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Short Communications

Character Association and Path Analysis for Seedling Vigour Index in Stored Wheat Seed

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The vigour index is a multiplicative end product of many complex components like germination (%), root and shoot length of seedling. These parameters play an important role for high planting value of seed lot and early establishment of crop (Mahajan and Nayeem, 1989). Hence, only one character as such would not be more effective for establishing the real quality of seeds, but several characters often have to be handled together.

Cleaned seeds of four wheat varieties (Sonalika, Lok-1, Kalyan Sona and GW 496) having about 100 per cent moisture were stored from May 1992 to April 1993 in 4000 gauge polythene bags under ambient conditions and tested for seed moisture (%), seed index (100 seed weight), seed density (g cm^{-3}), imbibitional rate (cc g^{-1}), electrical conductivity (dS m^{-1}) of seed leachate, germination (%) (Anon, 1985), germination rate and seedling growth in terms of root length, shoot length and fresh weight of 10 days old seedlings. Vigour index was determined by multiplying the germination (%) with the sum of root and shoot length (cm). Correlation coefficient among all the components was computed seperately. The components having significant correlation with the dependent variable vigour index were subjected to path coefficient analysis (Deway and Lu, 1959).

The correlation study (Table 1) indicated that the vigour index was found to be significant and positively associated with seedling shoot and root length and fresh dry weight of seedling, germination rate and germination per cent. This indicated that functionally related traits tend to be highly integrated morphologically and their correlation structure confirms to the functional relationship structure. Such association helps in reducing the complexities of testing procedures for seed quality. The present results are in agreement with the findings of Mahajan and Nayeem (1989). Strong and positively significant correlation was observed between seed moisture and electrical conductivity. Both the parameters have antagonistic relationship with the vigour index suggesting that an increase in seed moisture and electrical conductivity would reduce the vigour index. Consequenty, both the traits had negative correlation with seed density, imbibitional rate, germination per cent

TABLE 1

Correlation coefficient among vigour index and different components during storage.

Components	seed moisture (%)	Seed index (g)	Seed density (g/cm^3)	Imbibitional rate (cc/g)	Electrical conductivity (ds/m)	Germination (%)	Germination rate	Seedling fresh weight (mg)	Seedling root length (cm)	Seedling shoot length (cm)	Dry weight of seedling (mg)
Vigour index	-0.565**	-0.115	0.028	0.263	-0.682**	0.738**	0.777**	0.894**	0.947**	0.974**	0.913**
Seed moisture		0.518*	-0.511*	-0.341	0.864**	-0.821**	-0.869**	-0.423	-0.371	-0.532*	-0.458*
Seed index			-0.995**	0.246	0.619**	-0.426	-0.447*	0.119	0.118	-0.031	0.030
Seed density				-0.287	-0.629**	0.427	0.473*	-0.130	-0.140	0.015	-0.046*
Imbibitional rate					-0.031	0.184	0.143	0.212	0.299	0.215	0.219
Electrical conductivity						-0.906**	-0.962**	-0.505*	-0.485*	-0.646**	-0.533*
Germination							0.952**	0613**	0.512*	0.691**	0.619**
Germination rate								0.648**	0.581**	0.745**	0.673**
Fresh weight of seedling									0.813**	0.948**	0.980**
Root length of seedling										0.901**	0.846**
Shoot length of seedling											0.952**

** Significant at 1 per cent level of probability.

* Significant at 5 per cent level of probability.

TABLE 2

Direct and indirect effects of various components on vigiour index.

Components	Seed moisture (%) X1	Imbibitional rate (cc/g) X2	Electrical conductivity (ds/m) X3	Germination (%) X4	Germination rate X5	Shoot length of seedling (cm) X6	Root length of seedling (cm) X7	Fresh weight of seedling (mg) X8	Dry weight of seedling (mg) x9	'r' value
X1	**-0.021**	0.001	0.020	-0.234	0.149	-0.195	-0.191	0.001	0.001	-0.565**
X2	0.005	**-0.018**	-0.001	0.052	-0.008	0.079	0.154	-0.001	0.000	0.263
X3	-0.018	-0.001	**0.024**	-0.258	0.055	-0.237	-0.250	0.001	0.001	-0.682**
X4	0.017	-0.003	-0.021	**0.285**	-0.054	0.254	0.264	-0.002	-0.001	0.738**
x5	0.018	-0.003	0.023	-0.271	**0.057**	0.299	0.299	-0.002	-0.001	0.777**
X6	0.011	-0.004	-0.015	0.197	-0.042	**0.367**	0.465	-0.002	-0.01	0.974**
X7	0.008	-0.005	-0.011	0.146	-0.033	0.331	**.0.516**	-0.002	-0.001	0.947**
X8	0.009	-0.004	-0.012	0.175	-0.036	0.348	0.319	**-0.002**	-0.001	0.894**
X9	0.010	-0.004	-0.013	0.176	-0.038	0.349	0.436	-0.002	**-0.001**	0.913**

Residual effect = 0.027

** Significant at 1% level of significance.

germination rate, fresh weight and dry weight of seedling and root and shoot length of seedling indicating their adverse effect of these characters. Singh (1987) made similar observation in sorghum.

Among the nine characters involved for path analysis (Deway and Lu, 1959), root and shoot length of seedling and germination (%) appeared to govern the vigour index directly with high positive values. These traits also had positive influence all characters, except seed moisture and electrical conductivity. Therefore, it indicated that the correlation among these traits and with vigour index explain ture relationship between them. Germination rate, fresh and dry weight of seedling had negative direct effect on vigour index though their correlation with vigour index were strong and significantly positive. This revealed that the indirect effects played major role. Under such situations, the indirect causal factors viz., shoot and root length of seedling and germination per cent are to be considered important. These findings are in agreement with the findings of Singh (1987) for sorghum and Mahajan and Nayeem (1989) for wheat.

Thus, from the correlation and path coefficient analysis it emerged that root and shoot length of seedling and germination per cent appear to be important components contributing to the vigour index directly and indirectly and thereby, help in estimating the planting value of seed lot and establishment of wheat crop.

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