

Original Research Article

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

Comment [AK1]: Overall comment: This manuscript may be accepted after whole formality of journal.

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).

Comment [AK2]: A study was conducted on wheat (*Triticum aestivum* L.) in laboratory at Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, during the 2019–20 for correlation and heritability analysis for seed quality under controlled conditions in wheat.

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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 (*Tritium spp.*) is being grown up on 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 a 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 lower most 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 crops supernumerary this sector. Using seed of low 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.) in laboratory of Department of Seed Science and Technology (GPB). The experiment was conducted

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to evaluate the 30germplasmwiththreechecks(PBW343,NW1014,NW5054) in a completely randomized design. The experiment was conducted in the laboratory by placing four replications (ISTA,.....). The datawas recordedon10randomlyselectedseedsandseedlingsforthirteencharactersviz.1000-seedweight (g), seed length (mm), seed breadth (mm),shootlength(cm),rootlength(cm),seedlinglength (cm), seedling dry weight (mg), speed ofgermination,germination(%),vigourindex-I,vigour index-II, first count (%), final count (%).Data recordedontheabovecharactersweresubjectedtoestimatethecoefficientofvariation[4], estimationof heritability(Hanson, 1963) [5]and genetic advance (Johnson, *et al.*, 1955) [6],vigouranalysis(AbdulBakiandAnderson, 1973)[7].

Comment [AK5]: Year.....?

ResultandDiscussion

The study of genetic variability and seed qualityamong30genotypesofwheatalongwiththreechecks wasassessedbyemploying the Estimationof coefficient of variation [4], estimationof heritability[5]and genetic advance [6], vigouranalysis[7].Thediscrimination of germplasms into four replications suggested the presenceof a highdegreeofgeneticvariability in the material evaluated. The estimateof geneticvariabilityandassessmentofseedqualityrecordedthatthegenotypespresentwithrespecttothirteencharactersunderstudy,whilemuch more variability wasobserved in HI1628, TL3012,DM7,WAPD1519forcharactersi.e., seedlength(mm),seedbreadth(mm),shootlength(cm),rootlength(cm),seedlinglength(cm),vigourindex-I, vigour index-II. The analysis of variancefoundhighlysignificantdifferencesforallthecharactersstudied.Therangeofvariationwasm aximum for vigour index -II, followed by vigourindex-I,seedlingdryweight,shootlength,rootlength, seedling length, seed germination (%), firstcount, final count, speed of germination, 1000-seedweight,seedwidthandseedlength.

Comment [AK6]: Showed variability

Theestimatesofphenotypiccoefficientofvariation(PCV)andgenotypiccoefficientofvariation(GCV)for the thirteenthseedqualityparametersofwheatgenotypesarepresentedintable1.Theresultshoweda close correspondence between thephenotypicandgenotypicvariancesforallthecharactersindicatingstableexpression.Thehighesti

mates (>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 by several 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 per cent 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 for 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 studied earlier workers Moshatati, *et al.* (2012) [10], Lakshmi, *et al.* (2016) [9], Sudeepthi, *et al.* (2020) [11]. The 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). A significant and positive correlation was noted for the first count (0.196), 1000-seed weight (0.253) and germination percentage (0.255) with vigour index -II while rest of the two characters showed non-significant correlation with this character which are presented in table 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), vigour index-I (0.336), seedling length (0.287), germination percentage (0.278). A

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significant positive phenotypic correlation for final count (0.236) and 1000-seed weight (0.214) shows with vigour index-II while rest three characters 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 and quality seed production come through a proper channel. We have studied about the thirty germplasm including three checks by checking of thirteen seed quality parameter i.e., 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 present study high genotypic and phenotypic correlation coefficient between the seed quality parameter was found. The highly positive significant genotypic correlation between germination percentage with final count and 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 was conducted under laboratory conditions for checking the quality of different germplasm and found highly significant phenotypic correlation of seedling length with root length, seedling length with shoot length and germination percentage with final count and it was also 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]**.

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Conclusion

The analysis of the experiment revealed highly significant differences for all the features, contributing attributes to seed quality under study, among the thirty genotypes and three checks of wheat (*Triticum aestivum* L). All of the characteristics shown high significant correlation. The 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 might be useful for enhancing and choosing the dominant wheat genotypes for seed quality in wheat.

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Comment [AK11]: More recent reference would be added.

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

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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

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)	0.315**	-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)		0.442**	0.179	-0.207*	-0.032	-0.062	0.425**	-0.223*	0.061	0.022	0.029	0.377*
Seed Width (mm)			0.231*	0.099	-0.195	-0.255*	0.334**	0.032	-0.033	-0.126	0.168	0.361*
Shoot Length (cm)				0.369**	0.799**	0.186	0.124	0.108	0.424**	0.412**	0.729*	0.423*
Root Length (cm)					0.867**	0.235*	0.091	0.160	0.174	0.302**	0.679*	0.109
Seedling Length (cm)						0.270**	0.124	0.181	0.339**	0.444**	0.848*	0.317*
Speed of germ							-0.052	0.370**	0.757**	0.817**	0.331*	0.132

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

*,**significantat5%and1%level,respectively

UNDER PEER REVIEW

Table 4: Top-performing genotype relative to average performance

Characters	Genotypes
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.