

## Original Research Article

# Correlation and Heritability Analysis for Seed Quality Under Controlled Conditions in Wheat (*Triticum aestivum* L.)

### Abstract

In a laboratory at Acharya Narendra Deva University of Agriculture and Technology in Kumarganj, Ayodhya, Uttar Pradesh, a study was conducted on wheat (*Triticum aestivum* L.) during the 2019–20 academic year. In a wheat crop research, 30 germplasm were tested using three checks each for the parameters of seed weight, seed width, seed length, shoot length, root length, seedling length, seedling dry weight, germination (%), first count, final count, and vigour index-I and vigour index-II. In this study, the germplasm was assessed using parameters and the correlation coefficient. The vigour index-II demonstrated a very significant positive phenotypic connection with root length (0.828), final count (0.564), and first count (0.552), as well as a genotypically significant positive correlation with final count (1.165), root length (0.867), and first count (0.552). The highest estimates (>15%) of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were registered in the case of vigour index-I (PCV=17.36%, GCV=17.24%), shoot length (PCV=15.96%, GCV= 15.77%), seed width (PCV=15.35%, GCV=15.19%). The moderate estimate (10%) of PCV and GCV were recorded for root length (PCV=12.72%, GCV=12.56%), and seedling length (PCV=11.46, GCV=11.30).

**Keyword**– *Correlation, Germplasm, Vigour, Laboratory*

**Introduction**- Wheat is a cereal crop. It is predominantly present in the world; it provide food

for people. In India mostly found in Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Rajasthan, Chattisgarh etc. Globally, wheat (*Triticum spp.*) is grown up in about 220.83 million hectares holding the position of highest state among all crops with annual production hovering around 769.31 million tons [1]. In India, it's grown in area of 30.55 million hectares with production of 107.18 million tonnes and output of 3508 kg/ha. correspondingly In India uppermost area under wheat cultivation 9.54 million hectares in Uttar Pradesh with the get-together of 32.75 million tonnes and productivity 3432 kg/ hectare. The highest productivity 5183 kg/hectare in Punjab and lowermost productivity 1666 kg/hectare in Maharashtra [2]. The globe chief wheat producing countries are China, India, USA, Russia, Australia, Germany, France, Pakistan, Argentina, Turkey, Iran and Italy. With the increasing world population, demand of wheat crop is projected to extend by 60% by 2050, if this increment influences up to 9.7 billion obviously by the United Nations [3]. Constant increase in agriculture production and productivity essentially requires continuous expansion of recent and improved types of crops and efficient scheme of production and offer of seed to farmers. Seed quality within the sum of these qualities which differentiate the seed from the grain. The important seed quality attributes are genetic purity, physical purity, germination, moisture, well-being and vigour. In addition to above quality seed should be of unchanging size and willow good. Germination capacity of superiority seed portions should be high for gaining the specified crop supernumerary in this sector. Using seed of lower germination will diminish the sphere establishment or stand and thus the yields will be dropped. Seed germination is rested low with a range of things which is compulsory to the seed during its formation, maturing, ripening, like infection with the pest and pathogen. Subideal condition of nutrients and water and precocious rains or frost at the maturity stage. In addition, post-harvest operations and management of the seed lots during marketing or supply are answerable for affecting the seed quality.

## **Material and methods**

The experiment was carried out during 2020-21 at Acharya Narendra Deva University of Agriculture and Technology Kumarganj Ayodhya (U.P.) Laboratory Department of seed science and technology (GPB). The experiment was conducted to evaluate the 30 germplasm with three checks (PBW-343, NW-1014, NW-5054) in a completely randomized design. The experiment was conducted in the laboratory by placing four replications (Acc. to ISTA). The data was

recorded on 10 randomly selected seeds and seedlings for thirteen characters viz. 1000-seed weight (g), Seed length (mm), Seed breadth (mm), Shoot length (cm), Root length (cm), Seedling length (cm), Seedling Dry Weight (mg), Speed of germination, Germination (%), Vigour index-I, Vigour Index-II, First count (%), Final count (%). Data recorded on the above characters were subjected to estimate the coefficient of variation [4], Estimation of heritability (Hanson, 1963) [5] and genetic advance (Johnson, *et al.*, 1955) [6], Vigour analysis (Abdul Baki and Anderson, 1973) [7].

## Result and Discussion

The study of genetic variability and seed quality among 30 genotypes of wheat along with three checks was assessed by employing the Estimation of coefficient of variation [4], Estimation of heritability [5] and genetic advance [6], Vigour analysis [7]. The discrimination of germplasms into four replications suggested the presence of a high degree of genetic variability in the material evaluated. The estimate of the genetic variability and assessment of seed quality recorded that the genotypes present with respect to thirteen characters under study, while much more variability observed in HI- 1628, TL- 3012, DM-7, WAPD- 1519 for characters Seed length (mm), Seed breadth (mm), Shoot length (cm), Root length (cm), Seedling length (cm), Vigour index-I, Vigour Index-II. The analysis of variance found highly significant differences for all the characters studied. The range of variation was maximum for Vigour Index -II, followed by vigour index-I, seedling dry weight, shoot length, root length, seedling length, seed germination (%), first count, final count, speed of germination, 1000-seed weight, seed width and seed length. The estimates of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) for the thirteen seed quality parameters of wheat genotypes are presented in Table-1. The result showed a close correspondence between the phenotypic and genotypic variances for all the characters indicating stable expression. The highest estimates (>15%) of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were registered in the case of vigour index-I (PCV=17.36%, GCV=17.24%), shoot length (PCV=15.96%, GCV= 15.77%), seed width (PCV=15.35%, GCV=15.19%). The moderate estimate (10%) of PCV and GCV were recorded for root length (PCV=12.72%, GCV=12.56%),

and seedling length (PCV=11.46, GCV=11.30). The result of the present study in respect of the genotypic and phenotypic coefficient of variation is similar to the result found earlier workers Singh, *et al.* (2017), Geleta, T. (2017), and Prasad, *et al.* (2020). The magnitude of heritability in the broad sense varied between 98.63% in case of vigour index-I to 65.71% for germination (%). The high estimates of  $[h^2 (bs)\%]$  ( $>75\%$ ) were noted in the case of vigour index-I (98.63%), seed width (98.02%), shoot length (97.62%), root length (97.41%), seedling length (97.25%), 1000-seed weight (94.11%), seed length (91.71%), speed of germination (90.55%), vigour index-II (90.34%), seedling dry weight (90.12%). Moderate estimates of heritability were recorded for first count (79.02%), While the final count (68.75%) and germination percentage (65.71%) should have low estimates of heritability ( $<70\%$ ). The estimates of high heritability coupled with high genetic advance vigour index-I, seed width, and shoot length indicated that the heritability of the traits is mainly due to the effect of genes and selection is effective for such traits. The result obtained under the present investigation is in accordance with earlier reports by Akshitha, *et al.* (2020) [8], Lakshmi, *et al.* (2016) [9], Moshatati, *et al.* (2012) [10]. The estimated medium heritability and genetic advance in first count, final count and germination percentage indicating the medium range of heritability and genetic advance studies earlier workers Moshatati, *et al.* (2012) [10], Lakshmi, *et al.* (2016) [9], Sudeepthi, *et al.* (2020) [11]. Vigour index-II exhibited highly significant and positive genotypic correlation with seedling dry weight (0.810), shoot length (0.423), final count (0.388), vigour index-I (0.380), seed length (0.377), seed width (0.361), seedling length (0.317), first count (0.196), 1000-seed weight (0.253) and germination percentage (0.255) while a significant and positive correlation was noted with vigour index - II. Rest of the 2 characters showed non-significant correlation with this character is presented in table no.3. The phenotypic correlation coefficient for vigour index-II was found highly significant with seedling dry weight (0.721), seed length (0.350), seed width (0.341), shoot length (0.392), 38 vigour index-I (0.336), seedling length (0.287), germination percentage (0.278). Final count (0.236) and 1000-seed weight (0.214) shows a significant positive phenotypic correlation with vigour index-II. Rest 3 character showed non-significant correlation with this character is presented in table 3. The quality seed production and improvement of variety/germplasm is very complex in nature, quality seed production come

through a proper channel. We have studies about the 30-germplasm including three checks by checking of 13 seed quality parameters that are 1000-seed weight, seed width, seed length, shoot length, root length, seedling length, seedling dry weight, first count, final count, germination percentage, vigour index-I and vigour index-II. In this study we found high genotypic and phenotypic correlation coefficient between the seed quality parameters. 43 found high positive significant genotypically between germination percentage with final count, seedling length with root length revealed by earlier researchers like **Sajjad, et al. (2012) [12]**, **Kumar, et al. (2017) [13]**, **Olawamide, et al. (2018) [14]**, **Manjeet, et al. (2020) [15]**. The study conducted under laboratory conditions for checked the quality of different germplasm highly significant phenotypic correlation found between seedling length with root length, seedling length with shoot length, and germination percentage with final count found by earlier workers like **Shobha, et al. (2020)**, **Panwar, et al. (2018)**, **Wen, et al. (2017)**, **Sajjad, et al. (2012) [16, 17, 18, 12]**.

## Conclusion

The analysis of the experiment revealed extremely significant differences for all the features, contributing attributes to seed quality under study, among the 30 genotypes and 3 checks of wheat (*Triticum aestivum* L). All of the characteristics have extremely significant relationships, Seed length (0.377), seed width (0.361), shoot length (0.423), seedling length (0.317), seedling dry weight (0.810), final count (0.388), and vigour index-I (0.380) all exhibited extremely high positive correlations with each other. According to the overall findings, it appears that some of the information gathered here will be useful for enhancing and choosing the dominant wheat genotype.

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**Table 1: Estimates of range, grand mean, phenotypic (PCV) and genotypic (GCV) coefficient of variation, heritability in a broad sense [ $h^2$ (bs)%] and genetic advance in percent of mean (Ga %) for thirteen characters in wheat genotypes**

Characters	Range (Min. – Max.)	Mean(x)	PCV(%)	GCV(%)	Heritability [ $h^2$ (bs)%]	Genetic advance in percent of 5% mean (Ga%)
1000 Seed Weight(g)	28.52- 44.85	39.95	8.88	8.62	94.11	17.22
Seed Length(mm)	5.62- 7.25	6.36	8.74	8.37	91.71	16.51
Seed Width(mm)	2.69- 4.18	3.43	15.35	15.19	98.02	30.99
Shoot Length (cm)	5.60- 12.70	9.72	15.96	15.77	97.62	32.10
Root Length (cm)	10.00- 17.00	13.93	12.72	12.56	97.41	25.53
Seedling Length(cm)	17.50- 29.30	23.87	11.46	11.30	97.25	22.97
Speed of germination	17.34- 22.32	19.59	6.97	6.63	90.55	13.00
Seedling Dry Weight(mg)	123.0- 163.0	145.2	6.94	6.59	90.12	12.89
First Count	72.00- 88.00	80.91	4.73	4.20	79.02	7.70
Final Count	82.00- 94.00	87.85	3.92	3.25	68.75	5.55
Germination Percentage	85.31- 94.86	88.82	3.36	2.72	65.71	4.54

VigourIndex-I	1540.0-3637	2106.4	17.36	17.24	98.63	35.27
VigourIndex -II	10824-14507	12631	7.47	7.10	90.34	13.90

**Table2:Estimatesofphenotypiccorrelationcoefficientbetweendifferentcharactersinwheatgenotypes**

Characters	SeedLength(mm)	SeedWidth(mm)	ShootLength(cm)	RootLength(cm)	SeedlingLength(cm)	Speedofgermination	SeedlingDryWeight(mg)
1000SeedWeight(g)	<b>0.251*</b>	-0.149	-0.014	-0.080	-0.052	0.130	
SeedLength(mm)		<b>0.396**</b>	0.179	-0.203*	-0.026	-0.062	
SeedWidth(mm)			<b>0.215*</b>	0.100	0.186	-0.234*	
ShootLength(cm)				<b>0.344**</b>	0.782**	0.162	0.124
RootLength(cm)					<b>0.828**</b>	0.238*	0.062
SeedlingLength(cm)						<b>0.222*</b>	
Speedofgermination							
SeedlingDryWeight(mg)							

FirstCount						
FinalCount						
GerminationPercentage						
VigourIndex-I						

\*,\*\* significant at 5% and 1% level, respectively

**Table 3: Estimates of the genotypic correlation coefficient between different characters in wheat genotypes**

Characters	Seed Length (mm)	Seed Width (mm)	Shoot Length (cm)	Root Length (cm)	Seedling Length (cm)	Speed of germination	Seedling Dry Weight (mg)	First Count (No.)	Final Count (No.)	Germination Percentage (%)	Vigour Index -I	Vigour Index -II
1000 Seed Weight (g)	<b>0.315**</b>	-0.168	0.001	-0.093	-0.055	0.144	0.269**	0.006	0.270**	0.281**	-0.036	0.253*
Seed Length (mm)		<b>0.442**</b>	0.179	-0.207*	-0.032	-0.062	0.425**	-0.223*	0.061	0.022	0.029	0.377*
Seed Width (mm)			<b>0.231*</b>	0.099	0.195	-0.255*	0.334**	0.032	-0.033	-0.126	0.168	0.361*
Shoot Length (cm)				<b>0.369**</b>	0.799**	0.186	0.124	0.108	0.424**	0.412**	0.729*	0.423*
Root Length (cm)					<b>0.867**</b>	0.235*	0.091	0.160	0.174	0.302**	0.679*	0.109
Seedling Length (cm)						<b>0.270**</b>	0.124	0.181	0.339**	0.444**	0.848*	0.317*
Speed of germination							<b>-0.052</b>	0.370**	0.757**	0.817**	0.331*	0.132

SeedlingDry Weight(mg)								<b>-0.048</b>	-0.002	0.032	0.136	0.810* *
FirstCount									<b>0.552**</b>	0.461**	0.216*	0.196*
FinalCount										<b>1.165**</b>	0.463* *	0.388* *
Germination Percentage											<b>0.525* *</b>	0.255*
VigourIndex -I												<b>0.380* *</b>

\*,\*\*significantat5%and1%level,respectively

UNDER PEER REVIEW

**Table 4: Top-performing genotype relative to average performance**

<b>Characters</b>	<b>Genotypes</b>
1000 -Seed Weight (g)	AKAW-3717, DWAP- 1108, DWAP- 1531, HI- 8737, HI- 8802, HI- 8713, HI- 8751, GW- 1339, HI- 1628, TL- 3012, HS- 627, HI-1009.
Seed Length (mm)	DWPD- 1516, HI- 8777, HI- 1621, DM- 7, CG- 1018, MP- 1338, GW- 1339, HI- 1628, HS- 645, TL- 3012, HS- 627.
Seed Width (mm)	WAPD- 1505, DWAP- 1530, HI- 8708, HI- 8802, HI- 1620, HI- 8751, DM- 7, GW- 1339, HI- 1628, HS- 645, TL- 3012.
Shoot Length (cm)	WAPD- 1519, HI- 1620, HI- 1621, HI- 8751, MPO- 1336, DM- 7, DM- 6, CG- 1018, GW- 1339, HI- 1628, HI- 1009.
Root Length (cm)	DWPD- 1516, WAPD- 1519, WAPD- 1524, DWAP- 1530, HI- 8708, HI- 1620, HI- 8751, MPO- 1336, DM- 7, DM- 6, CG- 1018.
Seedling Length (cm)	WAPD- 1519, HI- 0765, HI- 1620, HI- 1621, HI- 8751, MPO- 1336, DM- 7, DM- 6, CG- 1018, GW- 1339, HI- 1009.
Speed of germination	AKAW- 4901, WAPD-1519, WAPD-1508, WAPD- 1524, DWAP-1108, DWAP-1531, HI-8737, HI-8751, DM-7, CG- 1018, HI-1628, HI- 1009.
Dry Weight (mg)	WAPD-1505, DWPD-1516, WAPD-1524, DWAP-1108, HI-8777, HI-8737, DM-7, DM-6, HS-645, TL-3012, HS-627.
First Count	AKAW-4901, AKAW-3717, WAPD-1519, DWAP-1108, DWAP-1531, HI-1620, HI-1621, HI- 8751, HI-1628, TL-3012, HI-1009.
Final Count	AKAW-3717, WAPD-1519, DWAP-1108, DWAP-1531, HI-8737, HI-8751, DM-7, CG-1018, HI-1628, TL-3012, HI-1009
Germination (%)	AKAW-3717, DWAP-1108, DWAP-1531, HI-8737, HI-8751, MPO-1336, DM-7, CG-1018, HI-1628, TL-3012, HI-1009.
Vigour Index -I	WAPD-1519, DWAP-1108, DWAP-1531, HI-1620, HI-8751, MPO-1336, DM-7, DM-6, CG-1018, HI-1628, HI-1009.
Vigour Index -II	WAPD-1505, HI-8708, HI-8777, HI-8737, HI-8751, DM-7, DM-6, HI-1628, TL-3012.