate that growth of wheat varieties was significantly influenced by different dates of sowing and varieties. 30th November sowing date found comparatively better in terms of increasing plant height (8.51%), tiller (14.90%) and dry matter accumulation (13.38%), compared to 30th December sowing. The maximum growth rate of the plants under the 30th November sowing might be due to plants get more time for their growth and development compared to late sowing which has short growth and a short time period.

Among varieties, HD 2967 exhibited Maximum plant height (110.40 cm), number of tillers (520.08 m-2), dry weight (1070.85 g m-2) compared to K-307. The variety HD 2967 recorded an increase in terms of plant height (7.06%), number of tillers (2.8%), dry matter accumulation (25.71%) compared to the variety K-307.

Probably because of the better genomics of the variety HD 2967, which excels in terms of growth and development, especially in particular climatic conditions compared to other varieties.

These results are in conformity with the findings of Anil Kumar Netam *et al*. (2020) [10], Bidusi Tripathy *et al*. (2020), Sandeep Kumar Singh *et al*. (2020), Mohammad Yusuf *et al*. (2019).

Effect of treatments on yield attributing characters of wheat varieties

The Data pertaining to yield attributing character revealed that 30th November sowing was found significantly better than 15th December and 30th December. The increment recorded under different yield attributes varied to the tune in length of ear (5.72 %), ear weight (19.20%), grains per ear-1 (15.75%), test weight (7.50%), under 30th November sowing compared to 30th December sowing. The better yield attributes under 30th November sowing is probably due to the good vegetation at early sowing compared to 30th December sowing.

The variety HD 2967 recorded better yield attributes varied the tune in the length of the ear length (9.40%), ear weight (10.75%), grain ear-1 (9.22%), and test weight (2.77%) compared to the variety K-307. Similar findings were also reported by Charanjeet Kaur (2017), Bashir *et al.* (2016), Kaur *et al*. (2015), Dwivedi *et al.* (2015) and Shirpurkar *et al.* (2007).

Effect of treatments on yield of wheat varieties

The data pertaining to the yield of wheat was significantly influenced by different dates of sowing and varieties. The biological yield of wheat increased 5.38% and 13.93 % under 30th November compared to 15th December and 30th December sowing.

Similarly, grain yield increased 44.68 % in the 30th November sowing compared to 30th December sowing respectively. The Straw yield increased 17.73% under the 30th November sowing compared to the 30th December sowing. The harvest index was also increased 13.98 % under 15th November compared to 30th December sowing.

Under different varieties HD 2967 produced maximum biological yield (11.32%), grain yield (27.52%), straw yield (21.22%), and harvest index (28.94%) compared to K-307. It might be due to better genomics characters as well as better growth characteristics and yield attributes of the variety HD 2967 achieved under favourable climatic conditions.

Similar findings were reported by Amarjeet *et al*. (2020), Mohammad Yusuf *et al*. (2019), Chetan Lal (2019), Kumar *et al*. (2015).

Table 1: Effect of weather parameters, date of sowing on performance of wheat varieties

Treatment	Growth Attributes				Yield Attributes				Yield			
	Plant population 2 (m)	Plant height (cm)	Til2lers (m)	Dry matter accumulation (g/m^2)	Length of ear (cm)	Ear weight (g)	Grains ear-1	Test weight (g)	Biological yield (q/ha-1)	Grain yield (q/ha-1)	Straw yield (q/ha-1)	Harvest Index (%)
Date of sowing												
15th Nov	123.93	111.925	537.875	1152.20	9.60	2.11	53.55	39.31	115.16	44.94	70.22	39.05
30th Nov	122.65	108.919	519.500	1060.03	9.40	1.98	48.70	37.31	105.90	37.20	68.70	35.15
15th Dec	122.44	103.056	468.125	920.169	9.08	1.77	46.26	36.56	90.71	31.06	59.64	34.26
SE(d)±	0.490	0.638	1.275	10.169	0.049	0.016	0.479	0.156	1.001	0.663	0.420	0.320
CD (P=0.05)	NS	1.592	3.180	25.367	0.122	0.041	1.196	0.390	2.496	0.500	1.047	0.799
Varieties												
HD 2733	124.058	107.717	512.417	1048.04	9.17	1.98	49.72	37.85	103.10	40.15	62.94	38.67
K-307	123.091	103.175	505.750	973.992	8.91	1.92	47.37	37.60	97.30	35.31	61.99	36.09
K-9107	122.681	110.733	495.750	1084.05	9.75	1.86	49.18	37.44	108.32	33.17	75.15	30.51
HD 2967	122.208	110.242	520.083	1070.45	9.61	2.06	51.74	38.46	106.98	42.30	64.68	39.34
SE(d)±	0.376	0.520	2.078	8.897	0.058	0.018	0.361	0.129	0.944	0.707	0.420	0.413
CD (P=0.05)	NS	1.073	4.286	18.353	0.120	0.036	0.744	0.267	1.947	1.459	1.047	0.852
Interaction												
V X D												
SE(d)±	0.651	0.901	3.599	15.410	0.101	0.030	0.625	0.224	1.635	1.225	0.805	0.716
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	1.408	NS	NS	2.676	1.753	1.541
D X V												
SE(d)±	0.747	1.008	3.368	16.778	0.100	0.031	0.723	0.249	1.734	1.251	0.814	0.698
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	1.628	NS	NS	2.733	1.772	1.503

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