Effect of sowing dates and varieties on growth and yield of wheat (Triticum aestivum L.) in central plain zone of U.P.

Abstract

A field experiment was conducted in*Rabi* season during 2022-23 on the entitled "Effect of sowingdates and varieties on growth and yield of wheat (*Triticum aestivum*L.) in centralplain zone of U.P."insandyloamsoilatStudent'sInstructionalFarm,C.S.AzadUniversityofAgricultureandTechnology,Kanpur-208002(U.P.).Theexperimentconsistedofninetreatmentcombinationscomprisedofthreesowingon 23rdNovember,8thDecember,and23rdDecemberandthreevarietiesviz., K-307, K-9107 and HD-2967. Variety HD-2967 find out yielded more than the other varieties K-307, K-9107 for the reason thatnumberof grain ear^{-1}, grain weight ear^{-1}and testweightwas more inthis variety as compared to other two varieties. Results reveal that significant influence with highergrain yield (41.66q ha^{-1}) under sowingon 23rd November. It was significantlysuperior over sowingon 8th December (36.34 q ha^{-1}) followed by sowing on 23rd December (33.26 q ha^{-1}). The variety HD-2967 was superior to K-307, and K-9107, respectively from yield point of view and its attributesregardingselectionofvarietiesunderthreedatestestedinthestudywasalsoverycleararthatsequenceof varieties in order of preference was HD-2967, K-9107 and K-307. The study also confirmed thatconsequentdelayinsowingsignificantlydecreasestheyieldirrespective ofvarieties. Thus,itisrecommendedthatwheatcropmaybesowninmonthofNovembertoobtainthehigheryield.

Key words: Wheat, Yield, Sowing date, Varieties, Grain

Introduction

Wheat (*Triticum aestivum* L.) is most staple and second most important crop after rice in India, whichcontributes nearly one third of the total food grains production. It is consumed mostly in the form ofbreadas'Chapati'.WheatisgrowninIndia inanareaofabout30.46millionhectareswithaproductionof 104.00 million tonnes and normal productivity of 3.41 tonnes per hectare [1]. Wheat providessustenance to around 35 percent of the world's population, and it accounts for about 20% of the world'sprotein supply. Wheat kernels contain approximately 12 percent water, with carbohydrates (65-80percent) primarily

as starch, protein (8-15 percent) containing adequate amounts of all essential aminoacids(exceptlysine,tryptophan,andmethionine),fats(1.5-2percent),minerals(1.5-2pekrcent),vitamins (such as B complex and vitamin E), and crude fibres (2.2 percent). Wheat straw is used forcattlebeddingandfeed.

The major wheat producing States are Uttar Pradesh, Madhya Pradesh, Punjab, Haryana, Rajasthan,Bihar, Maharashtra, Gujarat, Karnataka, West Bengal, Uttarakhand, Himachal Pradesh and Jammu &Kashmir. These States contribute almost hundred per-end exception of total Wheat production in thecountry. Remaining states, namely, Jharkhand, Assam, Chhattisgarh, Delhi and other North Easternstatescontributeonlyabout0.5%ofthetotalwheatproductioninthecountry.(Anonymous,2023-24)[2]. In 2023-24, the globalproduction of wheat was about 784.91 million metric tonnes and in Indiawasabout112.74millionmetrictonnes.UttarPradeshaccountsfor33millionmetrictonnesproduction followed by Madhya Pradesh(22.41 million metric tonnes) and Punjab (14.82 millionmetric tonnes). The Rabi crops data released recently by the Directorate of Economics and Statisticsindicates that wheat harvest is expected to be slightly lower than the previous year, at 107-108 millionmetric tons. In 2023-24, food grain production is slightly lower at 328.8 million tonnes, primarilybecauseofpooranddelayedmonsoons.(EconomicSurveyofIndia,2023-24)[2].Wheatisgrownina variety of soils of India. Soils with a clay loam or loam texture, good structure and moderate waterholding capacity are ideal for wheat cultivation. Heavy soils with good drainage are suitable for wheatcultivation under dry conditions. These soils absorb and retain rain water well. Heavy soils with poorstructure and poor drainage are not suitable as wheat is sensitive to water logging. Wheat can besuccessfullygrownonlightersoilsprovidedtheirwaterandnutrientholdingcapacityareimproved.

MaterialsandMethods

TheexperimentwaslaidoutatStudent'sInstructionalFarmofChandraShekhar AzadUniversity of Agriculture and Technology, Kanpur (U.P.) India during*Rabi* season during 2022-23.The field waswell levelled havingassured irrigation and drainagefacilities. Geographically, Kanpuris situated in subtropical region. It is situated at an elevation of 125.9 meter Above mean sea level,26^{o}39'35" North latitude and 80^{o}18'25" East longitude. It is

situated in the alluvial belt of Indo-gangetic plain in the central part of Uttar Pradesh, which comes into central plain zone. Normally, theclimate of the area is semi-arid with hot summer, moderate rainfall and cold winter. The factorialrandomized block design (FRBD) was used in conducting experiment. Nine treatments combinationcomprised of three sowing dates *viz.* crop Sown on 23rd November (D1), 8th December (D2), and cropsown onn 23rd December (D3) along with three varieties i.e. K-307, K-9107 and HD-2967 with threeReplication, plant spacing 22.5 cm row to row. An uniform Recommended dose of 120 kg N, 60 kgP_2O_5 and 60 kg K_2O/ha was applied for wheat crop through urea, DAP and murate of potash as basal,respectively. Rest half dose of N was top dressed in two equal splits doses at tillering and panicleinitiation stages. The soil texture may be experimental was sandy loam having P^H 7.7, organic carbon0.47%, available nitrogen 223 kg/ha, available P_2O_5 12.6 kg/ha and available K_2O 155 kg/ha. Theother cultural practices were adopted as recommended packages of practice. The crop was given 4irrigations at critical stages. Ten plants were selected randomly in each plot and tagged for measuringheight.Heightwasmeasuredatdifferentcriticalstagesandatharveststagewiththehelpofmeterscalefromgroundsurfacetothetipoftheuppermostleafbeforeearemergenceanduptothebaseofearafteremergence

thegrowth,yieldattributesandgrainyieldwererecordedforalltreatmentsattimeofharvestcrop.

Result and discussion

GrowthAttributes

The results revealed that growth characters *viz.* initial plant population, plant height,number of tillers,dry matter accumulation of plant illustrates that growth of wheat varieties was significantly influencedby differentdates of sowing and varieties. This may also be dueto the congenialweather conditionand best use of available soil moisture in maximum elongation period. The crop period due to first,second, and third date of sowing has been decreasing, respectively which makes it clear that 23rdNovember hasenjoyed the maximum numberof days for developmentof plants.23rdNovembersowing date found comparatively better in terms of increasing plant height (1.00%), number of tillers(2.22%) and dry matter accumulation (2.92%), compared to 23rd December sowing. The maximumgrowthrateoftheplantsunderthe23rdNovembersowingmightbeduetoplantsgetmoretimeefortheir growth and development compared to late sowing which has short growth and a short time period.Amongvarieties, HD 2967 exhibitedMaximumplant height(99.65 cm), number of tillers (387.88 m^{-2}), dry matter accumulation (1113.01g m^{-2}) compared to K-307.

The variety HD 2967 recorded anincrease in terms of plant height (0.6%), number of tillers (0.7%), dry matter accumulation (2.5%)compared to the variety K-307. Probably because of the better genomics of the variety HD 2967, whichexcels in terms of growth and development, especially in particular climatic conditions compared toother varieties. These results are in conformity with the findings of Behera (1994), Kumar and Sharma (2003), Dhaka*etal.*(2007), KeimDC *et al.*(2004), NainwalandSingh(2000), Musaddique*etal.*(2000),Anil Kumar Netam *et al.* (2020),Mishra *et al.* (2003), Sanjay Chauhan *et al*. (2020), Mohammad Yusuf *etal*.(2019) andMattas*etal.*(2011).

YieldAttributes

The data pertaining to yield attributing character revealed that 23rd November sowing wasfound significantly better than 8th December and 23rd December. The mean longest length (11.34 cm)was found significantly of 23rd November sowing due to longed crop duration as compared to 8thDecember (9.81 cm) and 23rd December (9.66 cm). Among the varieties, HD-2967 had longer ears(10.78cm)ascomparedtotheothertwovarieties.Thegrainear-1forthe23rdNovembersowingwasfoundsignificantlyhigherincomparisonto8thDecemberand23rdDecembersowing.Themaximumgrain ear-1 under 23rd November may be due to more synthesis of food material in timely sown. Thehighestgrainear-1wasrecordedundervarietyHD-2967(44.20)incomparisontoK-9107andK-307.It might be due to the genetic character of variety HD-2967. The grain weight ear-1 for the 23rdNovembersowingwasfoundsignificantlyhigherincomparisonto8thDecemberand23rdDecembersowing. The maximum grainweightear-1 under the 23rdNovember maybe due to the reason thatno.ofgrains/earwerehigher.Thehighestgrainweightear-1wasrecordedundervarietyHD-2967(2.21g). Since number of grains ear-1 were also higher in this variety, this must have contributed to moregrain weight ear-1. Test weight is a crucial wheat attribute that contributes to yield and is highlyinfluenced by the genetic potential of a variety as well as the current growing environment. The testweight peaked in the crop sown on 23rd November (37.44 g) and declined with later sowing dates 8thDecember(37.22 g)and23rd December (36.55).This couldbe because the grainswere forcedtomature and dry under later sowing conditions by a sudden increase in temperature and a strong wind.Variety HD-2967 (37.55 g) recorded the highest test weight than K-307(37.22 g) and K-9107 (36.44g). It appears that HD-2967 superiority results

from the effective translocation of metabolites towardsgraindevelopment.

The increment recorded under different yield attributes varied to the tune in length of ear(14.92%), grain weight ear^{-1} (20.35%), grains ear^{-1} (11.44%) and test weight (2.37%), under 23rdNovember sowing compared to 23rd December sowing. The variety HD 2967 recorded better yieldattributesvariedthetuneinthelengthoftheearlength(8.62%),grainweightear^{-1}(12.21%),grainsear^{-1} (10.63%) and test weight (0.89%) compared to the variety K-307. Similar findings were alsoreported by Singh *et al.*(1994), Shirpurkar *et al.*(2007), Ranu *et al.* (2018),M.A. Mumtaz *et.al.* (2015), Jat*etal*.(2004),Dhaka*etal.*(2006)andSanjay*etal.*(2020).

Yield

Thedatapertainingtotheyieldofwheatwassignificantlyinfluencedbydifferentdatesof sowing and varieties. The biological yield of wheat increased 5.33% and 11.60 % under 23rd Novembercompared to 8th December and 23rd December sowing. Similarly, grain yield increased 20.16 % in the23rdNovembersowingcomparedto23rdDecembersowing.Thestrawyieldincreased7.08%undert he23rdNovembersowingcomparedtothe23rdDecembersowing.

Theharvestindexwasalsoincreased 10.03 % under 23rd November compared to 23rd December sowing.Under different varietiesHD 2967 produced maximum biological yield (3.79 %), grainyield(4.01%), strawyield (4.24 %),andharvestindex(0.50%)comparedtoK-307.Itmightbeduetobettergenomicscharactersaswellas better growth characteristics and yield attributes of the variety HD 2967 achieved under favourableclimatic conditions. Similar findings were reported bySingh *et al.* (1994), Thorat*et al.*(2000), Kumar *et al.*(2015), M.A. Mumtaz *et.al.* (2015),Mishra*etal*.(2003),JatandSingh(2004),Dhaka*etal.*(2006), Ranu *et al.* (2018) andSanjay Chauhan*etal.*(2020).

Table1:Effectofsowingdatesandvarietiesongrowthandyieldofwheatduring2022-23

Treatments	GrowthAttributes				YieldAttributes				Yield			
	Plantpopulation (m^{-2})	Plant height (cm)	Tillers (m^{-2})	Dry matteraccumulation (gm^{-2})	Length ofear(cm)	Grain weight ear^{-1}(g)	Grains ear^{-1}	Testweight(g)	Biological yield (qha^{-1})	Grain yield (q ha^{-1})	Straw yield(q ha^{-1})	HarvestIndex(%)
Dateofsowing												
23rdNovember	120.47	99.47	390.33	1133.77	11.34	2.32	44.11	37.44	120.83	41.66	79.16	34.69
8thDecember	120.44	99.08	384.33	1117.70	9.81	2.02	41.55	37.22	114.50	36.34	78.15	31.81
23rdDecember	120.22	98.55	381.66	1100.6	9.66	1.85	39.06	36.55	106.92	33.26	73.55	31.21
SE±(D)	0.29	0.32	1.728	1.381	0.103	0.03	0.550	0.345	0.659	0.381	1.129	0.410
CD(P=0.05)	NS	0.69	3.69	2.59	0.22	0.10	1.09	NS	1.41	0.81	2.41	0.87
Varieties												
K-307	120.05	98.21	385.33	1096.33	9.85	1.94	39.50	37.22	110.10	37.27	72.82	33.74
K-9107	120.41	99.25	383.11	1142.82	10.17	2.04	41.03	36.44	117.71	35.26	82.00	30.06
HD-2967	120.67	99.65	387.88	1113.01	10.78	2.21	44.20	37.55	114.44	38.83	76.05	33.89
SE±(V)	0.29	0.32	1.728	1.381	0.103	0.03	0.550	0.345	0.659	0.381	1.129	0.410
CD(P=0.05)	NS	0.69	3.69	2.59	0.22	0.10	1.09	NS	1.41	0.81	2.41	0.87
Interaction(D*V)												
SE	0.50	0.56	2.99	2.39	0.179	0.07	0.953	0.598	1.142	0.660	1.955	0.711
CD(P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Conclusion

ThisexperimentconcludedthatthevarietiesHD-2967wassuperiortoK-307andK-9107fromyieldpointofviewanditsattributesregardingselectionofvarietiesunderdifferentdatestestedinthestudywasalsoveryclearthatsequenceofvarietiesinorderofpreferencewasHD-2967,K-9107,K-307.

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