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**Original Research Article**

# Selecting Suitable Wheat (*Triticum aestivum* L.) Variety for Gorakhpur and Deoria Region through Normalized Cumulative Ranks

**Mohit Yadav[1], Shri Niwas Singh[1], Tarkeshwar[2]*, Rohit Kumar Sahu[1], Kamlesh Kumar[1] and Praveen Kumar Yadav[1]**

[1]Department of Genetics and Plant Breeding, Baba Raghav Das Post Graduate College, Deoria (U.P.) - 274 001, India
[2]Department of Genetics and Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) – 224 229, India

**Corresponding author*

**A B S T R A C T**

An experiment was conducted at Centre for Research and Development (CRD), Gaunar Usaraha, Gorakhpur during *rabi* 2017-18 in normal soil, timely sown and irrigated conditions to find out better genotype among available stock for Gorakhpur and Deoria region. Total eighteen Wheat (*T. aestivum* L.) genotypes were evaluated on various under Randomized Block Design through NCR (Normalized Cumulative Rank) analysis. The results revealed that genotype HPST-16-17-6 is found superior followed by HPST-16-17-17 based on their ranks. Further, these genotypes can also be used in wheat breeding programmes as parent material for desired trait. The result also shows that HPST-16-17-6 is more close to the ideal plant type in comparison to HPST-16-17-17. Hence, the variety HPST-16-17-6 could be further improved by paying attention to its days to 50% flowering.

**Keywords**

Normalized cumulative rank, Bread wheat, Grain yield, Variability

## Introduction

Wheat (*Triticum aestivum* L., 2n=42) is the most stable food crop in the world. It is a self-pollinating annual plant in the true grass family Gramineae (Poaceae), it has been described as the "King of the cereals" because of the acreage it occupies, high productivity and the prominent position, it holds in the international food grain trade. It is a $C_3$ plant grown from temperate, irrigated to dry, high rain fall areas and from worm humid to dry, cold to environments. Undoubtedly, this wide adaptation has been possible due to the complex nature of the plants genome which provides great plasticity to the crop. The bread wheat is an allohexaploid (2n =6x= 42 having AABBDD with A, B and D genome) cereals crop with great genetic diversity worldwide. The majority of the cultivated wheat varieties belong to three main species of the genus *Triticum* are; the hexaploid wheat (2n=6x=42), *T. aestivum* L. (bread wheat), the tetraploid wheat (2n=4x=28), *T. durum* Desf and the diploid (2n=2x=14), *T. dicoccum* Schrank and *T. monococcum*. Globally, *T. aestivum* is most important species which covers 90% of the area. Second most popular wheat is *T. durum* which covers about 9% of the total area while *T. dicoccoum* and *T. monococcum* cover less than 1% of the total area. Wheat attains

unique prominent position in agriculture and economic perspective of our country because of being second most important food crop after rice.

The objectives of this study were to identify and select some superior genotypes for Gorakhpur region on the basis of yield and some other important traits like day to 50% flowering , plant height, tillers, maturity, spike length etc. This will also be helpful to find out suitable traits that could be used in breeding programmes for grain yield improvement.

## Materials and Methods

The experiment material of wheat germplasm where considered of 18 wheat genotypes, these genotypes were collected from genetic stock available in wheat section at Centre for Research and Development (CRD), Gaunar Usaraha, Gorakhpur, Uttar Pradesh India. The site of experiments is located at 26°42'45.50" N Latitude, 83°36'36.6" E Longitude and 83 meters above the mean sea level. The experiment was conducted to evaluate 18 wheat germplasm lines in good soil under timely sown and irrigated conditions, in Randomized block design. The entire experiment field was divided in 54 blocks of (11.5x 39.6) meter equal sized in 3 replications and row to row distance in 22 cm total area. The data on day to 50% flowering, plant height ( 30, 60, 90 ), tillers, flag leaf area, days to maturity, spike length, moisture% and average yield trial were recorded and subjected to NCR (Normalized cumulative rank ) analysis as suggested by Singh (2017) and used in many theses of post-graduate students (Gautam 2018; Singh, P. 2017; Singh, Sumit K. 2018 and Singh, Sunit K. 2017) and some papers (Singh 2018 and Singh *et al.* 2018). The formulae can be written as: 1. and 2. NCR = CR/CRmin, where, CR = cumulative rank; NCR = normalized cumulative rank; R = Rank; n = number of parameters/characters evaluated.

## Results and Discussions

Table-1 shows the average values of data on eight parameters. These data were subjected to NCR analysis and the results are given in Table-2. As per Table-2 on the basis of early vigor (plant heights at 30, 60 and 90 days successively) early flowering, number of tillers, flag leaf area, early maturity, spike length, moisture percentage and average yield, the performance or preferences order of the evaluated genotypes is as per Table-2. The best performer HPST-16-17-6 followed by HPST-16-17-17, HD 3086 and so on. From the same data set, late varieties can also be selected just by changing the sort order. This way a plant breeder can design the crop ideotype of his/her choice.

On the basis of Table-2 the top few (say five) varieties should be recommended for cultivation in surrounding villages. The preference order of top five genotypes is HPST-16-17-6, HPST-16-17-17, HD- 3086, HPST-16-17-4 and HPST 16-17-7. These variety should be recommended for cultivation to the farmers of this area, beside HPST-16-17-6 other genotypes were also found superior for other several traits, such as SHRI RAM 303 days of 50 % flowering, HPST-16-17-17 for plant height, and HPST 16-17-4 for average yield trial. These variety can also recommended to farmers as per there suitable need (Fig. 1 and Table 3).

**Table.1** The mean performance of 18 wheat genotypes on eight parameters

| Sort order (rows) VARIETY (down) | PLANT HEIGHT | | | DAYS TO 50% FLOWERING | TILLERS | FLAG LEAF AREA | MATURITY | SPIKE LENGTH | MOISTURE | Average Yield Trial |
|---|---|---|---|---|---|---|---|---|---|---|
| | 30 DAYS | 60 DAYS | 90 DAYS | | | | | | | |
| | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| HPST-16-17-4 | 17.25 | 73.06 | 102.39 | 76.33 | 3.93 | 27.56 | 117 | 19.03 | 11.3 | 452.33 |
| HPST-16-17-5 | 15.89 | 74.68 | 105.8 | 79 | 4.37 | 25.88 | 118.67 | 17.83 | 11.33 | 399 |
| HPST-16-17-6 | 16.8 | 80.18 | 117.68 | 78 | 4.2 | 30.32 | 115.33 | 19.9 | 11.17 | 377.67 |
| HPST-16-17-7 | 16.19 | 67.53 | 97.35 | 75.33 | 4.37 | 31.18 | 115.67 | 18.53 | 11.37 | 377.33 |
| HPST-16-17-8 | 15.82 | 61.83 | 103.76 | 77 | 4.2 | 28.76 | 115 | 18.27 | 11.5 | 408.33 |
| HPST-16-17-9 | 14.41 | 70.38 | 94.72 | 73.33 | 4.2 | 30.07 | 115.67 | 17.33 | 11.2 | 308.33 |
| HPST-16-17-10 | 16.55 | 71.83 | 102.46 | 77.67 | 4.1 | 27.92 | 117.33 | 16.6 | 11.33 | 366.67 |
| HPST-16-17-12 | 16.13 | 71.5 | 105.08 | 76.33 | 4.07 | 27.36 | 117.33 | 18.23 | 11.2 | 387.33 |
| HPST-16-17-13 | 15.34 | 74.75 | 105.98 | 77.33 | 4.03 | 24.9 | 118.33 | 17.7 | 11.4 | 405 |
| HPST-16-17-15 | 17.25 | 72.96 | 105.82 | 79.67 | 4.23 | 29.89 | 116.33 | 16.87 | 11.37 | 343 |
| HPST-16-17-16 | 15.27 | 70.71 | 103.13 | 77.67 | 4.33 | 28 | 116 | 16.23 | 11.13 | 380 |
| HPST-16-17-17 | 17.31 | 79.01 | 108.12 | 78.33 | 4.13 | 32.13 | 118.67 | 18.33 | 11.33 | 421.33 |
| PBW-677 | 16.04 | 70.08 | 104.52 | 75 | 4.23 | 24.81 | 118.33 | 17.57 | 11.4 | 396.33 |
| HD2932 | 17.61 | 70.67 | 102.59 | 78.33 | 4.1 | 28.7 | 115.67 | 16.57 | 11.4 | 450.33 |
| HD2985 | 15.94 | 74.7 | 107.5 | 76.33 | 4.3 | 26.86 | 118 | 17.17 | 10.93 | 379.33 |
| HD3086 | 18.64 | 76.36 | 98.04 | 75 | 4.37 | 30.55 | 119.67 | 15.97 | 10.93 | 375 |
| ARJUN 303 | 16.16 | 69.9 | 102.14 | 78 | 3.93 | 24.36 | 116.67 | 17.83 | 11.47 | 387.33 |
| SHRI RAM 303 | 15.67 | 65.59 | 95.49 | 74 | 4.2 | 25.49 | 119.33 | 17.37 | 11.03 | 213.33 |

**Table.2** The ranks of the data on eight para meters

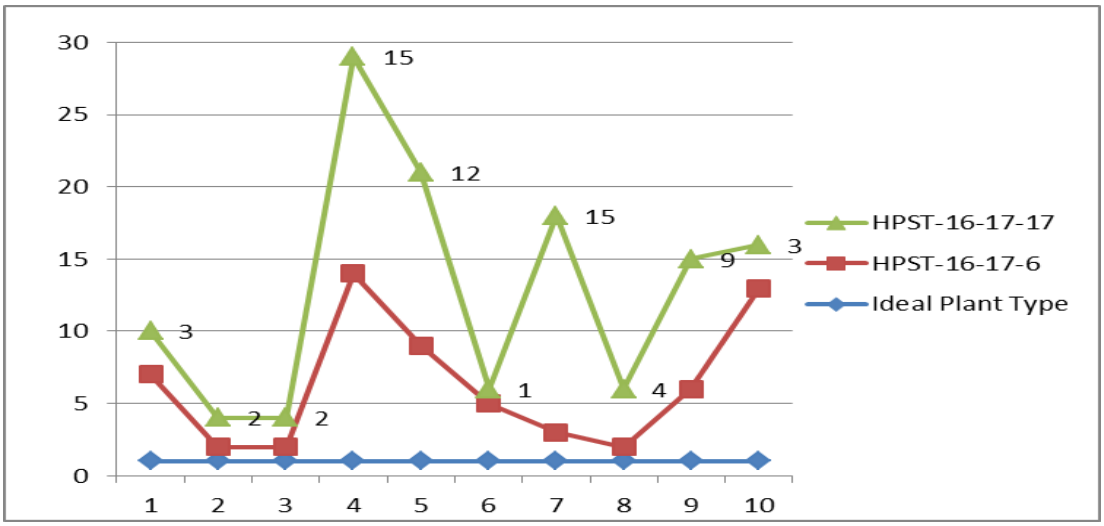
| Sort order (rows) VARIETY (down) | PLANT HEIGHT | | | DAYS TO 50% FLOWERING | TILLERS | FLAG LEAF AREA | MATURITY | SPIKE LENGTH | MOISTURE | Average Yield Trial | CR | NCR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 30 DAYS | 60 DAYS | 90 DAYS | | | | | | | | | |
| | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | | |
| HPST-16-17-6 | 6 | 1 | 1 | 13 | 8 | 4 | 2 | 1 | 5 | 12 | 53 | 1 |
| HPST-16-17-17 | 3 | 2 | 2 | 15 | 12 | 1 | 15 | 4 | 9 | 3 | 66 | 1.25 |
| HD3086 | 1 | 3 | 15 | 3 | 1 | 3 | 18 | 18 | 1 | 14 | 77 | 1.45 |
| HPST-16-17-4 | 4 | 7 | 13 | 6 | 17 | 11 | 9 | 2 | 8 | 1 | 78 | 1.47 |
| HPST-16-17-7 | 8 | 16 | 16 | 5 | 1 | 2 | 3 | 3 | 12 | 13 | 79 | 1.49 |
| HD2985 | 12 | 5 | 3 | 6 | 5 | 13 | 12 | 13 | 1 | 11 | 81 | 1.53 |
| HPST-16-17-12 | 10 | 10 | 7 | 6 | 15 | 12 | 10 | 6 | 6 | 8 | 90 | 1.7 |
| HPST-16-17-8 | 14 | 18 | 9 | 9 | 8 | 7 | 1 | 5 | 18 | 4 | 93 | 1.75 |
| HPST-16-17-5 | 13 | 6 | 6 | 17 | 1 | 14 | 15 | 7 | 9 | 6 | 94 | 1.77 |
| HPST-16-17-15 | 4 | 8 | 5 | 18 | 6 | 6 | 7 | 14 | 12 | 16 | 96 | 1.81 |
| HD2932 | 2 | 12 | 11 | 15 | 13 | 8 | 3 | 16 | 14 | 2 | 96 | 1.81 |
| HPST-16-17-16 | 17 | 11 | 10 | 11 | 4 | 9 | 6 | 17 | 4 | 10 | 99 | 1.87 |
| HPST-16-17-9 | 18 | 13 | 18 | 1 | 8 | 5 | 3 | 12 | 6 | 17 | 101 | 1.91 |
| PBW-677 | 11 | 14 | 8 | 3 | 6 | 17 | 13 | 10 | 14 | 7 | 103 | 1.94 |
| HPST-16-17-13 | 16 | 4 | 4 | 10 | 16 | 16 | 13 | 9 | 14 | 5 | 107 | 2.02 |
| HPST-16-17-10 | 7 | 9 | 12 | 11 | 13 | 10 | 10 | 15 | 9 | 15 | 111 | 2.09 |
| SHRI RAM 303 | 15 | 17 | 17 | 2 | 8 | 15 | 17 | 11 | 3 | 18 | 123 | 2.32 |
| ARJUN 303 | 9 | 15 | 14 | 13 | 17 | 18 | 8 | 7 | 17 | 8 | 126 | 2.38 |

(Sort orders 1= Ascending; 0 = Descending)

**Table.3** The comparison between top 2 genotypes

| The Ranks of | PLANT HEIGHT | | | DAYS TO 50% FLOWERING | TILLERS | FLAG LEAF AREA | MATURITY | SPIKE LENGTH | MOISTURE | Average Yield Trial |
|---|---|---|---|---|---|---|---|---|---|---|
| | 30 DAYS | 60 DAYS | 90 DAYS | | | | | | | |
| Ideal Plant Type | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| HPST-16-17-6 | 6 | 1 | 1 | 13 | 8 | 4 | 2 | 1 | 5 | 12 |
| HPST-16-17-17 | 3 | 2 | 2 | 15 | 12 | 1 | 15 | 4 | 9 | 3 |

**Figure.1** The graphical presentation of comparing the two top performers with the Ideal Plant Type




The graphical representation shows that HPST-16-17-6 is more close to the ideal plant type in comparison to HPST-16-17-17. Hence, the variety HPST-16-17-6 could be further improved by paying attention to its days to 50% flowering.

This way the NCR method analysis statistical ranking method seems very efficient in finding out "What need to be done" in the breeding, if we include all types of plant genetic resources in our NCR method analysis .Then we would be able to locate get the "from where to need full genes" for further improvements for example in the above case of HPST 16-17-6 its DFF could be improve by crossing with HPST 16-17-9 (rank 1 in DFF). This way a plant breeders could plan a combination breeding programs on the techniques.

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