Original Research Article

Performance of wheat genotypes under late sown conditions in eastern region of Uttar Pradesh

Abstract

There is an increase in the world population greatly during the past decade. In order to support the growing population scientists are looking towards the high yielding varieties to provide for the world. As such field experiment entitled “Performance of Wheat genotypes under late sown conditions in Eastern region of Uttar Pradesh" was conducted during Rabi 2022 at Wheat Breeding Experimental Field, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36 %), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The experiment was laid out in Randomized Block Design with Eight genotypes which were replicated four times. The genotypes used in the experiment are NELS-201, NELS-202, NELS-203, NELS-204, NELS-205, NELS-206, NELS-207, NELS-

208. The experiment results revealed that the Wheat genotype NELS-208 performed better than other hybrids viz. Plant height (103.19 cm), dry weight (22.46 g), number of tillers per hill (12.85), number of grains per spike (84.00), spike length (13.40 cm), test weight (40.73 g), grain yield (3.10 t/ha), straw yield (4.85 t/ha), Harvest index (38.99%) was recorded significantly higher compared to other genotypes.

Key words: Wheat genotypes, Late sown, Growth attributes, Yield attributes.

INTRODUCTION :

Wheat *(Triticum species)* is a crop of global significance. It is grown in diversified environments. It is a staple food for millions of people. Approximately one-sixth of the total arable land in the world is cultivated with wheat. It requires a relatively 1ow temperature for satisfactory growth and development. In 2020, the total global production of wheat was **760 million tons**. China, India, and Russia are the three largest individual wheat producers in the world, accounting for about 41% of the world's total wheat production. India recorded a production of 107.6 million metric tonnes standing third in the global world production (**FAO statistics 2020**). The country needs to produce 100 million tonnes of wheat by 2030 to feed the ever- growing population, a significant challenge under changing climatic scenarios. Therefore, concerted efforts are needed to intensify the research on enhancing productivity per unit area on an ecologically and economically sustained basis. Various factors are responsible for the low production of wheat; sowing time and varietal selection are of primary importance. Wheat has its own definite abiotic and biotic requirements for growth and development. Optimum sowing time helps plants to attain a favourable environment. The timely sowing of wheat increases the number of tillers, spikes, grains per spike and grain weight, ultimately increasing grain yield **(Qasim *et al*., 2008).**

Delay sowing reduces the yield due to a decrease in the number of tillers, the number of grains per spike, and grain weight **(Ansary *et al*., 1989).** Singh and Uttam (1999) have estimated grain yield loss @ 39 kg ha-1 per day for each day delay in sowing from optimum sowing time. Plant where there is a delay in sowing, experience terminal heat stress. Heat stress affects wheat's various physiological, biological, and biochemical processes (Asseng ***et al*., 2015).** High temperatures cause a decrease in grain filling duration, photosynthetic capacity and rate of assimilating translocation **(Bala *et al*., 2014; Farooq *et al*., 2011; Raines, 2011).** Many high yielding varieties that have been recommended in the past are now losing their yield capacity due to changes in various edaphic and environmental conditions. Thus, continuous selection of great yielding varieties that can cope with changing environmental conditions is necessary **(Tahir *et al*., 2009).** In late sowing, the wheat genotype should be the short duration that can escape from the high temperature at the grain filling stage **(Phadnawis & Saini, 1992).** In order to compensate for yield losses in wheat caused by late sowing, breeders are searching for wheat genotypes that have increased heat tolerance under late planting conditions. Late sowing has been declared one of the significant problems in our agricultural system. Wheat is a temperate crop susceptible to high temperatures **(Wang *et al*., 2016).** Its different growth stages have different temperature requirements, and when exposed to extreme temperature, physiological behaviour and yield are affected negatively (Oyewole, **2016).** When the temperature rises above 24 ^{0}C and ranges toward 30 ^{0}C, the crop encounters heat stress **(Barnabas *et al*., 2008; Prasad and Djanaguiraman, 2014).** The crop's heat stress experienced by the crop during the anthesis and grain filling stage is known as terminal heat stress **(Suryavanshi and Singh, 2016).** This leads to various structural and physiological alterations in a plant, like reduction in the height of the plant, decreased spike length, number of grains, and total grain yield **(Dwivedi *et al*., 2017; Ihsan *et al*., 2016).**

Materials and methods :

The current study was carried out in the Wheat Breeding experimental Field, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj, during the Rabi season 2021-22, (U.P.). The experimental field is located approximately 9 kilometers from Prayagraj city, near the Yamuna River, on the left side of the Prayagraj-Rewa Road. Prayagraj is located in the subtropical zone of Uttar Pradesh, with hot summers and pleasant winters. The area's average temperature is 23°C to 38°C, with temperatures seldom dropping below 3°C or 4°C. The relative humidity levels range from 26% to 78%. In this location, the average annual rainfall is 1050 mm. The soil chemistry analysis revealed a sandy loam texture with a (pH 7.1), low amounts of organic carbon (0.48 percent) and potassium (215.4 kg/ha), and a low quantity of accessible phosphorus (13.6 kg/ha). The soil was electrically conductive and had a conductivity of 0.26 dS/m. The experiment was done with eight genotypes replicated four times in randomized block design. The genotypes that were used during the experimental period were NELS-201, NELS-202, NELS-203, NELS-204, NELS-205, NELS-206, NELS-207, NELS-208.

RESULT AND DISCUSSION :

1. *Growth parameters :*

Significantly higher plant height (103.19 cm) was recorded with NELS-208 among all the genotypes, whereas a significantly lower plant height (94.38 cm) was recorded with the NELS- 205 genotype. However, NELS-202 and NELS-201 with plant height (102.76 cm and 101.33 cm) were statistically on par with NELS-208. The statistical analysis of data between different Genotypes indicates that a significant effect on plant height was mainly due to the genetic potential of Genotypes and can also be affected by environmental factors like temperature, water, sunlight and nutrient uptake during its cropping period. Similar results were also reported by **Abdul *et al*., (2010).** A significantly higher tillers count (13.90 tillers/ hill) was recorded with NELS-208, whereas a significantly lower tillers count (9.65 tillers/hill) was recorded with NELS-205 genotype. However, NELS-202 and NELS-201 (13.50 and 12.95 tillers/hill), were statistically on par with NELS-208. The results pertained to Number of tillers /hi11s are tabulated in Table 1. An increase in growth parameters depends on irrigation by 90 per cent and nutrient uptake during the vegetative stage; it is an important factor during the tillers formation stage, and yield depends on the number of tillers developed during the vegetative stage, which is mainly due to genetic diversity and higher inheritance of character of seeds. Tillers may negatively or positively contribute to wheat productivity, which is maximum in the early stages and decrease at harvest. **Mumtaz *etal*., (2015)** also reported a similar result. As per the data showed in Table 1 higher plant dry weight (22.46 g) was recorded with NELS- 208 is significantly higher among all the genotypes whereas, significantly lower plants dry weight (18.36 g) with NELS-205 genotype. However, NELS-202 (21.39 g), NELS-201 (21.12 g), respectively were statistically on par with NELS- 208. Due to exposure to light and adequate supply of nutrients and photosynthetic activity increases which results in maximum dry weight of plant. Increase in dry matter production with increase in growth stages which reached maximum at harvest. Different seed rate of wheat may affect the dry matter accumulation in different varieties of wheat these results were supported **by Rehman *et al*., (2021).**

2. *Yield Parameters* :

On perusal of data of different genotypes tabulated in Table 1, results varied significantly on the number of grains/spikes. Which is recorded as significant with NELS-208 with the higher number of grains/spike (84.00) and significantly lower grains/spike (51.20) was recorded with the NELS-205 genotype. However, NELS-202 and NELS-201 with number of the grains/spike (82.90 and 80.54) were statistically on par with NELS-208. **Abdul *et al*., (2010)** stated that Less number of grains per spike was observed under late sowing probably due to less production of photosynthates and shorter growing period. Grain number per spike were significantly influenced by interaction effects of sowing time and genotypes. Higher spike length was statistically significant with NELS-208 and higher spike length (13.40 cm) among all the genotypes, whereas significantly lower spike length (11.00 cm) was recorded with the NELS-205 genotype. However, NELS-202 and NELS-201 with spike lengths (12.92 cm and 12.50 cm) were statistically on par with the NELS-208 genotype. Test weight was recorded as significant among all the genotypes with a significantly higher test weight (40.73 g) with NELS-208, whereas NELS- 205 recorded a lower test weight (36.78 g). However, NELS-202 and NELS-201 with test weights (40.56 g and 40.25 g) respectively were statistically on par with NELS- 208. The results are tabulated in Table 1. The late sowing resulted in decrease in the of the grain development due to shorter growing period. The genotypes were negatively affected as a result of late sowing. Reduction in grain weight is caused by high temperature during pre- and post-anthesis under field condition. The test weight was affected significantly by different sowing dates. Genetic factors influence test weight, and the number of irrigations, nutrient requirement and time of sowing are the factors which can positively or negatively affect the test weight of different genotypes. The results are in acceptance with **Ansary *et al*., (1989).** Data on grain yield as influenced by different genotypes are presented in Table 1. genotype produces a significantly higher grain yield (3.10 t/ha) with NELS-208 recorded among all the genotypes, whereas a significantly lower grain yield (1.87 t/ha) was recorded with the NELS-205 genotype. However, NELS- 202 and NELS-201 with grain yields (2.80 t/ha and 2.78 t/ha) were statistically on par with NELS-208. **Rahman *et al*., (2009)** said that lower grain yield in late sowing was mainly due to lower germination counter per m^2, less number of tillers per m^2, less number of grains per spike and lower 1000 rain weight. Grain yield was significantly affected by wheat genotypes, terminal stress and interaction of wheat genotypes. The greater reduction in seed yield due to high temperature was under late sown condition and there was a decline in grain yield under high temperature during grain filling stage. The moderately high temperatures and short periods of very high temperatures during grain filling severely affect the yield, yield components and grain quality in wheat. It is observed from Table 1 that the straw yield of wheat was also affected by the number of tillers/hills, whereas genotype NELS-208 produced significantly higher straw yield (4.85 t/ha) and significantly lower straw yield (4.30 t/ha) was recorded with NELS- 205 genotype. However, NELS- 202 and NELS- 201 with straw yield (4.79 t/ha and 4.77 t/ha), respectively, were statistically on par with NELS- 208. Data on the harvest index in Table 1 revealed that the harvest index of wheat is significantly affected by genotypes. The significantly higher harvest index (38.99 %) was recorded with NELS-208, whereas the lower harvest index (30.35 %) was recorded with NELS- 205 genotype. However, NELS- 202 (36.88 %), NELS-201 (36.81%) respectively were statistically on par with NELS-208. An Increase in tillers counts during the growth stages of wheat crop significantly improve in production of high grain yield and straw yield. **Patel *et al*., (2012)** also reported the same.

3. Conclusion :

It is concluded that genotype NELS-208 was found to be more desirable for producing significantly higher Plant height (103.19 cm), number of tillers/hill (13.90), grain yield (3.10 t/ha), straw yield (4.85 t/ha). Findings are based on research done in one season in Prayagraj (Allahabad) U.P. further trails may be required for considering it for the recommendation.

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Table 1: Evaluating the performance of wheat genotypes on growth, yield and yield attributing traits under late sown conditions in Eastern region of Uttar Pradesh

GENOTYPES	PLANT HEIGHT	NO.OF TILLERS PER HILL	PLANT DRY WEIGHT (g)	NO. OF GRAINS PER .IKE	SPIKE LENGTH (cm)	TEST WEIGHT (gm)	GRAIN YIELD (t/ha)	STRAW YIELD (t/ha)	HARVEST INDEX (%)
NELS-201	101.33	12.95	21.12	80.54	12.50	40.25	2.78	4.77	36.81
NELS-202	102.76	13.50	21.39	82.90	12.92	40.56	2.80	4.79	36.88
NELS-203	96.28	11.00	18.87	65.21	11.30	37.21	2.43	4.50	35.10
NELS-204	98.07	11.25	19.29	60.89	11.50	37.54	2.47	4.60	34.94
NELS-205	94.38	9.65	18.36	51.20	11.00	36.78	1.87	4.30	30.35
NELS-206	99.43	12.55	20.68	75.64	12.00	38.50	2.61	4.70	35.74
NELS-207	98.14	12.05	19.23	70.60	11.80	37.89	2.51	4.65	35.06
NELS-208	103.19	13.90	22.46	84.00	13.40	40.73	3.10	4.85	38.99
F Test	S	S	S	S	S	S	S	S	S

S.EM (+)	1.10	0.18	0.18	0.69	0.11	0.44	0.02	0.05	0.28
CD (p=0.05)	3.24	0.52	0.52	2.02	0.31	1.29	0.07	0.15	0.82