Original Research Article

STABILITY ANALYSIS FOR YIELD AND PHYSIOLOGICAL TRAITS IN BREAD WHEAT (*Triticum aestivum* L. em.Thell.)

ABSTRACT

The present investigation was carried out with 32 diverse genotypes of bread wheat in completely randomized block design with 3 replications at Norman E. Borlaug Crop Research Centre, G.B. Pant University of agriculture & Technology Pantnagar for the screening of genetic variability under three environments viz., timely sown (E1), late sown (E2) and very late sown (E3) conditions.The observations were recorded on 16 agronomic traits and 3 physiological traits. The statistical analysis was performed to analyze stability for different yield and physiological traits using Eberhart and Russell model. Genotypic performance varied substantially over different sowing conditions. Stability analysis revealed that the maximum number of stable genotypes were observed in grain weight per spike followed by number of tillers per plant, number of spikelets per spike, biological yield per plant, CTD-II, SPAD value, CTD-I, 1000-grains weight, relative water content, days to 75% heading, spike length, harvest index while no stable genotypes were observed for days to 75% anthesis, days to maturity and plot yield. The genotypes bearing the desired values of mean performance, stability parameters can be exploited in future breeding programme for developing stable varieties for yield related and physiological traits under different sowing conditions in wheat crop. These genotypes can be used as donor parents in crop improvement programme.

Keyword: Bread Wheat, Stability, 1000-grains weight, CTD, and Harvest Index.

1. Introduction: Wheat is a crucial staple food crop that nourishes around 40% of the global population, supplying 20% of the total food calories and protein in human nutrition **(Gupta et al., 2008).** Wheat is a significant crop in India, both in terms of the amount of land it occupies and its ability to be grown in various agricultural and meteorological conditions. Wheat plays a significant role in India's food security system, covering an area of around 31.13 million hectares and yielding 109.60 million tonnes of wheat with productivity rate of 3100 kg/ha **(USDA 2023).** According to the state-wise data, Uttar Pradesh has the largest acreage and output of wheat, followed by Punjab and Madhya Pradesh. The genotype and its interaction with the existing environment are the primary factors that determine the ultimate yield. The interaction between genotype and environment is especially significant in the manifestation of quantitative traits, which are governed by polygenic systems and are heavily influenced by environmental factors. Therefore, in order to obtain impartial estimates of distinct genetic factors, it is crucial to replicate the experiment across numerous contexts. The genotype, environment, and interaction of genotype and environment determine crop production, which is of primary interest to plant breeders. The outcome of the genotype x environment interaction is manifested as the adaptability and stability of the genotype. When there is an interaction between genotype and environment, the ranking of genotypes will vary across different settings. Hence, the stability of productivity holds great significance. Therefore, it is usually preferable to analyze the stability of hybrids with regards to economically significant traits. The estimations of genotype x environment interactions provide insight into the stability or buffering capacity of the populations being studied. The current study was designed to assess the interaction between genotype and environment and to determine stability parameters for grain yield and its components in bread wheat. A genotype with consistent performance is highly desirable for its capacity to adapt to a wide range of conditions. Lately, there has been a concentrated interest in regression analysis. The regression method was initially introduced by **Yates and Cochran in 1938**, and later refined by **Finlay and Wilkinson in 1963** to analyze how different environments affect the adaptation of different varieties. The addition of an additional parameter, specifically the deviation from regression by **Eberhart and Russell (1966)**, resulted in a minor improvement in the regression technique. They argue that when evaluating the phenotypic stability of a genotype, both linear (bi) and non-linear (S2di) functions should be taken into account. **Eberhart and Russell (1966)** provided a definition of a stable genotype as one that exhibits a high average yield, a regression coefficient (bi) close to one, and a deviation from regression (S^2di) close to zero. Subsequently, **Breese (1969)** and **Paroda and Hayes (1971)** proposed that linear regression (bi) should be seen solely as an indicator of the response of a specific genotype, while the deviation from regression (S2di) should be seen as a measure of stability. **Mehra and Ramanujan (1979)** and **Singh and Singh (1980)** proposed a mechanism for categorizing various genotypes into distinct groups. Breeding for genotypes with a high yield potential is always justified due to instances where the yield potential may not be fully realized. Thus, it is imperative to prioritize the enhancement of yield stability **(Ceccarelli, 1989)**. Genetic control determines the stability of traits, as stated by **Bradshaw (1965) and Scott (1967)**. Consequently, it is possible to selectively breed for stability. The stability of yield may rely on the stability of several yield components. Therefore, it is crucial to have knowledge regarding the relative stability of various yield components in order to comprehend the many mechanisms that contribute to yield stability. Genotype stability is a very valued characteristic for its broad adaptability.

2. Materials and Methods: The initial research related to screening was carried out in the experimentalarea of N.E. Borlaug Crop Research Centre (NEBCRC), G.B. Pant University of Agriculture andTechnology. Pantnagar, District U.S. Nagar, Uttarakhand during *rabi*, 2014-15. The experimental material consists of 32 genotypes**(Table 1)** of bread wheat including 3 checks, namely, HD-2967, PBW-343 and C-306. The experiment was laid out in randomized complete block design (RBD) with three replications under three sowing conditions viz., timely sown (E1), late sown (E2) and very late sown condition (E3) on 15 November, 2014, 15 December, 2014, 15 January, 2015 respectively. All the thirty two genotypes were evaluated during r*abi* 2014-15. Each entry was planted in 5 meter long four rows plot. The rows were spaced 20 cm apart.All the recommended package of practices for wheat was followed to raise a healthy crop.All the yield attributing and physiological observations on most of the characters were recorded on single plant basis except for days to 75 per cent heading, maturity and canopy temperature depression (CTD). Five representative plants from each plot were randomly selected and tagged for recording the observations on single plant basis.

Table 1: List of genotypes/varieties.

Sl. No.	**Genotype**	**Sl. No.**	**Genotype**	**Sl. No.**	**Genotype**	**Sl. No.**	**Genotype**
1.	PBN-51	**9.**	IC-532653	**17.**	HI-1563	**25.**	SONORA-64
2.	BWL-1793	**10.**	DHARWAR DRY	**18.**	HD-2864	**26.**	BACANORA-88
3.	BWL-0814	**11.**	GIZA-155	**19.**	RAJ-3765	**27.**	SALEMBO
4.	HD-2967 (check)	**12.**	ARIANA-66	**20.**	RAJ-4083	**28.**	CHIRYA-3
5.	BWL-1771	**13.**	PBW-343 (check)	**21.**	DBW-14	**29.**	BWL-9022
6.	BWL-0924	**14.**	BABAX	**22.**	WH-730	**30.**	CUS/79/PRULLA
7.	C-306 (check)	**15.**	IEPACA RABE	**23.**	RAJ-4037	**31.**	K-9465
8.	IC-11873	**16.**	OTHERY EGYPT	**24.**	SERI-82	**32.**	TEPOKO

Average datafrom selected plants in respect of different character were used for statistical analysis. The observations were recorded for the sixteen yield attributing traits like days to 75% heading, days to 75% anthesis, days to 75% maturity, plant height, peduncle length, number of tillers per plant, grain filling duration, spike length, number of spikelets per spike, number of grains per spike, grain weight per spike, 1000 grain weight, biological yield per plant, grain yield per plot, harvest index and three physiological traits, canopy temperature depression (CTD), relative water content percent (RWC%) and chlorophyll content (SPAD value) of leaf. Canopy temperature was recorded 4 times at the interval of 10 days at different growth stages of the crop from the start of flowering (GS61) to early dough stage (GS 83 as per **Zodoks*et al*., 1974**) and it was mentioned as canopy temperature -I (CT–I), canopy temperature-II (CT-II), canopy temperature-III (CT-III) and canopy temperature-IV (CT-IV), and difference between canopy temperature and ambient temperature was calculated and it was designated as canopy temperature depression (CTD I, II, III and IV).The infrared thermometer was used to measure the canopy temperature. SPAD value was observed at flowering stage by SPAD meter.

Estimation of G x E interaction: The stability parameters were calculated as per the procedure given by **Eberhart and Russell (1966)**. They suggested three parameters mean, regression of individual mean performance on environmental index, and deviation from regressionto categorize the genotypes for their stability. These parameters are in the following model:

$$Y_{ij} = \mu + b_i I_j + \delta_{ij}$$

Where,

Y_{ij} = Mean performance of the i^{th} genotype in the j^{th}environment

g = Number of genotypes

n = Number of environments

μ = Mean performance of i^{th} genotypes over all the environments

b_i = Regression coefficient that measure the response of the i^{th} genotype to varying environments.

I_j = j^{th} environment index

δ_{ij} = Deviation from regression of the i^{th} genotype at the j^{th} environment

Deviation from regression from each genotype was tested using the 'F' test.

3. Result and Discussion:

3.1 Pooled analysis of variance: The pooled analysis of variance (**Table 2)** revealed that mean squares due to genotypes as well as environments were found highly significant for days to 75% heading, days to 75% anthesis, grain filling duration, spike length, number of spikelets per spike, number of grains per spike, grain weight per spike, plot yield and 1000- grains weight when tested against pooled deviation. This indicated significant variations exist among genotypes and environments. G x E interaction was highly significant for days to 75 % anthesis, plant height, grain filling duration, number of grains per spike, grain weight per spike, number of tillers per plant, biological yield per plant, grain yield per plant, plot yield, harvest index, canopy temperature depression-I and II, SPAD value, relative water content and relative water content while significant for 1000- grains weight when tested against pooled deviation.The coincidence of significant genotypic performance with environmental values were observed for days to 75 % anthesis, grain filling duration, number of grains per spike, grain weight per spike, plot yield, 1000-grains weight, and CTD-I as evident by significant G x E (Linear) mean squares when tested against pooled deviation which indicated that performance of genotypes over environments could be predicted reasonably for these traits. The mean sum of squares due to environments (Linear) was also noted significant differences for all the traits except number of tillers per plant and canopy temperature depression-III when tested against pooled error, suggesting that differences between environments were considerable for all the traits except number of tillers per plant and canopy temperature depression-III and it was influenced greatly by environment indicating thereby that large differences between environments created by sowing dates was justified and had linear effects.Mean sum of squares due to pooled deviation were significant for all the traits under study which suggested that prediction of performance of genotypes over environments based on regression analysis for these traits might not be very reliable. The results, in general, are in agreement with those of **Kishor *et al.* (1992)**, **Mishra *et al.* (2000), Sharma *et al.* (2000), Arya *et al.* (2004), Najeeb *et al.* (2004)**, **Yadav and Choudhary (2004), Banerjee*et al.* (2006), Shah et al. (2009), El-Badawy (2012), Ranjana and Kumar (2013) and Pansuriya*et al.* (2014)** reported in wheat for stability analysis.

3.2 Stability analysis: The phenotypic expression of a character is not always same under all the environments and different genotypes may respond differently to any specified environment. This response of genotypes to environmental fluctuations is due to genotypes x environment fluctuations, which is less defined and non-predictable. Thus, study of G x E interactions is essential for the identification of phenotypically stable genotypes, it includes three parameters, mean performance (*Xi*), regression coefficient (bi) and deviation from regression (S^2d_i). A genotype is said to be stable if it had high mean performance above the average of all the genotypes, regression coefficient (bi =1) i.e. does not differ from unity and deviation from regression approaching to zero (S^2d_i =0). Genotypes with bi significant and lesser than unity do not respond favourably to improved environmental conditions and hence could be regarded as specifically adapted to poor environments when their mean performance is more than average. On the other hand, a genotype is said to be specially adapted to favorable environment and below average in stability, when its regression is significantly more than unity (bi>1), higher mean performance and S^2d_i is nearly zero. Such genotypes tend to respond favorably to better environments but perform poor in unfavorable environment.

The mean value of each genotype in three environments and their stability parameters, linear (b_i) and non-linear (S^2d_i) sensitivity coefficients for each character are presented in **Table 3, Table 4, Table 5and Table 6.**

3.2.1 Days to 75 % heading: The linear sensitivity coefficients b_i ranged from 0.577 (Sonora 64) to 1.469 (Ariana 66) for days to 75 % heading. The value of mean ranged from 68.11 (Sonora 64) to 89.89 (Ariana

66) and the value of S^2d_i ranged from -1.079 (Raj 4083, Raj 4037, WH 730) to 38.272 (Arian 66). The linear sensitivity coefficients b_i value was significant for Ariana 66 which was 1.469*.

3.2.2 Days to 75 % anthesis: The linear sensitivity coefficients b_i ranged from 0.796 (HI 1563) to 1.598 (Ariana 66) for days to 75 % anthesis. The value of mean ranged from 74.778 (Sonora 64) to 88 (Ariana 66) and the value of S^2d_i ranged from -1.124 (BWL 0924, PBN 51) to 161.536 (Ariana 66). The linear sensitivity coefficients b_i value was significant for Ariana 66 which was 0.980*.

3.2.3 Days to maturity: The linear sensitivity coefficients b_i ranged from 0.676 (DBW 14) to 1.151 (BWL 9022) for days to maturity. The value of mean ranged from 112 (IC 118737) to 128.778 (Ariana 66) and the value of S^2d_i ranged from -1.447 (Salembo) to 14.958 (Dharwar Dry). The linear sensitivity coefficients b_i value was significant for DBW-14 which was 0.676*, 0.820* for Raj 4037, 0.765* for BABAX, 0.809* for C-306.

3.2.4 Grain filling duration: The linear sensitivity coefficients b_i ranged from -0.423 (DBW 14) to 2.096 (Raj 3765) for grain filling duration. The value of mean ranged from 32 (K 9465) to 41.889 (Othery Egypt) and the value of S^2d_i ranged from -1.423 (HI 1563) to 132.073 (Ariana 66). The linear sensitivity coefficients b_i value was significant for PBN 51 which was 0.699*, 0.695* for BWL 0814, 0.874* for BWL 1771, 0.845* for BWL 9022, 1.114* for BWL 1793, 0.852* for IEPACA RABE, 0.608* for Chirya-3, 1.218* for Dharwar Dry, 0.935* for Raj 3765, 0.955* for HI 1563, 0.606* for HD 2864, 0.732* for DBW 14, 1.977* for WH 730, 1.341* for Raj 4037, 0.917* for Tepoko, 1.144* for Othery Egypt, 1.049* for Seri 82, 0.984* for Salembo, 1.913* for Ariana 66, 0.631* for IC 118737, 0.981* for C-306, 1.101* for PBW 343.

3.2.5 Plant height: The linear sensitivity coefficients b_i ranged from 0.606 (HD 2864) to 1.977 (WH-730) for plant height. The value of mean ranged from 71.733 (Raj 4037) to 111.456 (C 306) and the value of S^2d_i ranged from -2.459 (BWL 9022, BABAX) to 34.637 (PBN 51).

3.2.6 Spike length: The linear sensitivity coefficients b_i ranged from -0.423 (GIZA 155) to 1.758 (IC 118737) for spike length. The value of mean ranged from 8.749 (IC 532653) to 12.09 (CUS/79/PRULLA) and the value of S^2d_i ranged from -0.081 (BWL 1771) to 0.528 (Dharwar Dry). The linear sensitivity coefficients b_i value was significant for Hi 1563 which was 1.687* for HI 1563, 0.159* for Sonora 64, -0.423* for GIZA 155, 1.758* for IC 118737.

3.2.7 Number of spikelets per spike: The linear sensitivity coefficients b_i ranged from -0.426 (Tepoko) to 2.515 (HI 1563) for number of spikelets per spike. The value of mean ranged from 15.548 (Raj 4037) to 21.807 (Ariana 66) and the value of S^2d_i ranged from -0.356 (HD 2967) to 3.782 (Tepoko). The linear sensitivity coefficients b_i value was significant for HI 1563 which was 2.515*, -0.426* for Tepoko, -0.345* for Giza 155, 2.424* for IC 118737.

3.2.8 Number of grains per spike: The linear sensitivity coefficients b_i ranged from -1.047 (Sonora 64) to 2.032 (BWL 1771) for number of grains per spike. The value of mean ranged from 41.944 (C-306) to 61.511 (PBN 51) and the value of S^2d_i ranged from -3.17 (HI 1563) to 47.682 (Tepoko). The linear sensitivity coefficients b_i value was significant for BWL 1771 which was 2.032, 0.160* for DBW 14, -1.047* for Sonora 64.

3.2.9 Grain weight per spike: The linear sensitivity coefficients b_i ranged from 0.147 (Sonora 64) to 1.766 (WH 730) for grain weight per spike. The value of mean ranged from 1.283 (Sonora 64) to 2.218 (Othery Egypt) and the value of S^2d_i ranged from -0.07 (Chiarya-3, WH-730, Sonora 64, PBW-343) to 0.161 (Tepoko). The linear sensitivity coefficients b_i value was significant for CUS/79/PRULLA which was 1.526*, 1.766* for WH 730, 0.147* for Sonora 64, 0.474* for IC 118737.

3.2.10 Number of tillers per plant: The linear sensitivity coefficients b_i ranged from -5.595 (DBW 14) to 7.69 (IC 118737) for number of tillers per plant. The value of mean ranged from 5.333 (WH 730) to 7.167 (CUS/79/PRULLA, Chirya-3) and the value of S^2d_i ranged from -0.076 (BWL 1793) to 2.885 (HD 2864). The linear sensitivity coefficients b_i value was significant for DBW 14 which was -5.595*, and 7.690* for IC 118737.

3.2.11 Biological yield per plant:The linear sensitivity coefficients b_i ranged from -0.185 (Raj 4037) to 2.457 (PBW 343) for biological yield per plant. The value of mean ranged from 12.09 (Sonora 64) to 21.91 (Chirya-3) and the value of S^2d_i ranged from -0.082 (BWL 0814) to 41.935 (BWL 0924).

3.2.12 Grain yield per plant: The linear sensitivity coefficients b_i ranged from 0.137 (Ariana 66) to 2.535 (BABAX) for grain yield per plant. The value of mean ranged from 4.442 (Sonora 64) to 8.333 (Chirya 3) and the value of S^2d_i ranged from -0.057 (BWL 0814) to 9.858 (PBW 343). The linear sensitivity coefficients b_i value was significant for BWL 9022 which was 2.074*, 2.535* for BABAX, 2.059* for Othery Egypt, 2.048* for PBW 343.

3.2.13 Plot yield: The linear sensitivity coefficients b_i ranged from 0.254 (IC 532653) to 1.571 (BWL 1771) for plot yield. The value of mean ranged from 731.556 (Raj 4037) to 2310.44 (Salembo) and the value of S^2d_i ranged from -186.156 (Raj 4083) to 571506.76 (Salembo). The linear sensitivity coefficients b_i value was significant for BWL 1771 which was 1.571*, 1.533* for BWL 0924, 0.254* for IC 532653.

3.2.14 1000-grains weight: The linear sensitivity coefficients b_i ranged from 0.03 (BWL 1771) to 2.023 (C-306) for 1000-grains weight. The value of mean ranged from 26.661 (Sonora 64) to 42.95 (CUS/79/PRULLA) and the value of S^2d_i ranged from -1.252 (BWL 1793) to 28.292 (HD 2864). .

3.2.15 Harvest index: The linear sensitivity coefficients b_i ranged from -1.666 (CUS/79/PRULLA) to 5.144 (BABAX) for harvest index. The value of mean ranged from 29.965 (Ariana 66) to 46.347 (WH 730) and the value of S^2d_i ranged from -2.302 (IEPACA RABE) to 302.688 (HD 2864). .

3.2.16 Canopy temperature depression-I: The linear sensitivity coefficients b_i ranged from -4.535 (Ariana 66) to 5.184 (BWL 0814) for canopy temperature depression-I. The value of mean ranged from 1.8 (Sonora 64) to 5.778 (PBN 51) and the value of S^2d_i ranged from -0.22 (BWL 0814) to 6.0722 (C-306). The linear sensitivity coefficients b_i value was significant for BWL 0814 which was 5.184* and -4.535* for Ariana 66.

3.2.17 Canopy temperature depression-II: The linear sensitivity coefficients b_i ranged from -1.118 (IC 532653) to 2.869(WH 730) for Canopy temperature depression-II. The value of mean ranged from 2.5 (BWL 0814) to 4.478 (Seri 82) and the value of S^2d_i ranged from -0.011(CUS/79/PRULLA) to 2.762 (Ariana 66). The linear sensitivity coefficients b_i value was significant for DBW-14 which was 2.679*, -1.118* for IC 532653, 2.472* for IC 118737.

3.2.18 Canopy temperature depression-III: The linear sensitivity coefficients b_i ranged from -3.694 (Raj 3765) to 8.163 (BWL 0924) for canopy temperature depression-III. The value of mean ranged from 1.122 (PBN 51) to 3.884 (BWL 0924) and the value of S^2d_i ranged from -0.282 (IC 118737) to 8.521 (BWL 0924). The linear sensitivity coefficients b_i value was significant for BWL 0924 which was 8.163*.

3.2.19 Relative water content: The linear sensitivity coefficients b_i ranged from -2.905 (C-306) to 4.309 (Seri 82) for relative water content. The value of mean ranged from 58.062 (PBN 51) to 81.366 (GIZA 155) and the value of S^2d_i ranged from -0.819 (PBW 343) to 566.939 (BWL 0924). The linear sensitivity coefficients b_i value was significant for BABAX which was 0.791* and 3.228* for Seri 82, 1.491* for C-306. .

3.2.20 SPAD value: The linear sensitivity coefficients b_i ranged from -6.264 (K 9465) to 4.34 (BWL 0814) for SPAD value. The value of mean ranged from 35.417 (Dharwar Dry) to 52.722 (K 9465) and the value of S^2d_i ranged from -0.773 (C-306) to 139.359 (Raj 3765). The linear sensitivity coefficients b_i value was significant for BWL 0814 which was 1.809*, -0.658* for Raj 3765, 1.315* for K 9465.

Based on these facts the maximum number of stable genotypes were observed in grain weight per spike (PBN-51, BWL-902, BWL-1793, IEPACA RABE, CHIRYA-3, Raj 3765, K-9465, Tepoko, BABAX, Othery Egypt, and HD-2967) followed by number of tillers per plant (BWL-9022, BWL-1793, CUS/79/PRULLA, Chirya-3, Dharwar Dry, Raj 3765, Raj 4093, Raj 4037, Giza 155, Bacanora-86, and HD-2967), number of spikelets per spike (BWL-1771, BWL-9022, Dharwar Dry, K-9465, BABAX, and Ariana 66), biological yield per plant (BWL-0814, BWL-9022, Chirya-3, Raj 3765, HI 1563, and Raj 4083), CTD-II (BWL-1771, BWL-1793, Tepoko, Babax, Sonora 64, and HD-2967), SPAD value (PBN-51, BWL-9022, DBW-14, WH-730, Othery Egypt, and

Ariana-66), CTD-I (BWL-1771, CUS/79/PRULLA, Dharwar Dry, IC-532653, and Salembo), 1000-grains weight (BWL 1771, IEPACA RABE, WH-730, and C-306), relative water content (DBW-14, K-9465, and Salembo), days to 75% heading (PBN 51 &Dharwar Dry), spike length (BWL 0814 and BWL 9022), harvest index (CUS/789/PRULLA), plant height (Giza 155), number of grains per spike (PBN 51), and grain yield per plant (BWL-0814) while no stable genotypes were observed for days to 75% anthesis, days to maturity and plot yield**(Table 7).**

Some varieties were found stable for more than one traits such as variety PBN-51 was stable for days to 75 % heading, number of grains per spike, grain weight per spike, and SPAD value; BWL-0814 for spike length, biological yield per plant and grain yield per plant; BWL-9022 for number of spikelets per spike, grain weight per spike, number of tillers per plant, biological yield per plant, and SPAD value; BWL-1771 for 1000- grains weight, CTD-I and II; Dharwar Dry for number of spikelets per spike, number of tillers per plant and CTD-I; K-9465 for number of spikelets per spike, grain weight per spike and relative water content; BABAX for number of spikelets per spike, grain weight per spike and relative water content; Ariana-66 for number of spikelets per spike and SPAD value; Raj-3765 for grain weight per spike and number of tillers per plant; HD-2967 for number of tiller per plant, grain weight per spike and CTD-II; IEPACA RABE for grain weight per spike and 1000- grains weight; and CUS/79/PRULLA for number of tillers per plant and harvest index. Stability of these varieties for multiple traits will provide more opportunity to breeder for effective selection of parents in crop improvement programmes.The results, in general, are in agreement with those of **Kishor *et al.* (1992)**, **Mishra *et al.* (2000), Sharma *et al.* (2000), Arya *et al.* (2004), Najeeb *et al.* (2004)**, **Yadav and Choudhary (2004), Banerjee*et al.* (2006), Shah et al. (2009), El-Badawy (2012), Ranjana and Kumar (2013) and Pansuriya*et al.* (2014)** reported in wheat for stability analysis.

4. Summary and Conclusion: Genotypic performance varied substantially over different sowing conditions.The stable genotypes were observed for all yield related attributes and physiological traits under study except for days to 75% anthesis, days to maturity and plot yield. Some varieties such as PBN-51, BWL-0814, BWL-9022, BWL-1771, Dharwar Dry, K-9465, BABAX, Ariana-66, Raj-3765, HD-29, IEPACA RABE and CUS/79/PRULLA were found stable for more than one character.The genotypes bearing the desired values of mean performance and stability parameters can be exploited in future breeding programme for developing stable varieties for yield related and physiological traits under different sowing conditions in wheat crop. These genotypes can be used as donor parents in crop improvement programme.

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Table 2: Pooled analysis of variance for yield, yield attributes and physiological traits.

Source of variation	d.f.	DH	DA	DM	PH	GFD	SL	NSS	NGS	GWS	NTP
Genotype (G)	31	54.711**	24.191**	44.160**	14.322	309.367**	1.798**	5.152**	77.842**	0.189**	0.674
Environment (E)	2	3,265.323**	4,430.939**	6,818.094**	266.515**	4,972.124**	22.469**	23.607**	1,423.155**	8.759**	0.996
GXE	62	4.606	6.340**	4.649	9.189**	19.797**	0.220	0.790	22.250**	0.049**	0.525**
E+(GXE)	64	106.503	144.609	217.569	17.230	174.557	0.916	1.503	66.028	0.321	0.539
E(Linear)	1	6,530.646**	8,861.877**	13,636.188**	533.030**	9,944.247**	44.939**	47.213**	2,846.311**	17.517**	1.993
GXE(Linear)	31	6.956**	6.046	6.382*	8.125	30.801**	0.299*	0.921	32.829**	0.065*	0.534
Pooled deviation	32	2.185**	6.427**	2.825**	9.933**	8.518**	0.137*	0.638**	11.306**	0.031*	0.499**
Pooled error	186	3.222	3.371	4.351	4.279	7.378	0.242	1.069	9.517	0.022	0.229

Continued….

Source of variation	d.f.	BY	GY	PY	TGW	HI	CTD-I	CTD-II	CTD-III	SPAD	RWC
Genotype (G)	31	13.695	3.246	405,539.858**	40.663**	46.331	5.167**	0.837	0.998	83.401	37.508
Environment (E)	2	295.679**	80.962**	17,022,719.347**	250.292**	248.514**	8.303*	23.144**	2.362	544.726**	162.268**
GXE	62	10.005**	1.603**	89,105.382**	5.359*	32.040**	1.721**	1.013**	1.299	77.147**	30.830**
E+(GXE)	64	18.932	4.083	618,280.818**	13.013	38.805	1.927	1.705	1.332	91.759	34.938
E(Linear)	1	591.359**	161.924**	34,045,438.694**	500.583**	497.029**	16.606**	46.287**	4.724	1,089.452**	324.537**
GXE(Linear)	31	9.304	1.827	104,054.531	4.569	36.025	1.811	1.284	0.937	70.196	50.324**
Pooled deviation	32	10.371**	1.336**	71,838.850**	5.956**	27.178**	1.580**	0.719**	1.609**	81.470**	10.982**
Pooled error	186	0.251	0.178	654.017	3.787	6.914	0.067	0.036	0.938	2.547	2.321

*Significant at 5% level**Significant at 1% level

DF-Days to 75%, **DA-**Days to 75% anthesis, **DM-**Days to 75% maturity, **GFD-**Grain filling duration, **PH-**Plant height, **PL-**Peduncle length, **SL-**Spike length, **NSS-**Number of spikelets per spike, **NGS-**Number of grains per spike, **GWS-**Grain weight per spike, **NTP-**Number of tillers per plant, **BY-**Biological yield per plant, **GY-** Grain yield/plot, **TGW-**1000 grain weight, **CTD-C**anopy temperature depression, **RWC-**Relative water content %, **SPAD-** Soil-plant analysis development (chlorophyll content)**, HI-**Harvest index %, **PY-** Plot Yield.

Table 3: Stability parameters for Days to 75 % heading, days to 75 % anthesis, days to 75 % maturity, grain filling duration, and plant height.

SI No.	Genotype	DH			DA			DM			GFD			PH		
		X_i	b_i	S^2d_i	X_i	b_i	S^2d_i	X_i	b_i	S^2d_i	X_i	b_i	S^2d_i	X_i	b_i	S^2d_i
1.	PBN-51	78.889	1.076	-0.275	81.444	0.983	-1.124	116.222	1.131	-0.712	34.778	1.720*	-0.881	83.111	0.699	34.637
2.	BWL-0814	78.111	1.074	-0.952	81.222	1.071	-0.976	117.778	1.146	-1.152	36.556	1.423*	-0.413	89.278	0.695	-1.758
3.	BWL-1771	79.333	1.044	1.046	82.111	0.960	-0.385	118.556	0.909	2.149	36.444	0.659*	6.089	82.878	0.874	0.130
4.	BWL-9022	72.889	1.133	4.719	76.667	1.188	0.655	114.111	1.151	1.755	36.444	1.446*	2.508	86.122	0.845	2.319
5.	BWL-0924	78.111	1.059	-0.486	81.778	0.983	-1.124	116.444	1.010	-1.401	34.667	1.100	-1.359	77.567	1.120	-2.459
6.	BWL-1793	74.556	0.858	-1.030	77.778	0.915	-0.843	115.111	1.056	-1.342	37.333	1.599*	-0.473	79.244	1.114	5.519
7.	CUS/79/PRULLA	78.000	1.189	-1.052	80.444	1.023	-0.888	116.556	1.063	-0.384	36.111	1.204	-1.069	101.978	1.074	5.662
8.	IEPACA RABE	74.222	0.906	-0.657	78.222	0.987	-0.835	115.111	1.087	-0.784	36.889	1.465*	0.662	86.156	0.852	-0.988
9.	CHIRYA-3	77.667	1.172	-1.012	79.778	1.028	-1.018	116.000	1.134	-1.022	36.222	1.537*	-0.268	84.911	0.608	8.158
10.	DHARWAD DRY	83.222	1.076	-0.275	85.444	1.000	-0.982	123.778	0.942	14.958	39.222	0.302*	24.021	101.567	1.218	-1.711
11.	RAJ3765	73.333	0.807	-0.331	79.444	0.860	0.900	115.333	1.107	0.542	35.889	2.096*	-1.394	82.400	0.935	8.774
12.	HI1563	72.667	0.673	1.497	78.889	0.796	-1.003	115.556	1.022	-1.438	36.667	1.929*	-1.423	82.233	0.955	-2.446
13.	HD2864	71.111	0.912	0.509	78.889	1.144	-0.685	112.889	0.882	-1.091	34.000	-0.216*	-0.202	81.078	0.606	1.323
14.	RAJ4083	72.778	0.958	-1.074	77.444	1.061	0.056	113.889	1.113	-1.341	36.444	1.289	0.749	76.911	0.652	-2.431
15.	DBW-14	70.778	0.694	-1.050	77.444	0.819	0.119	116.000	0.676*	12.445	39.667	-0.423*	17.813	75.789	0.732	12.513
16.	WH730	78.444	0.925	-1.073	80.667	0.900	-0.947	115.778	1.024	-1.426	35.111	1.505*	-1.291	89.122	1.977	17.220
17.	K9465	78.000	0.925	-0.986	81.111	0.915	-0.843	113.111	0.892	-0.870	32.000	0.770	0.253	86.344	0.907	32.249
18.	RAJ4037	78.111	0.925	-1.073	82.000	0.889	-0.398	118.778	0.820*	0.538	36.778	0.502*	3.560	71.733	1.341	9.912
19.	TEPOKO	76.444	0.863	1.796	81.556	0.856	4.715	115.444	1.060	-1.219	33.889	1.850*	2.954	91.156	0.917	-2.170
20.	BABAX	79.222	1.106	-1.070	83.000	0.924	5.112	121.778	0.765*	9.051	39.778	-0.315	52.555	88.289	1.147	-2.459
21.	OTHERI RGYPT	78.444	1.105	-0.839	80.889	0.953	-1.074	122.333	0.912	6.129	41.889	0.543*	11.961	87.089	1.144	4.995
22.	IC532653	83.889	1.168	1.516	87.444	1.163	-0.574	125.111	1.074	-0.711	36.667	1.172	-1.414	103.544	0.816	-0.552
23.	SERI82	70.556	0.662	-0.559	77.444	0.966	1.668	113.333	0.980	0.857	36.667	0.626*	2.709	80.000	1.049	20.863
24.	SONORA64	68.111	0.577	-1.039	74.778	0.809	-0.865	112.333	0.948	-0.385	38.222	1.182	-1.282	74.767	1.103	5.087
25.	SALEMBO	79.556	1.060	0.645	82.667	0.980	-0.827	119.333	1.057	-1.447	36.667	1.358*	-1.259	84.367	0.984	2.224
26.	ARIANA66	89.889	1.469*	38.272	88.000	1.598*	161.536	128.778	0.888	4.986	38.222	-0.219*	132.073	106.444	1.913	0.724
27.	GIZA155	77.222	1.060	0.645	80.222	1.054	3.115	118.889	1.077	0.511	38.667	1.142	-0.940	106.333	0.864	0.128
28.	BACANORA88	77.667	1.123	-1.039	80.444	1.045	-0.625	115.444	1.078	-1.303	35.000	1.185	-0.135	75.800	0.911	-1.741
29.	IC118737	76.778	1.092	-0.514	79.889	1.020	0.562	112.000	0.948	-0.385	32.111	0.616*	3.876	87.067	0.631	10.622
30.	C-306	75.222	1.122	-0.946	79.333	1.080	1.894	115.222	0.809*	9.457	36.444	-0.044*	17.727	111.456	0.981	11.712
31.	HD2967	78.000	1.174	-0.753	80.444	1.101	-0.759	115.778	1.119	0.249	35.333	1.155	2.351	89.244	1.236	18.893
32.	PBW343	78.778	1.013	3.001	82.556	0.929	6.137	115.222	1.118	-1.219	32.667	1.840*	4.153	80.300	1.101	-1.062

*Significant at 5% level, **Significant at 1% level

DF-Days to 75%, **DA-**Days to 75% anthesis, **DM-**Days to 75% maturity, **GFD-**Grain filling duration, **PH-**Plant height

Table 4: Stability parameters for spike length, number of spikelets per spike, number of grains per spike, grain weight per spike, number of tillers per plant.

SI No.	Genotype	SL			NSS			NGS			GWS			NTP		
		X_i	b_i	S^2d_i	X_i	b_i	S^2d_i	X_i	b_i	S^2d_i	X_i	b_i	S^2d_i	X_i	b_i	S^2d_i
1.	PBN-51	9.410	0.987	-0.043	17.978	0.671	2.128	61.511	1.709	0.219	2.001	1.359	0.006	6.444	5.693	1.970
2.	BWL-0814	10.176	0.765	-0.038	17.589	1.299	-0.235	50.444	1.407	1.008	1.802	1.314	-0.006	6.500	3.629	0.772
3.	BWL-1771	10.072	1.222	-0.081	19.673	1.652	-0.200	46.111	2.032*	32.759	1.857	1.209	0.035	6.244	3.707	0.084
4.	BWL-9022	10.743	0.722	0.203	19.162	-0.009	0.165	52.311	1.322	-2.056	2.127	1.428	0.013	6.422	-1.069	0.122
5.	BWL-0924	9.349	1.143	-0.051	16.359	1.504	0.028	50.822	0.936	-2.610	1.862	0.766	0.006	5.844	1.669	1.496
6.	BWL-1793	10.463	0.502	-0.030	17.811	0.548	0.215	52.133	0.477	0.812	1.970	0.924	-0.006	7.000	1.131	-0.076
7.	CUS/79/PRULLA	12.092	0.474	-0.073	16.648	0.434	-0.185	48.411	1.058	6.127	2.215	1.526*	0.027	7.167	-0.511	0.156
8.	IEPACA RABE	10.816	1.622	0.194	19.756	1.492	-0.353	49.822	0.692	-3.030	2.086	0.667	0.107	5.800	0.892	0.223
9.	CHIRYA-3	8.943	1.620	-0.025	18.000	2.015	-0.350	55.533	1.418	1.424	2.209	1.404	-0.007	7.167	3.115	0.069
10.	DHARWAD DRY	10.684	0.806	0.528	19.656	0.261	0.126	54.133	0.503	12.575	1.795	0.888	0.082	6.867	-2.095	-0.074
11.	RAJ3765	10.413	1.486	-0.077	18.459	1.593	1.550	53.711	0.584	17.284	1.874	0.806	0.013	6.667	5.022	0.033
12.	HI1563	10.854	1.687*	-0.078	17.648	2.515*	-0.277	49.556	0.617	-3.170	1.803	0.658	-0.005	6.111	-0.350	0.559
13.	HD2864	10.639	1.103	0.130	17.384	1.240	-0.124	50.200	1.576	16.912	1.811	0.913	0.010	6.767	-2.270	2.885
14.	RAJ4083	9.959	0.931	0.015	17.729	0.668	-0.254	48.422	0.600	-1.582	1.753	0.765	0.025	6.822	0.107	0.015
15.	DBW-14	10.280	0.588	0.005	18.444	0.396	0.856	45.800	0.160*	4.706	1.750	0.529	0.009	6.711	-5.595*	0.022
16.	WH730	11.351	1.429	-0.058	17.426	1.267	-0.085	45.733	1.332	-2.833	1.994	1.766*	-0.007	5.333	2.385	1.145
17.	K9465	10.324	0.907	0.059	18.562	0.315	-0.276	44.067	1.465	17.472	1.928	1.001	-0.001	5.756	2.624	-0.066
18.	RAJ4037	9.726	1.043	0.035	15.548	0.158	0.768	43.089	0.306	-1.015	1.557	0.954	0.062	6.422	1.748	-0.050
19.	TEPOKO	10.387	1.062	0.527	17.767	-0.426*	3.782	60.333	0.721	47.682	2.205	1.095	0.161	5.967	-3.054	-0.010
20.	BABAX	11.479	1.444	-0.063	19.740	0.244	0.074	53.489	1.521	37.442	1.842	1.408	0.027	6.311	0.846	0.060
21.	OTHERI RGYPT	9.988	0.893	-0.027	17.459	1.037	0.196	54.444	1.430	27.332	2.218	1.087	0.017	6.200	3.692	0.044
22.	IC532653	8.749	1.000	0.307	18.673	1.988	0.319	42.644	1.694	17.715	1.404	1.156	0.015	6.522	1.874	1.155
23.	SERI82	9.244	1.007	-0.029	18.433	2.326	-0.312	52.756	0.814	-2.240	1.450	0.754	0.023	5.889	-3.363	-0.048
24.	SONORA64	9.064	0.159*	0.009	17.089	0.567	-0.009	48.578	-1.047*	3.885	1.283	0.147*	-0.007	5.856	4.405	1.414
25.	SALEMBO	9.912	1.210	-0.067	19.051	1.461	1.038	47.844	1.560	-3.151	1.787	1.066	-0.003	5.911	2.897	0.160
26.	ARIANA66	10.412	0.917	0.216	21.807	0.379	0.081	46.889	1.682	8.412	1.467	0.641	0.006	5.478	1.196	0.244
27.	GIZA155	9.513	-0.423*	-0.031	20.111	-0.345*	0.893	47.956	1.013	4.607	1.615	1.302	0.082	6.800	-0.709	-0.045
28.	BACANORA88	9.541	0.985	-0.053	19.192	0.583	-0.341	55.711	0.468	-1.325	1.807	0.971	0.011	6.433	1.003	-0.057
29.	IC118737	10.540	1.758*	-0.059	18.333	2.424*	-0.348	59.444	1.225	-2.934	1.430	0.474*	-0.004	5.889	7.690*	-0.005

30.	C-306	9.287	0.537	0.216	15.873	1.050	0.118	41.944	1.130	15.752	1.688	1.020	0.060	6.100	-0.562	0.951
31.	HD2967	9.943	1.443	0.068	18.314	0.961	-0.356	51.978	0.914	8.386	1.904	1.199	0.018	6.711	-3.467	-0.031
32.	PBW343	9.223	0.969	0.169	16.907	1.732	0.389	42.844	0.681	3.698	1.589	0.799	-0.007	6.100	-0.282	0.414

*Significant at 5% level **Significant at 1% level

SL-Spike length, **NSS-** Number of spikelets per spike, **NGS-**Number of grains per spike, **GWS-**Grain weight per spike, **NTP-**Number of tillers per plant

Table 5: Stability parameters for biological yield per plant, grain yield per plant, 1000- grains weight, and harvest index.

SI No.	Genotype	BY(per plant)			GY(per plant)			PY			TGW			HI		
		X_i	b_i	S^2d_i	X_i	b_i	S^2d_i	X_i	b_i	S^2d_i	X_i	b_i	S^2d_i	X_i	b_i	S^2d_i
1.	PBN-51	17.911	2.377	36.569	5.867	1.280	2.631	1,418.889	1.161	1,214.934	35.048	**1.405**	13.167	33.858	-0.647	14.189
2.	BWL-0814	20.467	-0.100	-0.082	7.000	0.741	-0.057	1,969.333	0.769	5,819.067	34.789	1.130	10.256	34.249	2.247	-2.006
3.	BWL-1771	19.111	0.985	33.841	6.933	1.087	3.490	1,843.778	1.571*	28,333.557	36.722	0.030	-0.180	36.033	1.881	-1.279
4.	BWL-9022	20.644	2.037	0.109	8.222	2.074*	0.085	1,595.111	1.000	19,801.997	42.844	1.484	-1.118	38.815	1.819	-1.769
5.	BWL-0924	18.622	1.352	41.935	6.156	0.662	0.023	1,510.444	1.533*	-44.498	39.288	1.909	-1.176	34.465	-0.203	95.557
6.	BWL-1793	20.444	0.719	24.693	7.778	0.828	0.537	1,419.667	1.245	214,003.301	37.939	1.409	-1.252	38.320	1.425	23.141
7.	CUS/79/PRULLA	19.844	1.753	0.576	7.867	0.819	0.383	1,642.667	0.475	112,503.470	42.950	1.454	7.028	40.454	-1.666	0.128
8.	IEPACA RABE	18.978	1.002	2.271	7.756	0.975	0.489	1,623.333	1.255	3,263.414	37.011	1.268	-0.093	40.664	0.771	-2.302
9.	CHIRYA-3	21.911	1.252	0.193	8.333	0.955	0.991	1,934.222	0.721	8,340.412	35.628	0.166	7.048	37.919	0.162	4.673
10.	DHARWAD DRY	18.000	0.528	8.376	5.644	1.357	0.304	1,485.111	1.001	58,333.404	32.539	0.607	10.387	30.886	3.087	9.188
11.	RAJ3765	17.644	0.490	0.193	6.400	0.438	-0.035	1,278.444	1.332	1,340.211	36.400	0.755	19.103	36.228	0.288	0.303
12.	HI1563	18.267	0.610	0.124	6.311	1.205	0.082	1,364.444	1.480	3,230.722	35.283	0.462	-0.340	34.064	2.574	-2.238
13.	HD2864	14.911	0.291	11.064	6.200	0.488	1.038	1,621.333	0.961	70,354.540	36.083	0.163	28.292	42.664	0.571	304.688
14.	RAJ4083	18.111	1.214	-0.062	6.956	1.454	0.713	1,308.556	1.070	-186.156	35.072	0.759	0.454	37.582	2.002	17.998
15.	DBW-14	18.667	0.717	9.873	7.444	0.853	1.663	1,286.222	1.191	123,224.696	38.011	0.396	16.745	39.684	0.746	-2.002
16.	WH730	14.867	1.503	18.870	7.067	2.024	1.669	986.667	1.192	1,831.385	35.944	0.830	-0.014	46.347	2.440	25.563
17.	K9465	18.311	1.591	0.385	7.422	0.807	1.646	1,313.333	0.608	25,413.186	40.539	0.913	-1.008	41.182	-1.462	24.670
18.	RAJ4037	15.578	-0.185	5.968	6.244	0.707	4.278	731.556	1.066	126,264.603	35.828	0.548	3.548	39.815	2.871	35.046
19.	TEPOKO	15.156	0.263	1.217	6.222	0.640	0.555	1,529.556	0.693	36,164.325	33.394	0.413	-1.021	40.863	1.563	0.552
20.	BABAX	17.311	1.778	-0.051	6.444	2.535*	0.003	1,154.889	1.356	5,772.585	34.656	0.821	-0.657	34.391	5.144*	-0.975
21.	OTHERI RGYPT	18.733	2.003	26.422	6.956	2.059*	0.456	1,429.778	0.881	55,126.708	40.039	0.485	1.753	36.200	2.949	21.063
22.	IC532653	15.733	0.358	-0.068	4.867	0.622	0.501	806.444	0.254*	128,931.470	31.639	1.317	-1.146	30.771	1.601	13.707
23.	SERI82	15.511	1.621	35.079	5.200	1.462	1.956	1,250.444	1.104	1,132.356	29.783	1.895	2.458	32.922	1.372	10.347
24.	SONORA64	12.089	1.119	8.103	4.422	0.673	0.425	935.778	0.918	-145.058	26.661	1.546	-0.872	37.163	-0.344	15.860
25.	SALEMBO	19.044	1.096	1.457	6.178	0.646	1.974	2,310.444	1.164	571,506.764	38.439	0.563	-1.126	32.294	-0.033	14.895
26.	ARIANA66	16.667	0.834	0.926	4.933	0.137	-0.047	950.889	0.908	99,065.053	32.211	1.559	2.738	29.965	-1.264	-1.727
27.	GIZA155	17.578	0.963	5.066	5.622	0.363	0.007	1,094.667	0.621	3,220.823	36.956	1.358	19.265	32.492	-0.624	37.201
28.	BACANORA88	17.400	0.917	2.032	7.200	0.718	0.699	1,721.556	1.028	172,764.072	30.211	1.128	-0.860	41.405	-0.128	5.251
29.	IC118737	15.089	0.190	5.525	5.57.56	0.381	1.661	1,124.889	0.624	41,823.769	31.233	0.621	2.801	36.635	1.100	6.045
30.	C-306	15.111	0.249	10.701	**4.800**	**0.248**	**-0.049**	983.778	0.741	18,911.683	40.606	2.023	0.077	32.192	0.105	39.656
31.	HD2967	19.400	0.016	10.018	**7.689**	**0.714**	**2.920**	1,972.444	0.835	894.126	36.756	1.368	-0.874	39.474	1.803	0.451
32.	PBW343	16.422	2.457	27.872	**6.533**	**2.048***	**9.858**	1,596.667	1.245	353,656.116	36.233	1.215	16.828	39.407	-0.149	90.077

*Significant at 5% level, **Significant at 1% level

BY-Biological yield per plant, **GY-** Grain yield/plot, **PY-** Plot yield, **TGW-**1000 grain weight, **HI-** Harvest index

Table 6: Stability parameters for canopy temperature depression-I, II, III, relative water content and SPAD value.

SI No.	Genotype	CTD-I			CTD-II			CTD-III			RWC			SPAD		
		X_i	b_i	S^2d_i	X_i	b_i	S^2d_i	X_i	b_i	S^2d_i	X_i	b_i	S^2d_i	X_i	b_i	S^2d_i
1.	PBN-51	5.778	0.530	0.579	2.567	0.298	1.388	1.122	0.305	0.274	58.062	3.027	4.715	42.884	0.009	0.151
2.	BWL-0814	4.511	5.184*	-0.022	2.500	0.191	1.662	1.711	0.269	1.131	63.064	1.809	80.025	42.439	4.340*	-0.157
3.	BWL-1771	5.622	0.300	0.443	3.489	0.779	0.111	2.644	-0.371	1.999	73.882	1.522	98.765	41.842	3.428	11.386
4.	BWL-9022	1.844	0.041	0.791	2.816	2.140	1.072	2.344	-2.836	0.039	67.956	-0.269	36.570	43.844	1.783	-0.081
5.	BWL-0924	4.900	0.429	0.142	2.978	0.482	0.369	3.844	8.163*	8.521	64.914	1.059	566.939	44.828	0.093	24.080
6.	BWL-1793	2.233	1.157	1.212	3.453	0.047	0.139	2.311	-2.049	-0.101	72.146	0.395	-0.469	42.232	3.580	0.789
7.	CUS/79/PRULLA	4.433	3.175	-0.013	3.367	-0.101	-0.011	2.433	-1.663	0.141	71.499	0.738	1.361	43.256	4.028	7.318
8.	IEPACA RABE	2.022	-0.373	1.017	4.260	-0.009	0.584	3.111	-3.140	4.130	66.633	-0.383	30.202	40.736	2.088	39.016
9.	CHIRYA-3	5.211	1.963	3.333	3.389	0.473	1.470	2.433	1.248	1.226	74.432	1.707	99.310	40.518	0.224	3.558
10.	DHARWAD DRY	4.921	-0.869	0.201	4.156	-0.023	0.459	3.244	2.362	0.900	67.474	2.260	342.897	35.417	0.915	-0.121
11.	RAJ3765	1.933	-0.462	1.709	3.316	0.839	1.046	3.711	-3.694	0.051	61.804	-0.658	3.781	51.096	-5.075*	139.359
12.	HI1563	2.111	1.190	2.055	3.700	1.422	1.600	3.367	1.292	1.776	68.703	2.830	17.664	38.229	1.868	-0.757
13.	HD2864	2.289	-0.047	0.853	2.871	1.611	-0.001	2.689	2.128	2.672	73.203	0.603	265.657	44.556	-1.592	22.937
14.	RAJ4083	2.000	-1.214	1.015	2.931	1.934	-0.002	2.411	0.419	0.455	61.700	2.167	208.925	45.992	-0.612	-0.268
15.	DBW-14	2.133	-0.088	5.049	3.033	2.679*	0.246	2.433	2.686	2.464	72.756	1.661	0.216	44.444	1.225	-0.270
16.	WH730	3.811	1.033	0.358	3.578	2.869*	0.428	1.733	-0.352	0.578	65.680	0.848	5.114	47.856	1.105	-0.140
17.	K9465	3.911	2.841	0.324	2.589	1.930	0.523	2.767	1.408	4.477	72.493	1.315	-0.085	52.722	-6.264*	62.681
18.	RAJ4037	3.911	1.178	2.347	3.344	1.428	0.711	2.456	2.596	0.613	68.117	0.957	1.511	39.493	2.382	13.466
19.	TEPOKO	4.867	0.931	2.335	3.989	0.571	0.232	2.500	0.899	-0.083	71.203	2.381	18.093	40.192	1.692	-0.772
20.	BABAX	4.678	3.906	1.913	3.967	0.618	0.102	2.022	2.865	-0.053	70.619	3.657*	12.167	39.964	0.791	-0.736
21.	OTHERI RGYPT	4.389	3.307	0.617	3.644	0.667	1.003	2.167	1.583	0.039	71.344	1.289	75.940	46.362	2.459	-0.075
22.	IC532653	4.089	-0.625	0.122	3.300	-1.118*	0.607	2.633	0.745	0.408	72.464	0.415	24.831	43.133	0.140	-0.769
23.	SERI82	2.156	0.144	3.292	4.478	1.961	0.330	3.411	2.963	-0.021	60.231	4.309*	111.108	43.448	3.228	-0.592
24.	SONORA64	1.800	0.853	0.560	4.178	1.025	0.214	2.704	5.584	0.797	66.909	-0.294	4.504	38.163	0.250	1.133
25.	SALEMBO	5.378	1.358	0.170	3.111	0.898	1.735	2.511	-1.576	0.659	71.960	-0.093	0.114	43.829	3.064	2.229
26.	ARIANA66	3.022	-4.535*	0.341	3.000	0.489	2.762	2.111	1.925	3.516	73.206	-0.041	1.517	43.373	0.782	0.193
27.	GIZA155	5.033	2.558	1.344	3.378	1.819	0.325	3.078	4.845	0.182	81.366	0.034	212.060	41.489	0.519	-0.598
28.	BACANORA88	4.844	1.158	1.854	2.978	1.389	0.703	2.022	-0.031	0.935	77.556	-0.926	170.693	39.194	1.752	1.371
29.	IC118737	4.100	2.551	5.109	3.478	2.472*	0.006	2.556	2.011	-0.282	72.083	1.350	69.934	40.873	1.372	3.488
30.	C-306	4.333	2.450	6.072	4.156	1.050	1.676	2.533	-0.935	3.905	78.771	-2.905*	83.868	40.612	1.491	-0.773
31.	HD2967	5.056	-1.251	2.104	4.022	-0.421	0.099	3.056	-0.310	0.194	70.433	0.777	32.758	42.518	0.315	-0.109
32.	PBW343	3.711	3.225	2.618	3.389	1.591	1.028	2.611	2.660	-0.067	71.540	0.460	-0.819	41.328	0.617	-0.260

*Significant at 5% level **Significant at 1% level

CTD-I: Canopy temperature depression-I, **CTD-II: C**anopy temperature depression-II, **CTD-III: C**anopy temperature depression-III, **RWC-**Relative water content %, **SPAD-** Soil-plant analysis development (chlorophyll content)

Table 7: List of stable varieties showing high mean performance and having $b_i = 1$ and $S^2d_i=0$.

Sl.No.	Characters	Stable Genotypes
1.	**DH (2)**	PBN 51 and Dharwar Dry
2.	**DA (0)**	None
3.	**DM (0)**	None
4.	**GFD (0)**	None
5.	**PH (1)**	Giza 155
6.	**SL (2)**	BWL 0814 and BWL 9022
7.	**NSS (6)**	BWL-1771, BWL-9022, Dharwar Dry, K-9465, BABAX, and Ariana 66
8.	**NGS (1)**	PBN 51
9.	**GWS (11)**	PBN-51, BWL-9022, BWL-1793, IEPACA RABE, CHIRYA-3, Raj 3765, K-9465, Tepoko, BABAX, Othery Egypt, and HD-2967
10.	**NTP (11)**	BWL-9022, BWL-1793, CUS/79/PRULLA, Chirya-3, Dharwar Dry, Raj 3765, Raj 4093, Raj 4037, Giza 155, Bacanora-88, and HD-2967
11.	**BY (6)**	BWL-0814, BWL-9022, Chirya-3, Raj 3765, HI 1563, and Raj 4083
12.	**GY (1)**	BWL-0814
13.	**PY (0)**	None
14.	**TGW (4)**	BWL 1771, IEPACA RABE, WH-730, and C-306
15.	**HI (1)**	CUS/789/PRULLA
16.	**CTD-I (5)**	BWL-1771, CUS/79/PRULLA, Dharwar Dry, IC-532653, and Salembo
17.	**CTD-II (6)**	BWL-1771, BWL-1793, Tepoko, BABAX, Sonora 64, and HD-2967
18.	**CTD-III (0)**	None
19.	**RWC (3)**	DBW-14, K-9465, and Salembo
20.	**SPAD (6)**	PBN-51, BWL-9022, DBW-14, WH-730, Othery Egypt, and Ariana-66