



## Assessment of Genetic Parameters for Growth, Yield and Morphological Characteristics in Wheat (*Triticum aestivum* L.)

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### Abstract

The present study, titled "Assessment of Genetic Parameters for Growth, Yield and Morphological Characteristics in Wheat (*Triticum aestivum* L.)," was conducted during the *rabi* season of 2024–25 at the Agricultural Research Farm, Prof. Rajendra Singh (Rajju Bhaiya) University, Naini, Prayagraj, Uttar Pradesh. This research work had been planned with the objectives to analyze the morphological characters among different wheat genotypes for yield and quality traits, to assess genetic variability, heritability, and genetic advance among wheat, and to estimate the correlation among yield and its component traits. Thirteen wheat genotypes including a check variety, were evaluated under a randomized block design with three replications to assess genetic variability, morphological traits, heritability, and genetic advance. Data were collected for 17 traits. The analysis of variance revealed significant differences among genotypes for all the observed characters. The phenotypic coefficient of variation (PCV) values slightly exceeded the genotypic coefficient of variation (GCV), suggesting minimal environmental influence on trait expression. High estimates of both PCV and GCV were recorded for traits such as grain yield plot<sup>-1</sup> (g) and length of peduncle (cm). Traits including number of grains spike<sup>-1</sup> and grain yield plot<sup>-1</sup> (g) exhibited high heritability coupled with high genetic advance, indicating the predominance of additive gene action. Morphological traits were observed, viz., foliage colour, flag leaf anthocyanin colouration of auricles, ear time of emergence, plant length, ear shape in profile, ear density, grain colour, grain shape, and grain germ width. Among these genotypes, BBW-303 and HD-3086 emerged as superior in terms of yield performance.

**Keywords:** Genetic variability, morphological, heritability, genetic advance, phenotypic, genotypic

### 1. Introduction

Wheat (*Triticum aestivum* L.), commonly referred to as an annual and primarily self-pollinating species classified under the Triticeae tribe within the grass family Poaceae. It is an allohexaploid organism, containing 21 pairs of chromosomes arranged into three distinct subgenomes-A, B, and D-denoted as AABBDD, with a chromosome number of  $2n=6x=42$ . The development of this species resulted from natural hybridization events involving three diploid grass species: *Triticum urartu* (providing the A genome), *Aegilops speltoides* (contributing the B genome), and an unknown diploid relative of *Aegilops tauschii* (source of the D genome). The cultivation of wheat, dating back to around 10,000 B.C., represents a significant chapter in the history of agriculture (Venske et al., 2019). Wheat is believed to have been first domesticated in the Fertile Crescent-a region in the Middle East that extends across modern-day Jordan, Palestine, Lebanon, Syria, Turkey, Iraq, and Iran. The earliest domesticated wheats were

hulled (glume-bearing) types and included all three levels of polyploidy found in *Triticum* species: diploid, tetraploid, and hexaploid (Arzani and Ashraf, 2017). According to the USDA's 2023 report, global wheat production is projected to reach a record 800.2 million metric tons (mmt), an increase of 10.4 mmt compared to the May forecast. The European Union is expected to be the top wheat producer, with output forecasted at 140.5 mmt, up 1.5 mmt due to favourable conditions in France, Hungary, and Italy. China and India follow as the second and third largest producers, although most of their production does not enter the international market. China's output remains steady at 140.0 mmt, while India's estimate has increased by 3.5 mmt to 113.5 mmt (Sowell and Swearingen, 2023). The protein content in wheat typically ranges from 9% to 18% of the grain's weight (Shewry et al., 2009). Wheat proteins are categorized into gluten and non-gluten proteins. The non-gluten types-albumins (water-soluble) and globulins (soluble in saline solutions)-mainly contribute to structural and



metabolic functions and have a limited role in determining baking quality (Guerrieri et al., 2018). In terms of nutritional composition, einkorn wheat contains 15.5–22.8% protein and 23.8% amylose, while modern wheat varieties have 12.9, 19.9% protein and 28.4% amylose (Arzani et al., 2017). Wheat is a valuable source of complex carbohydrates, with its starchy endosperm-making up around 80% of the grain-serving as the main storage component. Unlike simple sugars, complex carbohydrates are preferred due to their slower energy release, providing a steady supply of energy aligned with the body's requirements (Cauvain, 2012). Additionally, diets high in complex carbohydrates are associated with reduced health risks, and wheat starch, offering approximately 1550kg per 100 grams, is considered an efficient nutritional energy source (Guragain et al., 2014). Among wheat types, durum (71%) and common wheat (75%) generally have slightly higher carbohydrate levels compared to ancient varieties, such as spelt (68%) and einkorn (67%) (Boukid, 2018). Wheat grains also contain lipids, comprising about 2.5–3.3% of the grain's weight, with 35–45% of these lipids located in the endosperm. These lipids include a range of compounds like phospholipids, fatty acids, and acylglycerols (Finnie et al., 2009). Wheat cultivation in India is predominantly concentrated in the northern states. According to the Second Advance Estimates for the agricultural year 2022–23, national wheat production is projected at 112.18 mt. Uttar Pradesh leads in cultivation area, followed by Madhya Pradesh, Punjab, Rajasthan, and Haryana (PIB Delhi, 2023). In Uttar Pradesh, wheat is cultivated over an area of 9.21 mha, yielding an average productivity of 2.7 t ha<sup>-1</sup> and a total production of 24.51 mt (Anonymous, 2020). This research work had been planned with the objectives to analyze the morphological characters among different wheat genotypes for yield and quality traits, to assess genetic variability, heritability, and genetic advance among wheat, and to estimate the correlation among yield and its component traits.

## 2. Materials and Methods

The experiment was conducted during the month of November, 2024 to February, 2025 at the Agricultural Research Farm of Prof. Rajendra Singh (Rajju Bhaiya) University, Naini, Prayagraj, Uttar Pradesh. The present investigation, entitled "Assessment of Genetic Parameters for Growth, Yield, and Morphological Characteristics in Wheat (*Triticum aestivum* L.)" was carried out with 13 wheat genotypes, viz., HUW-8038, HUW-669, HD-3086, HUW-234, BBW-303, DBW-168, DBW-39, HPW-373, HUW-510, OPATA, RAJMARI, M-6, SONALIKA, in irrigated (*Rabi*) conditions. The plants were grown in 2×2 m<sup>2</sup> plot with 22.5×10 cm<sup>2</sup> (R×P), a randomized block design (RBD) with three replications. The data was recorded on various traits viz., DAS to 50% flowering, Plant height 30, 60, 90, 120 DAS (cm), DAS to maturity, Spike length (cm), Length of flag leaf (cm), Number of spikelets, Length of peduncle (cm), Number of tillers per, Number of grains spike<sup>-1</sup>, Biological yield

(kg), 1000 seed weight (g), Seed yield plant<sup>-1</sup> (g), Seed yield plot<sup>-1</sup> (kg), Harvest index (%) and morphological characters were visually observed on various traits viz., foliage colour, flag leaf anthocyanin colouration of auricles, ear time of emergence, plant length, ear shape in profile, ear density, grain colour, grain shape, grain germ width. The average values for each trait across three replications were calculated for every genotype and subjected to statistical analysis through analysis of variance (ANOVA), and morphological characters were estimated following the method proposed by PPV and FR DUS guideline.

## 3. Results and Discussion

Analysis of variance showed significant differences among the 13 genotypes, including the check variety, for the 17 characters studied. Analysis of variance showed significant differences among the genotypes at 1% and 5% levels of significance. Mean sum squares are given in Table 1 for different characters. A mean performance of 13 wheat genotypes is given in Table 2. The plant height 30 DAS (cm) ranged from 28.55 cm to 32.58 cm with a mean of 31.10 cm. The maximum plant height 30 DAS (cm) was statistically recorded in RAJMARI (32.58 cm). Whereas, the minimum plant height 30 DAS (cm) was statistically recorded in HUW-669 (28.55 cm). Plant height 60 DAS (cm) ranged from 49.20 cm to 82.47 cm with a mean of 66.71 cm. The maximum plant height 60 DAS (cm) was statistically recorded in HUW-234 (82.47 cm). Whereas, the minimum plant height 60 DAS (cm) was statistically recorded in DBW-39 (49.20 cm). The plant height 90 DAS (cm) ranged from 84.13 cm to 99.03 cm with a mean of 91.24 cm. The maximum plant height 90 DAS (cm) was statistically recorded in HPW-373 (99.03 cm). Whereas, the minimum plant height 90 DAS (cm) was statistically recorded in DBW-39 (84.13 cm). Plant height 120 DAS (cm) ranged from 89.00 cm to 100.60 cm with a mean of 95.37 cm. The maximum plant height 120 DAS (cm) was statistically recorded in HUW-234 (100.60 cm). Whereas, the minimum plant height 120 DAS (cm) was statistically recorded in Phool Bahar (89.00 cm). The number of tillers plant<sup>-1</sup> ranged from 2.67 to 4.60 with a mean of 3.79. The minimum number of tillers plants<sup>-1</sup> was observed in HD-3086 (2.67). Whereas the maximum number of tillers plants<sup>-1</sup> was observed in M-6 (4.60). Length of flag leaf (cm) ranged from 20.03 cm to 29.30 cm with a mean of 23.63 cm. The minimum length of the flag leaf (cm) was recorded in BBW-303 (20.03 cm). Whereas the maximum length of the flag leaf (cm) was recorded in DBW-168 (29.30 cm). Spike length (cm) ranged from 8.33 cm to 11.60 cm with a mean of 10.25 cm. The minimum spike length (cm) was observed in HUW-510 (8.33 cm). Whereas the maximum spike length (cm) was observed in HUW-669 (11.60 cm). Length of peduncle (cm) ranged from 12.43 cm to 21.80 cm with a mean of 17.86 cm. The minimum length of the peduncle (cm) was observed in DBW-39 (12.43 cm). Whereas the maximum length of the peduncle (cm) was observed in M-6 (21.80 cm). The DAS to 50% flowering ranged from 65.67 days to 81.67 days with a mean of 74.46



Table 1: Analysis of variance for 17 characters of Wheat genotypes

| Characters                           | mean sum of squares |             |          |
|--------------------------------------|---------------------|-------------|----------|
|                                      | Replications        | Genotypes   | Error    |
|                                      | (d.f=2)             | (d.f=12)    | (d.f=24) |
| Plant height 30 DAS (cm)             | 7.853               | 4.328*      | 1.152    |
| Plant height 60 DAS (cm)             | 53.760              | 300.492**   | 37.929   |
| Plant height 90 DAS (cm)             | 62.31               | 63.51*      | 15.28    |
| Plant height 120 DAS (cm)            | 0.359               | 58.563**    | 3.275    |
| No. of tiller plant <sup>-1</sup>    | 2.863               | 0.712*      | 0.194    |
| Length of flag leaf (cm)             | 16.399              | 26.333**    | 4.203    |
| Spike length (cm)                    | 0.979               | 2.131*      | 0.552    |
| Length of peduncle (cm)              | 8.409               | 30.661**    | 2.956    |
| DAS to 50% flowering                 | 7.154               | 86.419**    | 27.765   |
| DAS to maturity                      | 13.641              | 50.231**    | 2.474    |
| No. of spikeletss                    | 0.557               | 13.14*      | 0.49     |
| Number of grains spike <sup>-1</sup> | 0.173               | 199.925**   | 3.988    |
| Seed yield plant <sup>-1</sup> (g)   | 0.041               | 0.458*      | 0.034    |
| 1000-grains weight (g)               | 4.49                | 18.84**     | 2.10     |
| Biological yield (kg)                | 0.0944              | 0.135*      | 0.028    |
| Harvest index (%)                    | 1.9078              | 4.7442**    | 0.7039   |
| Grain Yield plot <sup>-1</sup> (g)   | 11622.641           | 43913.470** | 2760.419 |

\*Significant at ( $p=0.05$ ) level of probability, \*\* Significant at ( $p=0.01$ ) level of probability

days. The late DAS to 50% flowering was statistically recorded in M-6 (81.67 days). Whereas, the early DAS to 50% flowering was statistically recorded in HUW-234 (65.67 days). DAS to maturity ranged from 105.67 days to 120.67 days with a mean of 112.59 days. The late DAS to maturity was statistically recorded in M-6 (120.67 days). Whereas, the early DAS to maturity was statistically recorded in HUW-234 and OPATA (105.67 days). The number of spikelets ranged from 14.80 to 21.4 with a mean of 19.03. The minimum number of spikelets was observed in HUW-510 (14.80). Whereas, the maximum number of spikelets was observed in HD-3086 (21.40). Number of grains spikes<sup>-1</sup> ranged from 40.40 to 71.93 with a mean of 51.61. The minimum number of grains spikes<sup>-1</sup> was observed

in DBW-39 (40.40). Whereas, the maximum number of grains spikes<sup>-1</sup> was observed in BBW-303 (71.93). Seed yield plant<sup>-1</sup> (g) ranged from 2.20 g to 3.63 g with a mean of 2.88 g. The minimum seed yield plant<sup>-1</sup> (g) was recorded in HUW-8038 (2.20g). Whereas, the maximum seed yield plant<sup>-1</sup> (g) was recorded in BBW-303 (3.63 g). 1000-grain weight (g) ranged from 44.33g to 52.33 g with a mean of 47.59 g. The minimum 1000-grain weight (g) was recorded in HD-3086 (44.33 g). Whereas, the maximum 1000-grain weight (g) was recorded in HPW-373 (52.33 g). Biological yield (kg) ranged from 1.17 (kg) to 1.98 (kg) with a mean of 1.77 (kg). The minimum biological yield (kg) was recorded in SONALIKA (1.17 kg). Whereas, the maximum biological yield (kg) was recorded in DBW-168 (1.98 kg). Harvest index (%) ranged from 52.53% to 56.58% with a mean of 54.78%. The minimum harvest index (%) was observed in OPATA (52.53%). Whereas the maximum harvest index (%) was observed in HUW-669 (56.58%). Grain yield plot<sup>-1</sup> (g) ranged from 620.00 (g) to 1078.67 (g) with a mean of 931.97 (g). The minimum grain yield plot<sup>-1</sup> (g) was recorded in SONALIKA (620.00 g). Whereas the maximum grain yield plot<sup>-1</sup> (g) was recorded in DBW-39 (1078.67 g). Ranjana et al. (2013), Naheed et al. (2016), Poudel et al. (2017), Elahi et al. (2020), and Poonia et al. (2023) also recorded highly significant differences among the wheat genotypes for most of the characters under their studies.

The perusal of Table 3 and Figure 1 revealed that the highest phenotypic coefficient of variance (PCV) was exhibited by grain yield/plot (g) (22.95%), followed by length of peduncle (cm) (19.55%). Similar findings were also observed by Devesh et al. (2018) and Singh et al. (2024). The perusal of Table 3 and Figure 1 revealed that the highest genotypic coefficient of variance (GCV) was exhibited by grain yield plot<sup>-1</sup> (g) (22.25 %) followed by length of peduncle (cm) (17.02%). Similar findings were also observed by Poudel et al. (2017), Elahi et al. (2020) and Poonia et al. (2023). The estimation of heritability in the broad sense and genetic advance was estimated and laid out

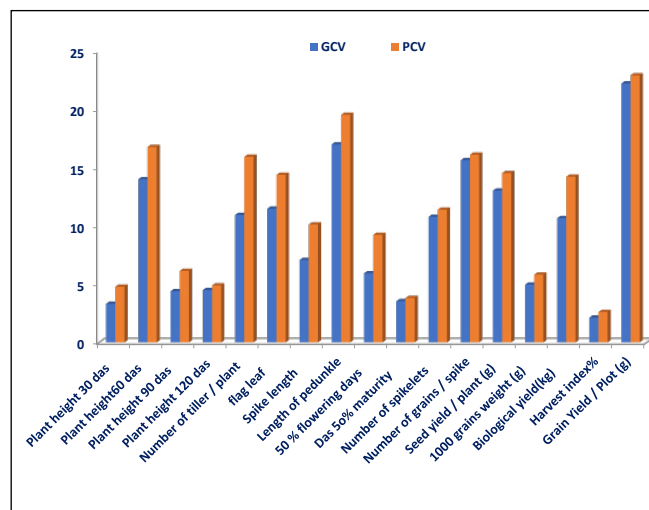


Figure 1: Genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV)



Table 2: Evaluation of 13 wheat genotypes

| Genotypes | Plant height<br>30 days | Plant height<br>60 days | Plant height<br>90 days | Plant height<br>120 days             | No. of tiller<br>plant <sup>-1</sup> (cm) | flag leaf<br>(cm)         | Spike<br>length (cm)     | Length of<br>peduncle (cm) |                                       |
|-----------|-------------------------|-------------------------|-------------------------|--------------------------------------|-------------------------------------------|---------------------------|--------------------------|----------------------------|---------------------------------------|
| HUW-8038  | 31.90                   | 68.15                   | 91.27                   | 93.47                                | 4.20                                      | 20.13                     | 10.53                    | 16.13                      |                                       |
| HUW-669   | 28.55                   | 55.60                   | 95.93                   | 91.27                                | 4.00                                      | 21.77                     | 11.60                    | 13.67                      |                                       |
| HD-3086   | 31.00                   | 69.17                   | 90.37                   | 96.80                                | 2.67                                      | 22.84                     | 9.73                     | 15.97                      |                                       |
| HUW-234   | 32.00                   | 82.47                   | 98.00                   | 100.60                               | 3.73                                      | 21.19                     | 9.80                     | 19.87                      |                                       |
| BBW-303   | 30.93                   | 72.80                   | 93.87                   | 99.23                                | 4.13                                      | 20.03                     | 10.77                    | 16.63                      |                                       |
| DBW-168   | 30.60                   | 67.67                   | 93.73                   | 99.27                                | 3.73                                      | 29.30                     | 9.70                     | 14.17                      |                                       |
| DBW-39    | 31.40                   | 49.20                   | 84.13                   | 96.60                                | 3.80                                      | 21.43                     | 10.10                    | 12.43                      |                                       |
| HPW-373   | 31.87                   | 70.65                   | 99.03                   | 99.73                                | 3.40                                      | 28.50                     | 11.03                    | 19.20                      |                                       |
| HUW-510   | 31.07                   | 72.43                   | 87.93                   | 86.00                                | 3.27                                      | 22.83                     | 8.33                     | 20.07                      |                                       |
| OPATA     | 31.17                   | 64.63                   | 89.30                   | 90.60                                | 3.80                                      | 24.72                     | 10.20                    | 21.50                      |                                       |
| RAJMARI   | 32.58                   | 63.13                   | 87.63                   | 96.20                                | 4.20                                      | 23.55                     | 10.07                    | 21.33                      |                                       |
| M-6       | 28.93                   | 51.33                   | 85.93                   | 98.33                                | 4.60                                      | 26.15                     | 11.33                    | 21.80                      |                                       |
| SONALIKA  | 32.33                   | 79.97                   | 88.93                   | 91.67                                | 3.80                                      | 24.73                     | 10.00                    | 19.40                      |                                       |
| A mean    | 31.10                   | 66.71                   | 91.24                   | 95.37                                | 3.79                                      | 23.63                     | 10.25                    | 17.86                      |                                       |
| SE        | 0.88                    | 5.03                    | 3.19                    | 1.48                                 | 0.36                                      | 1.67                      | 0.61                     | 1.40                       |                                       |
| CD5%      | 1.81                    | 10.38                   | 6.59                    | 3.05                                 | 0.74                                      | 3.45                      | 1.25                     | 2.90                       |                                       |
| CV        | 3.45                    | 9.23                    | 4.28                    | 1.90                                 | 11.60                                     | 8.68                      | 7.25                     | 9.63                       |                                       |
| Max       | 32.58                   | 82.47                   | 99.03                   | 100.60                               | 4.60                                      | 29.30                     | 11.60                    | 21.80                      |                                       |
| Min       | 28.55                   | 49.20                   | 84.13                   | 86.00                                | 2.67                                      | 20.03                     | 8.33                     | 12.43                      |                                       |
| Genotypes | 50% flow-<br>ering DAS  | DAS 50%<br>maturity     | No. of<br>spikelets     | No. of grains<br>spike <sup>-1</sup> | Seed yield<br>plant <sup>-1</sup> (g)     | 1000-grains<br>weight (g) | Biological<br>yield (kg) | Harvest<br>index %         | Grain Yield<br>plot <sup>-1</sup> (g) |
| HUW-8038  | 74.00                   | 115.67                  | 20.20                   | 59.27                                | 2.20                                      | 45.67                     | 1.63                     | 56.13                      | 863.00                                |
| HUW-669   | 76.67                   | 115.00                  | 20.27                   | 52.40                                | 2.29                                      | 46.00                     | 1.75                     | 56.58                      | 938.00                                |
| HD-3086   | 73.67                   | 111.33                  | 21.40                   | 57.13                                | 3.24                                      | 44.33                     | 1.81                     | 54.57                      | 946.00                                |
| HUW-234   | 65.67                   | 105.67                  | 17.87                   | 51.53                                | 2.77                                      | 46.00                     | 1.86                     | 54.25                      | 980.00                                |
| BBW-303   | 72.67                   | 113.00                  | 20.20                   | 71.93                                | 3.63                                      | 45.67                     | 1.71                     | 54.69                      | 1010.00                               |
| DBW-168   | 79.67                   | 114.33                  | 18.27                   | 43.80                                | 3.21                                      | 48.33                     | 1.98                     | 55.82                      | 894.00                                |
| DBW-39    | 79.67                   | 115.33                  | 17.27                   | 40.40                                | 2.89                                      | 50.33                     | 1.93                     | 53.74                      | 1078.67                               |
| HPW-373   | 80.00                   | 113.67                  | 20.00                   | 55.27                                | 2.80                                      | 52.33                     | 1.88                     | 52.66                      | 806.67                                |
| HUW-510   | 68.00                   | 109.67                  | 14.80                   | 46.20                                | 2.80                                      | 49.00                     | 1.93                     | 54.69                      | 1076.67                               |
| OPATA     | 72.33                   | 105.67                  | 19.40                   | 49.67                                | 2.53                                      | 51.00                     | 1.89                     | 52.53                      | 992.00                                |
| RAJMARI   | 77.67                   | 111.00                  | 20.61                   | 51.33                                | 3.00                                      | 48.33                     | 1.80                     | 55.51                      | 973.33                                |
| M-6       | 81.67                   | 120.67                  | 15.73                   | 46.13                                | 3.00                                      | 46.67                     | 1.65                     | 55.86                      | 937.33                                |
| SONALIKA  | 66.33                   | 112.67                  | 21.33                   | 45.80                                | 3.08                                      | 45.00                     | 1.17                     | 55.17                      | 620.00                                |
| A mean    | 74.46                   | 112.59                  | 19.03                   | 51.61                                | 2.88                                      | 47.59                     | 1.77                     | 54.78                      | 931.97                                |
| SE        | 4.30                    | 1.28                    | 0.57                    | 1.63                                 | 0.15                                      | 1.18                      | 0.14                     | 0.69                       | 42.90                                 |
| CD5%      | 8.88                    | 2.65                    | 1.18                    | 3.37                                 | 0.31                                      | 2.44                      | 0.28                     | 1.41                       | 88.54                                 |
| CV        | 7.08                    | 1.40                    | 3.68                    | 3.87                                 | 6.41                                      | 3.04                      | 9.43                     | 1.53                       | 5.64                                  |
| Max       | 81.67                   | 120.67                  | 21.40                   | 71.93                                | 3.63                                      | 52.33                     | 1.98                     | 56.58                      | 1078.67                               |
| Min       | 65.67                   | 105.67                  | 14.80                   | 40.40                                | 2.20                                      | 44.33                     | 1.17                     | 52.53                      | 620.00                                |



in Table 3 and Figure 2. The value of heritability in broad sense were observed high for the character number of grains spike<sup>-1</sup> (94.25%), grain yield plot<sup>-1</sup> (g) (93.97%), number of spikelets (89.60%), DAS to maturity (86.55%), plant height 120 DAS (cm) (84.91%) and seed yield plant<sup>-1</sup> (g) (80.57%). Genetic advance in percent of the mean, 5% for the studied characters, was recorded from high to low magnitude. High genetic advance is recorded for character grain yield plot<sup>-1</sup> (g) (44.43%), number of grains spike<sup>-1</sup> (31.32%), and length of peduncle (cm) (30.51%). Similar findings were also observed by Anuj et al. (2017), Malbhage et al. (2020), and Zewdu et al. (2024).

Foliage colour was visually observed at the stage of flag leaf sheath extending, which is pale green in HUW-669, HUW-510, M-6, and green in HUW-8038, HUW-234, BBW-303, DBW-168, OPATA, Sonalika, and dark green in HD-3086, DBW-39, HPW-373, Rajmari. Flag leaf anthocyanin colouration of auricles was visually observed at the stage of the first spikelets of inflorescence, just visible is absent in HUW-8038, HUW-669, HD-3086, HUW-234, BBW-303, DBW-168, DBW-39, HPW-373, HUW-510, OPATA, Rajmari, M-6, Sonalika. Similar findings were also observed by Rani et al. (2024) (Figure 3).

Ear time of emergence was visually observed at the stage of the first spikelets of inflorescence, just visible is early in Sonalika, HUW-234, HUW-510, and medium in HUW-8038, HUW-669, HD-3086, BBW-303, OPATA, Rajmari, Sonalika, and late in DBW-168, DBW-39, HPW-373, M-6. Ear shape in profile was visually observed at the stage of caryopsis hardening is tapering in HUW-8038, BBW-303, HPW-373, DBW-168, Rajmari, Sonalika, and parallel-sided in HUW-669, OPATA, M-6

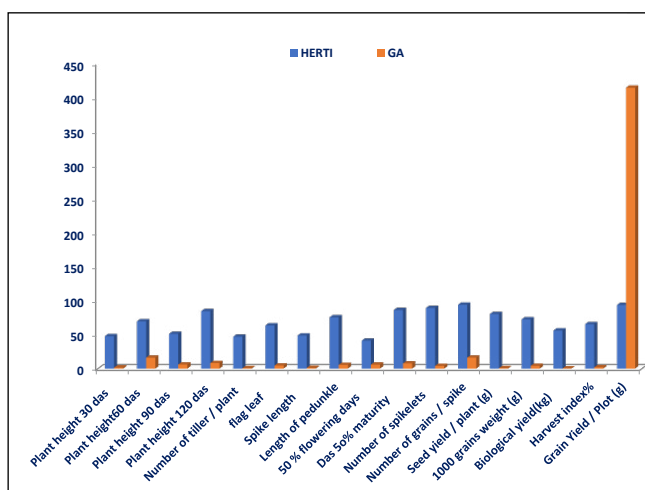


Figure 2: Heritability, genetic advance

and club-shaped in HD-3086, HUW-234, DBW-39, HUW-510. Ear density was visually observed at the stage of hard dough is lax in Sonalika, HUW-510 and medium in HUW-8038, DBW-168, OPATA and dense in HUW-669, HD-3086, HUW-234, DBW-39, BBW-303, HPW-373, Rajmari, and M-6. Similar findings were also observed by Ouaja et al. (2021) (Figure 4).

Grain colour was visually observed at the stage of caryopsis hard is white in OPATA, Sonalika and amber in HUW-8038, HD-3086, HUW-234, DBW-39, HUW-510, M-6, BBW-303, and red in HUW-669, HPW-373, and Rajmari. Grain shape was visually observed at the stage of caryopsis hard is ovate in BBW-303, DBW-168 and oblong in HUW-8038, HUW-669, HD-3086,

Table 3: Estimation of components of variance and genetic parameters for different quantitative characters in Wheat

| Genotypes                                 | Vg        | Vp        | GCV (%) | PCV (%) | HERTI (%) | GA (%) | GA AS (%) |
|-------------------------------------------|-----------|-----------|---------|---------|-----------|--------|-----------|
| Plant height 30 DAS                       | 1.06      | 2.21      | 3.31    | 4.78    | 47.88     | 1.47   | 4.72      |
| Plant height 60 DAS                       | 87.52     | 125.45    | 14.02   | 16.79   | 69.77     | 16.10  | 24.13     |
| Plant height 90 DAS                       | 16.08     | 31.36     | 4.39    | 6.14    | 51.27     | 5.91   | 6.48      |
| Plant height 120 DAS                      | 18.43     | 21.70     | 4.50    | 4.89    | 84.91     | 8.15   | 8.54      |
| Number of tiller plant <sup>-1</sup> (cm) | 0.17      | 0.37      | 10.95   | 15.95   | 47.15     | 0.59   | 15.50     |
| flag leaf (cm)                            | 7.38      | 11.58     | 11.49   | 14.40   | 63.71     | 4.47   | 18.90     |
| Spike length (cm)                         | 0.53      | 1.08      | 7.08    | 10.13   | 48.81     | 1.04   | 10.19     |
| Length of peduncle (cm)                   | 9.24      | 12.19     | 17.02   | 19.55   | 75.75     | 5.45   | 30.51     |
| 50 % flowering DAS                        | 19.55     | 47.32     | 5.94    | 9.24    | 41.32     | 5.86   | 7.86      |
| DAS 50% maturity                          | 15.92     | 18.39     | 3.54    | 3.81    | 86.55     | 7.65   | 6.79      |
| Number of spikeletss                      | 4.22      | 4.71      | 10.79   | 11.40   | 89.60     | 4.00   | 21.05     |
| Number of grains spike <sup>-1</sup>      | 65.31     | 69.30     | 15.66   | 16.13   | 94.25     | 16.16  | 31.32     |
| Seed yield plant <sup>-1</sup> (g)        | 0.14      | 0.18      | 13.05   | 14.54   | 80.57     | 0.70   | 24.13     |
| 1000-grains weight (g)                    | 5.58      | 7.68      | 4.96    | 5.82    | 72.68     | 4.15   | 8.72      |
| Biological yield (kg)                     | 0.0356    | 0.0635    | 10.68   | 14.24   | 56.18     | 0.29   | 16.48     |
| Harvest index %                           | 1.3468    | 2.0506    | 2.12    | 2.61    | 65.68     | 1.94   | 3.54      |
| Grain Yield plot <sup>-1</sup> (g)        | 42993.330 | 45753.749 | 22.25   | 22.95   | 93.97     | 414.05 | 44.43     |





Figure 3: Identification of foliage colour in HUW-8038, HUW-669, HD-3086, HUW-234, BBW-303, DBW-168, DBW-39, HPW-373, HUW-510, OPATA, Rajmari, M-6, Sonalika



Figure 4: Identification of Ear time of emergence, Ear shape in profile, Ear density in HUW-8038, HUW-669, HD-3086, HUW-234, BBW-303, DBW-168, DBW-39, HPW-373, HUW-510, OPATA, Rajmari, M-6, Sonalika

HUW-234, DBW-39, HPW-373, HUW-510, OPATA, Rajmari, M-6, and Sonalika. Grain germ width was visually observed at the stage of caryopsis hard is narrow HUW-669, HUW-234, BBW-303, HPW-373 and medium in HUW-8038, HD-3086, DBW-168, DBW-39, HUW-510, M-6, Rajmari, OPATA, Sonalika. Similar findings were also observed by Ouaja et al. (2021). Plant length was measured at the stage of caryopsis hard is long in HUW-510 and very long in HUW-8038, HUW-669, HD-3086, HUW-234, BBW-303, DBW-168, DBW-39, HPW-373, OPATA, Rajmari, M-6, and Sonalika. Similar findings were also observed by Sabhagnia et al. (2014) and Chauhan et al. (2023).

#### 4. Conclusion

The study concluded that the highest Genotypic Coefficient

of Variation and Phenotypic Coefficient of Variation were recorded for grain yield plot<sup>-1</sup> (g), with values of 22.25% and 22.95% respectively. The highest broad-sense heritability was observed for the number of grains spike<sup>-1</sup> (98.91%). Furthermore, the highest genetic advance in percent of the mean 5% was noted for grain yield plot<sup>-1</sup> (g) (44.43%). Based on superior performance in Seed yield plant<sup>-1</sup> (g) and Number of spikelets, the varieties BBW-303 and HD-3086 are recommended for cultivation by farmers.

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