Agronomic evaluation of wheat (*Triticum aestivum* L.) genotypes under north eastern plain zones

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Abstract

A field experiment was conducted during *Rabi* 2018 at Wheat Breeding experimental Field, Naini Agricultural institute, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1). The treatments consist of eleven genotypes (NE-IR-101 to NE-IR-111) among these five check varieties included, whose evaluation was observed. There were eleven treatments each replicated four times. The experiment was laid out in Randomized Block Design. The result showed that growth parameters viz. Plant height (103.37 cm), Number of tillers/hill (12.2/hill) at 120 DAS were found significantly higher in Treatment T$_2$ (NE-IR-108). Yield Parameters viz. Grain yield (3.95 t/ha), Straw yield (5.42 t/ha) were also recorded significantly high in treatment T$_8$ (NE-IR-108) as compared to other treatments. From the above data Genotype (NE-IR-108) was found to be productive.

Keywords: Genotype, productive, evaluation

Introduction

Wheat is the second most important staple cereal crop belongs to family *Poaceae*. Wheat stands next to Rice, both in area and production. The major wheat grown in north western part of the country like States are Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Bihar, Maharashtra, Gujarat and Himachal Pradesh. These States contribute about 99.5% of total wheat production in the country. Remaining States, namely, Jharkhand, Assam, Chhattisgarh Delhi and other North Eastern States contribute only about 0.5% of the total wheat production in the country. The major increase in the productivity of Wheat has been observed in the states of Punjab, Haryana and Uttar Pradesh. Higher area coverage is reported from UP in recent years. Uttar Pradesh has major share of total food grain production of 32.75 million tonnes with an area of 9.54 million ha, which makes it the major producer state in the country and share highest wheat grain production 32.75 million tonnes followed by Punjab (18.24 million tonnes), and MP (15.47 million tonnes). Uttar Pradesh shares 32.74%, Punjab accounts 12.08%, and Madhya Pradesh shares 18.95% of total wheat production in India. Punjab has the highest productivity 5.1 t/ha followed by Haryana 4.92 tonnes/ha, and average productivity of Uttar Pradesh is 3.43 tonnes/ha. (Annual report of Directorate of Economics & Statistics, 2018-19) [2].

Wheat is good addiction for nutritional requirement of human body as it contains 8-15% protein, starch 60-68%, fat 1.5-2.0%, cellulose 2.5% and minerals 1.2-2%. Beside staple food for human beings, wheat straw is good sources of feed for a large population of cattle in our country. Because of genetic variation, different varieties of crop may differ in growth and development behaviour and response to different management practices. Taller varieties are generally less responsive to fertilizer application and give lesser yields than the dwarf varieties. As genotypes vary widely, nitrogen has got differential response (Singh *et al.*, 2010) [7]. The varieties have been found to differ in their efficiency to accumulate dry matter and yield attributing characters. The development of semi-dwarf wheat cultivars which resist lodging more than conventional taller varieties have improved wheat yields by allowing greater efficient use of nitrogen (N) fertilizer. In Punjab (Singh *et al.*, 1996) [8] observed that the bread wheat varieties (WH 542 and HD 2329) recorded higher dry matter production, leaf area index and effective tillers than durum wheat.
(Virk et al., 2003) showed that varieties PDW 343 and WH 542 were significantly superior in grain yield than PBW 233 and WH 283. Mahajan and Nagarajan (2005) reported that two hybrids HM 9846 and HM 9837 were significantly superior in grain yield to the best check PBW 343.

Materials and Methods
A field experiment was conducted during rabi 2108-19 at the Wheat Breeding Experimental Field, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayag (Allahabad), Uttar Pradesh. The Wheat Breeding experimental field is situated at 25° 24’ 33” N latitude, 81° 51’ 12” E longitude (Google, 2018) and 98 m altitude above the mean sea level in North Eastern Plain Zone. The soil of the experimental field was sandy loam in texture, nearly neutral in soil reaction (pH 7.1). The total rainfall received during crop season 2018-19 was 4.83 mm. Wheat was sown on 29 November 2018 with plant geometry of 20 X 10 cm apart and evaluated in Randomized block design with eleven treatments four times replicated. The treatments are eleven genotypes (NE-IR 101 - 111) among these five check varieties are included. Optimum plant population maintained by thinning and gap filling. The thinning operation was done after 15 days of sowing. The observations were recorded on the different growth parameters viz. plant height, number of tillers per hill. Yield parameters viz. seed yield, Straw yield. The experimental crop was harvested separately from each plot on 10th April 2019. The produce from net plots were harvested in one lot and tied in bundles and allowed to complete dried material was passes through threshing operation. After threshing and winnowing the clean grains from each plot were weighed and the weight was recorded as grain yield in kg/plot and then converted in t/ha.

Results and Discussion

Growth Parameters

Plant Height
Plant height maximum at harvest (103.38 cm), was observed in treatment T8 (NE-IR- 108) over the rest of the treatments. The finding indicate that considerable variations were present among wheat genotypes for plant height which is attributed to genetic potential of certain variety and higher inheritance of this character. Similar findings have been reported by (Munsif et al., 2015) and (Abinasa et al., 2011).

Number of Tillers/Hill
Number of tillers per hill at harvest (12.5 tillers/plant), was found in treatment T8 (NE-IR- 108) over the rest of treatments. The development of tillers per hill is dependent on genetic background of plant and environmental conditions such as water, light, temperature and proper utilization of nutrient uptake at vegetative stage. Similar findings have been reported by (Spielmeyer and Richards 2004).

Yield parameters

Grain yield: Data showed significantly maximum grain yield (3.95 t/ha) was observed with treatment T8 (NE-IR-108) as the check variety got higher yield. However, T2 (NE-IR-102) with grain yield (3.94 t/ha) was statistically on par with T8 (NE-IR-108). The higher grain yield might be due to more grains per spike and grain weight which will be inherent genetic potential of the genotypes themselves. In addition, higher grain yield is probably related to the growth parameters such as the NE-IR-108 variety showed maximum tillers/hill because of more interception of solar radiation which stores further energy during photosynthesis. Enhancing grain yield potential is the most important objective in wheat breeding program. Expression of grain yield is dependent upon genetic potential and environmental factors and their interaction. Thus, it is strongly influenced by the environmental conditions. and has low to moderate heritability. Higher grain yields are usually associated with delayed maturity and lower protein content (Zhang et al., 2015). The genetic yield potential of a wheat varieties might be dependent on favourable conditions and suitable agronomic practices to be expressed. Thus, environmental factors such as water, fertilizer, disease and pest control also play significant role in increasing of grain yield (Knezevic et al., 2008).

Straw yield (t/ha)
The significantly maximum straw yield (5.42 t/ha) was found under maximum grain yield producing treatment T8 (NE-IR-108). However, T2 (NE-IR-108) with straw yield (5.41 t/ha) was statistically on par with T8 (NE-IR-108). Higher straw yield may be attributed to either taller plant height or higher tillers production of certain genotypes. Taller cultivars tend to produce more straw per unit of area than shorter cultivars. Other factors such as application of fertilizer, seed rate and growth habit may also be involved in the expression of this trait, such as NE-IR-108 had recorded more tillers. Shah et al., (2011) stated that straw and grain yields increase with increase in level of nitrogen.

| Treatments | Plant height (cm) | No. of tillers/hill |
|------------|------------------|---------------------|
| NE-IR-101  | 100.13           | 11.05               |
| NE-IR-102  | 101.73           | 11.47               |
| NE-IR-103  | 89.12            | 7.985               |
| NE-IR-104  | 99.1             | 10.01               |
| NE-IR-105  | 98.88            | 9.48                |
| NE-IR-106  | 94.3             | 8.57                |
| NE-IR-107  | 93.05            | 8.29                |
| NE-IR-108  | 103.38           | 12.15               |
| NE-IR-109  | 91.2             | 8.03                |
| NE-IR-110  | 97.73            | 8.92                |
| NE-IR-111  | 92.03            | 8.08                |
| F TEST     | S                | S                   |
| SEM (±)    | 0.19             | 0.10                |
| CD (P=0.05) | 0.55             | 0.29                |

Table 1: Evaluation of Wheat genotypes on the basis of growth parameters
Table 2: Evaluation of Wheat genotypes on the basis of yield

| Treatments | Grain yield (t/ha) | Straw yield (t/ha) |
|------------|-------------------|-------------------|
| NE-IR-101  | 3.71              | 5.29              |
| NE-IR-102  | 3.94              | 5.41              |
| NE-IR-103  | 3.14              | 5.04              |
| NE-IR-104  | 3.63              | 5.26              |
| NE-IR-105  | 3.58              | 5.27              |
| NE-IR-106  | 3.25              | 5.16              |
| NE-IR-107  | 3.23              | 5.13              |
| NE-IR-108  | 3.95              | 5.42              |
| NE-IR-109  | 3.15              | 5.04              |
| NE-IR-110  | 3.53              | 5.23              |
| NE-IR-111  | 3.18              | 5.08              |
| F TEST     | S                 | S                 |
| SEM (±)    | 0.05              | 0.04              |
| CD (P=0.05)| 0.15              | 0.12              |

Conclusion
On the basis of one-season experimentation Genotype (NE-IR-108) was found more productive (3.95 t/ha) due to efficient utilization of nutrients and their genetic inherited characters. The conclusions drawn are based on one-season data only which requires further confirmation for recommendation.

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