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VARIATIONS AND CORRELATIONS FOR SEED AND SEEDLING CHARACTERS IN SOYBEAN (*GLYCINE MAX* MERRILL) GERMPLASM

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The present study was carried out to examine the variability and inter-relationship for various characteristics recorded on seed and seedlings of soybean germplasm being conserved in the National Genebank at the National Bureau of Plant Genetic Resources, New Delhi. The study revealed significant differences between soybean accessions for seed vaiability parameters namely normal, abnormal seedling, dead seeds, seedling vigour and such as seed weight, volume and colour.

Key words : Soybean, *Glycine max*, variations, correlations, seedling characters

The worth of the germplasm seed for their long term conservation is assessed by evaluating seed viability and vigour when the seed is received and during the course of their storage in the genebank. Influence of seed size, seed weight and density on their laboratory and field performance has been extensively studied and documented (Singh *et al.*, 1972; Tiwari *et al.*, 1976; Borba, 1987;. Unsrisong, 1988; Song *et al.*, 1990). The objective of the present study was to examine the magnitude of variability for seed germination related characters. The relationships between some of the seed characteristics such as seed weight, volume, density, colour and seed leachate electric conductivity among themselves and with the seed viability parameters such as germinatiion, number of normal, abnormal seedlings and dead seeds and seedling vigour have also been examined.

MATERIAL AND METHODS

The seed material utilised for the present investigation comprising 30 soybean germplasm accessions exhibited variation in seed size, shape and colour. These seed samples were drawn from over 400 soybean germplasm accessions being maintained in NBPGR Genebank. A list of the germplasm utilised is given in table 1. Observations were recorded on 100 seed weight (g), seed volume, seed density and seed colour. The volume of the 100 seeds was measured by the volume of water displaced by these seeds in the

measuring cylinder. The seed density was computed as a ratio of weight and volume of the seed. Visual scoring on 1 to 5 scale was done for seed colour. The initial phase of each germination test comprised slow rehydration to 14-16 per cent moisture content by humidifying seeds above water in the dericator, to avoid imbibition damage. This required 2-4 days. The germination tests were carried out following the procedure prescribed by the International Seed Testing Association (ISTA, 1985 a) for this crop, using 50 seeds replicated thrice. The germination counts were taken after 7 days and numbers of normal, abnormal, dead and hard seeds were recorded according to criterion of normal germination (ISTA, 1985a, b). For seedling vigour, shoot lengths of normal seedlings in three replicates of 25 seeds each kept separately for germination, on pencil lined paper towels, were measured and mean was calculated for each replication.

Table 1. List of Soybean germplasm lines

S.No.	IC/EC No.	Origin	Year of introduction/ collection	S.No.	IC No.	Origin	Year of introduction/ collection
1.	EC-14483	AUSTRALIA	1959	16	IC-7562	NAMCHI	1960
2.	EC-15627	GERMANY	1959	17	IC-10036	H.P.	1962
3.	EC-30208	U.S.A.	1964	18	IC-10039	H.P.	1960
4.	EC-34121	HUNGARY	1965	19	IC-13048	W.B.	1966
5.	EC-36894	TAIWAN	1965	20	IC-13054	W.B.	1966
6.	EC-36956	JAPAN	1965	21	IC-18741	H.P.	1973
7.	EC-36999	USA	1966	22	IC-18764	H.P.	1973
8.	EC-39369	AUSTRALIA	1965	23	IC-24993	MIZORAM	1975
9.	EC-65767	USA	1969	24	IC-24068	U.P.	1974
10.	EC-98410	USSR	1971	25	IC-2500	MIZORAM	1975
11.	EC-121391	TAIWAN	1977	26	IC-25766	A.P.	1975
12.	EC-141430	USA	1981	27	IC-37187	SIKKIM	1980
13.	IC-2051	NEPAL	1953	28	IC-37191	SIKKIM	1980
14.	IC-2064	W.B.	1953	29	IC-37197	SIKKIM	1980
15.	IC-2065	W.B.	1953	30	IC-37203	SIKKIM	-

W.B. - West Bengal, H.P. - Himachal Pradesh, U.P. - Uttar Pradesh, A.P. - Arunachal Pradesh; IC and EC represents Indigenous and Exotic collextions

Leachate analysis

Three replicates of 10 seeds each were prepared and soaked in 25 ml of distilled water for 16h at 25 + 1°C. Electrical conductance of the leachate

was measured in a wheat-type conductivity bridge (Elico CM 82 T) and recorded in ml mho/cm^2

Statistical analysis

The replicated data was ssubjected to standard analysis of variance. The simple correlation co-efficients between seed viability and other seed characteristics were computed using MSTAT.

RESULTS AND DISCUSSION

The analysis of variance for five seed viability related traits has shown high significant differences between soybean accessions for normal seedlings, dead seeds, seedling vigour and leachate electrical conductivity (Table -2). The differences for the numbers of abnormal seedlings were significant only at probability 0.5 which indicated relatively low occurrence of abnormal seedlings. The significant differences in soybean accessions for these traits are expected when the germplasm represent a large number of accession from where these have been drawn.

Table 2. ANOVA (Soybean germplasm)

Source	D.F.	Normal seedling	Abnormal seedling	Dead seeds	Seedling vigour	Leachate E.C.ml mho/cm^2
Rep.	2	2.50	0.025	3.60	0.077	13.07
Accessions	29	87.979**	4.172*	83.82**	26.85**	1039.75**
Error	58	5.237	2.078	6.81	1.04	35.67
CV%		14.21	10.87	36.0	10.68	15.93
S.E.		1.87	1.18	2.13	0.83	4.88

**Significant at p = .01, *Significant p = .05.

The correlation coefficients between seed morphological characters such as seed weight, volume, seed density, seed colour among themselves and with various seed germination parameters have been presented in table 3. Seed weight showed significant positive correlations with seed volume and seed density. This trait was also significantly correlated with seed leachate electrical conductivity. Seeds with high density showed significant positive correlation with seedling vigour. However, the occurrence of more number of abnormal seedlings from high density seeds was indicated by significant positive correlation between these two traits which may be due to the accumulation of

damages to macromolecules within the embryonic tissue (James 1967; Koostra and Harrington 1969; Villiers, 1972). The results of these experiments have shown fundamental differences between large and small seeds with respect to their survival ability. Based on these results, it can be postulated that the accumulation of such damages may be more in larger than in smaller seeds. This view has been supported by the results obtained in the present study with the greater frequency of seedling abnormalities resulting from larger seeds.

Table 3. Correlation coefficients (Soybean germplasm)

Characters	Seed of volume	Seed density	Seed colour	Leachate E.C.	Normal seedling	Abnormal seedling	Dead seed	Seedling vigour
Seed weight	.971**	.534*	–.376	.747**	–.233	.313.	.216	–.081
Seed volume	-	.328	–.346	.776**	–.319	.209	.318	–.081
Seed density	-	-	–.191	.137	.328	.431*	–.387	.444*
Seed colour	-	-	-	–.495	.443*	–.387	–.425	.177
Leachate E.C.	-	-	-	-	–.657**	.279	.647**	–.347
Normal seedls.	-	-	-	-	-	–.343	-.973**	.793**
Abnormal seedls.	-	-	-	-	-	-	.160	–.280
Dead seeds	-	-	-	-	-	-	-	–.746**

**Significant at p = .01, * Significant at p = .05.

Seed colour showed significant negative correlation with leachate electrical conductivity and positive correlation with number of normal seedlings. This indicates that dull colour seeds deteriorate faster and bright creamy seeds produce more normal seedlings. Among several methods for testing for seed vigour, the electro-conductivity test (Bradnoc and Mathews, 1970) and measuring the length of seeldings which is used to determine physiological seed vigour (Yaklich and Kulik, 1979; Perry, 1981; Catizone and Lavato, 1987), have been found very effective for comparing the planting value of seed lots and accessions. Both these methods have been used in the present study. It is interesting to note that leachate electrical conductivity was significantly nega-

tively correlated with numbers of normal seedlings positively with number of dead seed indicating that this trait is a good indicator of seed deterioration. Frequency of normal seedling was negatively associated with occurrence of dead seed and it was highly positively correlated with seedling vigour. Therefore, the frequency of normal seedlings in soybean appear to be the good indicator of seed vigour and storage potential.

Present result clearly demonstrate the usefulness of recording seed density and colour data on the germplasm accessions received for longterm conservation as these traits have the bearing on seed storage potential and seed viability parameters.

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