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Analysis of Seed and Seedling Parameters in Wheat Germplasm

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ABSTRACT
Investigation were carried out with 11 seed and seedling characters namely; moisture content, 1000-seed weight, seed length, seed breadth, germination, shoot length, root length, speed of germination, seedling length, seedling dry weight and vigour index in forty wheat genotype under laboratory conditions. The experiment was conducted in Completely Randomized Design with three replications. The high estimate of heritability with high genetic advance in per cent of mean was observed for seed breadth, seedling dry weight, root length, 1000-seed weight, moisture content and shoot length, speed of germination and seedling dry weight showed moderate heritability coupled with high to moderate genetic advance in per cent of mean. Among the forty wheat genotypes, DSBL-108, followed by DSBL-28, DSBL-95, DSBL-12, DSBL-98, DSBL-83, DSBL-74, DSBL-52, DSBL-27 and DSBL-104 produced highest vigour index with very strong positive correlation of vigour index at genotypic and phenotypic level.
***Key words**: Wheat, Heritability , Germination and Vigour index.*

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INTRODUCTION

Wheat (*Triticuma estivum*L. Em. Thell.;2n=42), a self-pollinated crop of the Graminaceae family(Sub-family Poaceae) and genus *Triticum*, is the world's largest famous energy rich cereal crop. It has been described as the **'King of cereals'** because of the acreage it occupies, high productive and the prominent position it holds in the international food grain trade.

Seed is a basic input in agriculture and it plays a vital role in boosting up the productivity and economy of the country. Good healthy seed and seedling vigour ensures a good crop stand. Without the use of good quality seed, the investment, incurred on fertilizers, pesticides and water will not dividend which ought to be realized. Seed quality in the sum of all these attributes which differentiate the seed from the grain. The important seed quality attributes are: genetic purity, physical purity, germination, moisture, health and vigour. Seed vigour is an important quality parameter which needs to be assessed to supplement germination and viability text to gain insight into the performance of a seed lot in a field and storage. Major factor causing variations in vigour are genetic constitution of the seed, environmental and nutrition of the mother plant, stage of maturity at harvest, seed size, weight or specific gravity, mechanical integrity, deterioration, aging and pathogens. The vigour's level increases with time and maturity on the mother plant and decreases with age at harvesting.In addition to above quality seed should be of uniform size and should posses good. The present investigation was undertaken to evaluate the nature and magnitude of genetic variability, heritability and genetic advance for different vigour character as well as correlation coefficients among various vigour and vigour contributing characters.

MERTHODS AND MATERIALS:

The experimental material for the present investigation comprised of forty wheat diverse genotypes. The wheat sowing wide spectrum of variation for various seed characters, were evaluated in laboratory for 11 seed attributes. The experiment was conducted following Completely Randomized Design with three replications in Seed Testing Laboratory. The observations were recorded on eleven characters namely, moisture content, 1000-seed weight, seed length, seed breath, germination, shoot length, root length, speed of germination, seedling length, seedling dry weight and vigour index.

Seed moisture was carried out by digital moisture meter. 1000 seed were counted and weighed in gram. Seed length and seed breath are both measured by vernier callipers in millimetre (mm)of the dry seed.

Seed germination percentage under lab condition was estimated on the basis of germinated seed from 100 randomly selected seed kept for germination in seed germinator at 20±1^{0}C for 8 days. For the root length and shoot length the three replication of 25 seeds were kept in two layer of moist germination paper and rolled. The samples were kept in seed germinator maintained at 20±1^0 C. Ten seedling were randomly taken from each replication and on 8th day shoot and root length were measured by meter scale. The unit of shoot and root length was in centimetre (cm). Germination test was conducted in lab with three replication 100 seeds each replications by adopting Top on paper methods as described by ISTA procedures. Numbers of germinated seeds were counted daily and the index for the speed of germination was calculated by the formula suggested by Maguire (1962).

Speed of germination = $\sum [n_1/d_1+n_2-n_1/d_2=\ldots\ldots\ldots n_n-n_n-1dn]$

Where,

n = no. of seeds germinated on day (d)

d = serial number of days

The ten normal seedling were carefully removed randomly from each replication for the test of seedling length. After then their dry weights were recorded after over drying at 100^0 C for 24 hours. Vigour index were calculating as per the method prescribe by Abdul- Baki and Anderson (1973) expressed in whole number.

Vigour index = Mean germination (%) × Mean seedling length (cm)

The analysis of variance and simple correlations among the ten characters were worked out by standard methods through computer programming.

RESULTS AND DISCUSSIONS:

Statistical analysis revealed that significant genetic variability for all the eleven seed and seedling characters existed in wheat germplasm. The range, grand mean, phenotypic (PCV) and genotype (GCV) coefficient of variation, presented in the table 1.

The correlation coefficient was work out at phenotypic and genotypic levels for seed quality parameters in wheat genotypes are presented in table 2 and 3**.** In general the values of genotypic correlation coefficient were similar in sing or nature but slightly higher than phenotypic ones in magnitude for all the parameters.

Vigour index possessed highly significant and positive correlation with seedling length (0.831), root length (0.683) and shoot length (0.543) whereas germination per cent (0.150), speed of germination (0.099) and seed breadth (0.032) had non-significant.

Seedling dry weight exhibited highly significant and positive correlation coefficient with 1000-seed weight (0.726), and moisture content (0.659) while Seed length (0.376) showed significant and positive correlation with this characters whereas shoot length (0.178), root length (0.076), seedling length (0.042) had non-significant.

Seedling length indicated highly significant and positive association with these seed quality parameters likewise root length (0.758), shoot length (0.685) whereas seed breadth (0.094) and seed length (0.030), seedling dry weight (0.042) had non- significant.

Speed of germination showed significant and positive correlation with seed germination (0.333). Whereas remaining seed quality parameters had non-significant.

Root length possessed significant and positive correlation with shoot length (0.304), seed breath (0.160) has showed non-significant.

The 1000-seed weight exhibited highly significant and positive correlation with moisture content (0.935) on the other hand three seed quality parameter namely shoot length, seed germination and seed breath were expressed non-significant association with all the characters.

The analysis of variance for all the characters showed existence of variability among forty which validated further statistical analyses. The assessment of existing variability in germplasm collections was done by computing coefficients of variation at phenotypic and genotypic levels.

The heritability in broad sense (Hanson et al. 1956) and genetic advance in per cent of mean (Johnson et al. 1955) were calculated for understanding the transmissibility of characters. The natures of associations among different characters were studies by using phenotypic and genotypic correlation coefficient (Searle, 1961) and Path coefficient analysis Dewey and Lu, (1959).

The genotype, DSBL-108 produced highest vigour index of (2303.50) and showed highest mean performance for seedling length, root length and shoot length.

The genotype and phenotype coefficients of variability were computed to assess the nature and magnitude of existing variability in the germplasm. The high magnitude of genotypic coefficient of variation (GCV) along with phenotypic coefficients of variation (PCV) was recorded for seed breadth (PCV=44.36%, GCV=44.39).

The magnitude of heritability in broad sense varied between (99.70%) in case of seed breadth to (62.60%) for germination percentage. The high estimates of [$h^2_{(bs)}$%] (>90%) were noted in case of seed breadth (99.97%), Seedling dry weight (98.00%), moisture content (94.60%), 1000-seed weight (94.60%), root length (94.20%), shoot length (92.00%), moderate estimate of heritability (<90% to >80%) were observed for seedling length (89.20%), and speedof germination (82.70%), while the seed length (76.6 0%) vigour index (70.40%) and germination per cent (62.60%) were indicated low estimated of heritability.

In present study, very strong positive association of vigour index were observed with moisture content, 1000 seed weight, seed length, germination percentage, root length, shoot length and seedling length, speed of germination, seedling dry weight, vigour index at phenotypic as well as genotypic level.

In the present study, the path coefficient analysis was carried out at genotypic as well as phenotypic level. The highest positive direct effect on vigour index was exerted for seedling length, followed by germination percent and root length at phenotypic level. These characters have also been identified as major direct contributors towards vigour index in different crops. Similar result were observed by Nayeem and Despande. 1987; Peighambari et al., 2005, Sing et al. 2006, and Lallu Baghel et al. 2012, Mehta et al. 2013, Chauhan and Deswal 2013.

On the basis of results of path coefficient analysis at phenotypic and genotypic level it can be concluded that characters identified as important direct components like seedling length, germination percentage and seed width and important indirect components like root length, shoot length, 1000-seed weight and moisture content should be given due consideration at the time of devising selection strategy for improving vigour index in wheat variety.

CONCLUSION:

The salient result of the study and conclusions drawn from them are the analysis of variance of the parameter indicated highly significant differences among the forty wheat genotype for all the eleven seed character under study. Wide spectrum of variation was observed for characters of forty wheat genotypes. High magnitude of genotypic and phenotypic coefficients of variation was observed for seed breadth in mm. Moderate estimation of GCV and PCV were observed for seedling dry weight, 1000-seed weight and root length. A very strong highly significant and positive correlation of vigour index at genotypic and phenotypic level was observed with seedling length, root and shoot length.

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Table 1: Estimates of rang, grand mean, phenotypic (PCV) and genotypic (GCV) coefficient of variation, heritability in broad sense [$h^2_{(bs)}$%] and genetic advance in percent of mean($\overline{Ga}$ %) for different in wheat germplasm

Characters	Range (Min.-Max.)	Grand mean ($\bar{x}$)	PCV (%)	GCV (%)	Heritability [$h^2_{(bs)}$%]	Genetic advance in per cent of mean ($\overline{Ga}$%)
Moisture content (%)	12.08-12.75	12.49	1.42	1.38	94.60	2.76
1000-seed we	22.50-36.58	29.60	12.00	11.68	94.60	23.39
Seed length (mm)	5.20-6.70	6.12	5.64	4.94	76.60	8.90
Seed breadth (mm)	2.60-3.70	3.04	44.46	44.39	99.70	91.29
Germination (%)	82-92	87.35	3.63	2.38	62.76	4.69
Shoot length (cm)	9.20-13.90	11.08	9.81	9.41	92.00	18.59
Root length (cm)	8.0-13.0	10.60	11.44	11.10	94.20	22.20
Speed of germination	17.74-22.76	20.50	6.76	6.15	82.70	11.53
Seedling length (cm)	17.30-27.10	21.92	8.33	7.87	89.20	15.31
Seedling dry weight (mg)	0.14-0.31	0.21	20.03	19.83	98.00	40.43
Vigour index	1574.30-2303.50	1916.74	9.15	7.68	70.74	13.28

Table: 2: Estimates of Phenotypic correlation coefficient between different characters in wheat genotypes.

Characters	1000-seed weight (g)	Seed length (mm)	Seed breadth (mm)	Germination (%)	Shoot length (cm)	Root length (cm)	Speed of germination	Seed length (cm)	Seedling dry weight (mg)	Vigour index
Moisture content (%)	0.935**	0.447**	-0.234	-0.058	-0.045	-0.163	-0.155	-0.134	0.659**	-0.159
1000-seed weight (g)		0.514**	-0.181	-0.066	-0.021	-0.146	-0.210	-0.108	0.726**	-0.147
Seed length (mm)			-0.074	-0.074	0.123	-0.151	-0.319	0.030	0.376*	-0.049
Seed breadth (mm)				-0.119	-0.009	0.160	-0.170	0.094	-0.044	0.032
Germination (%)					-0.249	-0.019	0.333*	0.134	-0.075	0.150
Shoot length (cm)						0.304	-0.121	0.685**	0.178	0.543**
Root length (cm)							-0.020	0.758**	0.076	0.683**
Speed of Germination								-0.010	-0.245	0.099
Seedling length (cm)									0.042	0.831**
Seedling dry weight (mg)										-0.015

Table: 3: Estimates of Genotypic correlation coefficient between different characters in wheat genotypes.

Characters	1000-seed weight (g)	Seed length (mm)	Seed breadth (mm)	Germination (%)	Shoot length (cm)	Root length (cm)	Speed of germination	Seed length (cm)	Seedling dry weight (mg)	Vigour index
Moisture content (%)	0.989**	0.533**	-0.238	-0.090	-0.041	-0.182	-0.174	-0.139	0.692**	-0.158
1000-seed weight (g)		0.558**	-0.184	-0.132	-0.026	-0.153	-0.263	-0.147	0.759**	-0.185
Seed length (mm)			-0.092	-0.077	0.092	-0.168	-0.446	-0.154	0.417**	-0.168
Seed breadth				-0.151	-0.011	0.165	-0.189	0.095	-0.053	0.038

(mm)										
Germination (%)					-0.323	0.001	0.457**	-0.162	-0.098	0.295
Shoot length (cm)						0.322	-0.163	0.723**	0.181	0.590**
Root length (cm)							-0.051	0.834**	0.081	0.875**
Speed of Germination								-0.041	-0.272	0.160
Seedling length (cm)									0.034	0.983**
Seedling dry weight (mg)										-0.017

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