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## Screening of timely sown wheat (*Triticum aestivum* L.) varieties in relation to climate change in central plain zone of Uttar Pradesh

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### Abstract

The field experiment was conducted during *rabi* season of 2017-18 at Student's Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (UP) India to screen out timely sown varieties of wheat on the basis of their growth characters, yield attributes and yield under agroclimatic situation of Central Plain Zone of Uttar Pradesh. The treatments consisted ten wheat varieties viz. K307, K402, K607, K1006, HD-2733, DBW-17, HD2967, PBW-343, PBW-502 and PBW-550, laid out in Randomized Block Design replicated three times. The varieties were sown on 17<sup>th</sup> November 2017 and harvested of Physiological maturity ranged 130 days to 142 days after sowing. The inputs were given timely at recommended rates. The results exhibited that the performance of HD2967 and PBW-343 was found significantly superior over other varieties in terms of growth, yield attributes and yield. The variety HD-2967 recorded maximum grain yield (5590.0 kg ha<sup>-1</sup>), Harvest index (42.23%), net income (Rs. 80490ha<sup>-1</sup>) and B:C ratio (2.89) followed by PBW 343 recorded grain yield (5277.0 kg ha<sup>-1</sup>), harvest index (35.67%), net income (Rs. 65358-00 ha<sup>-1</sup>) and B: ratio (2.53) was recorded under PBW 502.

**Keywords:** Wheat, varieties, growth characters, yield attributes, yield

### Introduction

World trade in wheat is greater than for all other crops combined with rice, wheat is the world's most favoured staple food. It is a major diet component because of the wheat plants, agronomic adaptability with the ability to grow from near arctic regions to equator, from sea level to plains of tibet, approximately 4000 m. (13000 fit) above sea level. In addition to agronomic adaptability, wheat offers ease of grain storage and ease of converting grain into flour for making edible, palatable, interesting and satisfying foods.

In 100 grams, wheat provides 327 Kilocalories and is a rich source of multiple essential nutrients such as protein, dietary fibre, manganese, phosphorus and niacin. Several B vitamins and other dietary mineral are in significant content. Wheat is 13% water, 71% carbohydrates, and 1.5% fat. Its 13% protein content is mostly gluten (75-80% of the protein in wheat). Wheat proteins are deficient in the essential amino acid, lysine, white flours are more deficient in lysine compared with whole grains.

Currently agriculture is facing multi-dimensional challenges including climate change. Projected increase in temperature and frequency of weather extremes could significantly constrain wheat production in future climate. Average global temperature have increased over the last decades and are predicted to continue rising, along with a greater frequency of extremely hot days. Surprisingly, observed variation of  $\pm 2$  °C in average growing season in the main wheat growing regions can cause reduction in grain production of up to 50%. Most of this can be attributed to increased leaf senescence as a result of temperature  $> 34$  °C. (Assang *et al.* 2011) [1]. Wheat varieties vary for their duration as well as tolerance to temperature stress. A shorter duration cultivars is likely to yield less, while the longer duration variety may be exposed to more climatic stress. Hence farmer's always are in dilemma regarding the choice a variety. The majority of previous studies showed that increase in temperature shortened crop growing period, leading to reduced crop productivity (Wang *et al.* 2012) [2]. This study was aimed to quantify the response of long duration and medium duration varieties to high temperature and is expected to provide scientific basis for the choice of a variety in changing climate conditions.

### Material and Methods

The field experiment was conducted during *rabi* season of 2017-18 at Student's Instructional Farm of Chandra Shekhar Azad University of Agriculture & Technology, Kanpur Uttar

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Pradesh, India, situated at 125.9 meter altitude, 26.4148 North latitude, and 80.2321 East longitude. Treatments involved 10 wheat varieties viz. K307, K402, K607, K1006, HD2733, BDW-17, HD2967, PBW343, PBW502 and PBW 550 matures in 135 to 145 days after sowing. The treatments were laid out in Randomized Block Design replicated three times. The soil of experimental field was sandy loam with 55% sand, 25.50% silt and 19.50% clay with pH of 7.95. It was moderately fertile being low in organic carbon (0.42%) available N (179.0 kg ha<sup>-1</sup>), and Potash (156.0 kg K ha<sup>-1</sup>).

The meteorological observations recorded during the study period revealed that at the time of germination (November 2017) the temperature ranges 7.6 °C to 26.7 °C. The temperature during growth period i.e. December 2017, January 2018, February 2018 was ranged 5.3 °C to 14.6 °C (Minimum temperature) and 17.1 °C to 30.3 °C (maximum temperature). During maturity in the month of March and April 2018, the minimum temperature varies 13.9 °C to 22.3 °C and maximum temperature varies 30.7 °C to 36.1 °C. The relative humidity ranged between 45.9% to 83.8% and cumulative rainfall limited to only 15.8 mm, which reveals that almost dry *Rabi* season was notified in 2017-18.

## Results and Discussion

**Growth variables:** The data presented in Table-1 exhibited that significantly maximum plant height (89.95 cm) and tiller per meter square (477.29) was recorded under HD 2967 followed by PBW 343 and minimum plant height (77.02 cm) and tiller m<sup>-2</sup> (410.21) observed under variety PBW 502. The production of dry matter in terms of absolute growth rate (g day<sup>-1</sup>) recorded maximum at 35-45 days after sowing stage in all the varieties and later on a decreasing trend was observed till maturity. The wheat variety HD2967 recorded maximum absolute growth rate at different stages till 95-105 DAS stage. At maturity stage K402 recorded maximum growth rate compared to other varieties. The overall performance in terms of absolute growth rate HD 2967 and PBW-343 found better among all other varieties tested. The difference in growth characters in varieties might be due to their genetic diversity (Aslam *et al.* 2003) [3].

## Yield attributes

The data summarised in table-2 revealed that all the varieties exhibited significant difference in terms of yield attributes. The variety HD 2967 recorded significantly maximum ears (450.66 m<sup>-2</sup>), ear length (9.64 cm), grains ear<sup>-1</sup> (56.67) and test weight (43.17 g) followed by PBW 343 which recorded 425.53 ears m<sup>-2</sup>, 9.10 cm ear length, 53.49 grains ear<sup>-1</sup> and 40.75 g test weight found significantly at par and minimum ear's m<sup>-2</sup> (386.62), ear length (7.90 cm) grains ear<sup>-1</sup> (47.65) and test weight (36.30 g) recorded under PBW 502 variety. The better yield attributes in varieties might be due to better growth of particular variety. The highest grain yield was correlated with longer spike, growth duration, partitioning higher crop growth rate and grain spike weight ratio at anthesis phase (Gill, 2009) [4].

## Yield and economics

The data presented in Table-3 revealed that maximum grain yield (5590.0 kg ha<sup>-1</sup>) was recorded in variety HD 2967 and the growth yield of the varieties PBW 343 and K1006 found significantly at par. The minimum grain yield (4601.00 kg ha<sup>-1</sup>) was recorded under variety PBW 502. The grain yield increased to the tune of 21.49%, 14.69% and 13.25% under HD 2967, PBW 343 and K1006, respectively, compared to the variety PBW 502. The straw yield was recorded maximum (8397.00 kg ha<sup>-1</sup>) in the variety K607 followed by PBW -502, PBW 550, HD 2733 found significantly at par. The harvest index was recorded maximum (42.23%) in HD 2967 followed by PBW-343 (39.90%), K307 (39.50%) and K1006 (39.36%) found significantly at par. The yield data are closely related to absolute growth rate and dry matter production of different varieties. The above findings are closely related to the findings of Gill (2009) [4], Naresh *et al.* (2014) [5].

The economics of different varieties in terms of gross income, net income and B:C ratio revealed that among ten varieties tested three varieties viz HD-2967, PBW-343, and K 1006 evaluated maximum profit. The maximum gross income (Rs. 123195.00 ha<sup>-1</sup>), net income (Rs. 40490.00 ha<sup>-1</sup>) and B:C ratio (2.89) was obtained with the variety HD 2967, followed by PBW 343 and K1006. The minimum gross income (Rs. 108063.00 ha<sup>-1</sup>), net income (Rs. 65358.00 ha<sup>-1</sup>) and B:C ratio (2.53) was recorded under PBW 502.

**Table 1:** Growth characters of different wheat varieties.

Treatments	Plant Height (cm)		No. of Tillers m <sup>-2</sup>	Absolute Growth Rate (g day <sup>-1</sup> )					
	Maturity	95 DAS		0-35 DAS	35-45 DAS	45-55 DAS	55-75 DAS	75-95 DAS	95-105 DAS
K307	78.32	416.65	0.055	0.400	0.238	0.274	0.165	0.155	0.034
K402	83.55	444.28	0.059	0.420	0.251	0.289	0.173	0.168	0.046
K607	77.75	413.37	0.056	0.396	0.236	0.272	0.163	0.159	0.040
K1006	83.43	444.59	0.060	0.427	0.255	0.293	0.176	0.172	0.035
HD2733	80.82	427.46	0.058	0.412	0.246	0.283	0.170	0.165	0.030
DBW17	82.06	438.51	0.059	0.420	0.251	0.288	0.174	0.169	0.034
HD2967	89.95	477.29	0.064	0.458	0.274	0.314	0.189	0.184	0.036
PBW343	84.77	451.73	0.061	0.432	0.258	0.297	0.179	0.173	0.034
PBW502	77.02	410.21	0.055	0.392	0.234	0.269	0.162	0.124	0.041
PBW550	79.72	424.64	0.058	0.408	0.243	0.281	0.168	0.164	0.035
SE(d)±	2.6872	5.927	0.0054	0.0040	0.0028	0.0016	0.0018	0.0025	0.0019
CD (P=0.05)	5.6458	12.548	N.S.	0.0084	0.0059	0.0033	0.0039	0.0052	0.0040

**Table 2:** Yield attributes of different wheat varieties.

Treatments	No. of Ear's m <sup>2</sup>	Length of Ear(cm)	No. of grain ear <sup>-1</sup>	Test Weight (g)
K307	392.87	8.40	49.42	37.65
K402	419.42	8.84	51.98	39.60
K607	390.32	8.33	49.01	37.33
K1006	418.83	8.98	52.83	40.25
HD2733	405.70	8.67	50.99	38.84
DBW17	414.28	8.84	52.01	39.62
HD2967	450.66	9.64	56.67	43.17
PBW343	425.53	9.10	53.49	40.75
PBW502	386.62	7.90	47.65	36.30
PBW550	400.18	8.59	50.51	38.48
SE(d)±	16.266	0.1732	1.6873	0.7365
CD (P=0.05)	34.438	0.3632	3.5461	1.5480

**Table 3:** Yield and economics of different wheat cultivars.

Treatments	Grain Yield (kg ha <sup>-1</sup> )	Straw Yield (kg ha <sup>-1</sup> )	Harvest Index (%)	Gross Income (Rs ha <sup>-1</sup> )	Net Income (Rs ha <sup>-1</sup> )	B:C Ratio
K307	4875.00	7466.00	39.50	110224=00	67519=00	2.58
K402	5128.00	8107.00	38.75	116832=00	74127=00	2.74
K607	4834.00	8397.00	36.54	112776=00	70071=00	2.64
K1006	5211.00	8028.00	39.36	117987=00	75282=00	2.76
HD2733	5030.00	8207.00	38.00	115534=00	72829=00	2.70
DBW17	5130.00	8098.00	38.78	116835=00	74130=00	2.73
HD2967	5590.00	7648.00	42.23	123195=00	80490=00	2.89
PBW343	5277.00	7950.00	39.90	118853=00	76148=00	2.78
PBW502	4601.00	8299.00	35.67	108063=00	65358=00	2.53
PBW550	4983.00	8245.00	37.67	114817=00	72112=00	2.69
SE(d)±	181.32	229.27	0.3296	1158.0067	883.2486	0.0774
CD (P=0.05)	381.08	481.85	0.6930	2433.7065	1856.2654	0.1647

### Conclusion

Based on the findings of results it might be concluded that the variety HD2967, PBW-343 and K-1006 showed better performance in terms of grain yield, net income under timely shown situation of Central Plain Zone of Uttar Pradesh.

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