

STUDIES ON SEED VIGOUR IN SORGHUM

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Studies made on the nature of association of different vigour tests with field emergence in sorghum (CSH 5) seeds revealed that standard germination, vigour index, germination after soaking them in sodium hydroxide and ammonium chloride solutions and rate of germination correlated positively and highly significantly with field emergence. Rate of germination exhibited the maximum correlation coefficient of 0.764 with field emergence. Among the germplasm varieties, Is 3096, Is 1025, Is 6991, Is 2971, Is 2625 and Is 3541 recorded more than 95 per cent germination after nine months of storage. Varieties varied in their sensitivity to NH_4Cl soak test.

Seed vigour is the sum total of those properties of the seed which determine the potential level of activity and performance of the seed or seed lot during germination and seedling emergence. Vigour can not be quantified because it is a concept (Perry, 1978) and only specified components or manifestations can be expressed numerically (Heydecker, 1972). A number of vigour tests are in vogue and the test showing the closest association with field emergence potential varied from crop to crop and variety to variety (Suryakumar, 1980)

Seed vigour is a physiological property, determined by the genotype and modified by environment (Perry-1972). Varieties for better germination and storability available among the germplasm collection may be incorporated in the breeding programme, so that varieties with yielding ability coupled with good seed vigour could be evolved.

Studies were initiated to fix the most suitable vigour test for CSH 5 hybrid sorghum seeds and to evaluate

the seed vigour in a few sorghum germplasm varieties.

MATERIALS AND METHODS

Forty samples (200 g each) of CSH 5 hybrid sorghum seeds received at the seed Testing Laboratory, Coimbatore during 1982 for testing were obtained. Estimations on percentage germination in between roll-towel medium (ISTA 1976), mean length of root and shoot of ten normal seedlings, dry weight of ten normal seedlings, vigour index (percentage germination x mean length of normal seedlings), germination after soaking in 5 per cent NaOH for 2 minutes (Vanderlip *et al.*, 1973) and after soaking in 8 per cent NH_4Cl solution for 8 hours (Abdullahi and Vanderlip, 1972), rate of germination using the formula proposed by Maguire (1962), electrical conductivity of seed leachate (Presley, 1958) and field emergence potential were made.

Selfed seeds were obtained from 30 sorghum varieties raised during January, 1983, dried to a moisture content of 10 per cent, packed untreated

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ed in cloth bags and stored under ambient conditions. After nine months, data were collected on (a) percentage germination, (b) root length, (c) shoot length, (d) dry weight of seedlings, (e) germination after soaking in NH_4Cl solution and (f) electrical conductivity of seed leachate.

Statistical analysis

Inter-correlations among the data obtained from individual vigour tests were worked out (Goulden, 1959). The data collected for sorghum varieties were analysed by the F test for significance following the methods described by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

A number of tests are in vogue for assessing the seed vigour in sorghum. However, the test that shows the closest association with field emergence varies from variety to variety (Suryakumar 1980).

Standard germination correlated significantly and positively with root length, vigour index, germination after soaking in sodium hydroxide and ammonium chloride solutions, rate of germination and field emergence and negatively with electrical conductivity of seed leachate (Table 1). Grabe (1964) reported a close association between standard germination and field emergence in corn. However, Bedford *et al.* (1971) found no associations between the level of laboratory germination and field emergence of spring wheat.

Woodstock (1969) regarded root growth as the criterion for assessing seed vigour in corn. In the present study,

positive and significant association was exhibited by root length with stand germination, vigour index, germination after soaking in NH_4Cl solution, rate of germination and field emergence. A positive association between root length and seed vigour was reported by Dutta (1979) in rice.

Shoot length of the seedlings did not correlate significantly with any of the parameters studied. However, Wold *et al.*, (1972) in sorghum reported significant association between shoot length and seed vigour.

According to Evans and Bhati (1977), dry weight of seedlings vigour in wheat. In the present study, dry weight correlated positively and significantly with rate of germination.

Vigour index values showed positive association with standard germination, root length, germination after soaking in NaOH as well as NH_4Cl solution, rate of germination and field emergence potential. Electrical conductivity of seed leachate correlated negatively with vigour index. Abdul-Baki and Anderson (1973) recommended vigour index as a criterion for the assessment of seed vigour in soybean.

Germination after treating with NaOH solution correlated positively with percentage germination, vigour index, germination after soaking in NH_4Cl solution, rate of germination and field emergence potential. Germination after treating with NaOH solution correlated negatively with electrical conductivity of seed leachate. Vanderlip *et al.*, (1973) in sorghum reported similar relationship.

Abdullahi and Vanderlip (1972) observed close correlation of ammonium chloride soak test with standard germination and field emergence in sorghum. In the present experiment, all vigour tests except shoot length, dry weight of seedlings and electrical conductivity showed highly significant and positive association. Shoot length and dry weight of seedlings indicated non-significant association. However, Yayock *et al.* (1975) found that in sorghum the ammonium chloride soak test had no consistent predictive value when applied to many seed lots over three years at several locations.

Associations of rate of germination with all vigour tests were significant and positive. Correlation with electrical conductivity was negative. Dutta (1979) obtained similar relationship between rate of germination and seed vigour in rice.

Electrical conductivity of seed leachate correlated negatively and significantly with all tests except root length, shoot length and dry weight of seedlings. Matthews (1973) utilized this technique in peas related it to emergence in soil.

Among the various vigour tests, the test which exhibits the closest association with field emergence is the rate of germination with a correlation coefficient of 0.764. Suryakumar (1980) found the vigour index value to possess the maximum association with field emergence in sorghum cv. CO 22 and CO 23. He further reported that in finger millet, tests showing such closest association varied from variety to variety.

For sorghum cv. CSH 5, the best vigour test is the rate of germination and this should be conducted in addition to the standard germination tests because, the aim of vigour test is to provide useful, accurate and reproducible information, supplementing that obtained in the standard germination test (Woodstock, 1973).

Among the various germplasm varieties studied, IS 3096, IS 1025, IS 6991, AS 147, AS 6002, IS 2071, IS 7270, CO 24, IS 8031, IS 6776, IS 2625, AS 5218, IS 3541, AS 5158 recorded more than 90 per cent germination. AS 520 recorded the lowest germination of 40 per cent (Table 2). Genotypic differences in seed vigour and storability had been reported earlier by Agrawal *et al.* (1981).

The vigour parameters such as root length, shoot length, dry weight of seedlings, germination after soaking in NH_4Cl solution and electrical conductivity also showed wide variation. The root length in AS 147, shoot length in IS 1025, dry weight of seedlings in CO 11, germination after NH_4Cl soak in IS 1025 were the highest. Electrical conductivity of seed leachate was the least in AS 6002.

Varietal sensitivity to NH_4Cl soak test was evident. AS 147 and IS 2625 which showed 92 and 96 per cent germination recorded only 0 and 4 per cent germination after soaking in NH_4Cl solution. Similar varietal sensitivity to NH_4Cl soak test was reported in sorghum by Krishnasamy (1982).

Table 1. Inter-correlations among different vigour parameters in the seeds of sorghum cv. CSH 8

Standard	Root length	Shoot length	Dry weight	vigour index	NaOH	NH ₄ Cl	Rate germination	E C	Field emergence
Standard germination	0.394*	-0.255NS	0.095NS	0.823**	0.566**	0.469**	-0.652	-0.653**	0.738**
Root length		0.226NS	-0.032NS	0.786**	0.272NS	0.380*	0.468**	-0.181NS	0.425**
Shoot length			-0.067NS	0.182NS	-0.150NS	-0.185NS	0.194NS	0.281NS	-0.214NS
Dry weight				0.014NS	0.197NS	0.208NS	0.372*	-0.280NS	0.291NS
Vigour Index					0.472**	0.433**	0.614**	-0.436**	0.648**
NaOH						0.697**	0.593**	0.661**	0.733**
NH ₄ Cl							0.596**	-0.648**	0.716**
Rate of germination								-0.583**	0.764**
E.C.									0.700**

NS - Not Significant; * - Significant at P = 0.05

** - Significant at P = 0.01

Table 2. Seed vigour in sorghum varieties

No	Germination (%)	Root length (cm)	Shoot length (cm)	Dry weight (mg)	Germination after soaking in NH ₄ Cl solution (%)	Electrical conductivity μ mhos/cm
IS 3096	98	15.4	14.9	53.5	67	45
IS 2235	74	21.9	17.6	80.0	0	67
IS 2380	62	18.7	16.5	57.0	1	71
IS 3597	90	19.6	15.4	79.5	53	37
IS 2872	84	22.9	17.1	87.0	21	83
IS 1025	100	23.8	23.9	105.5	74	36
IS 6891	100	19.4	14.6	80.0	62	29
IS 2464	80	15.1	15.5	60.5	3	52
Co 22	67	17.7	14.1	52.5	3	103
AS 147	92	23.9	20.6	91.5	0	57
AS 6002	94	19.9	19.2	79.0	57	28
IS 2071	98	22.8	19.4	77.5	56	51
IS 8336	82	19.6	20.5	110.0	50	49
IS 7270	92	18.4	14.7	57.5	50	52
IS 2998	62	12.7	17.1	56.0	17	57
Co 24	94	15.6	14.3	60.0	56	62
IS 8031	94	14.1	15.9	68.0	18	47
IS 6776	94	18.2	18.7	79.5	36	50
IS 2625	96	14.1	14.0	81.5	4	42
IS 2585	78	19.7	16.8	87.5	44	83
Co 11	82	19.1	14.1	126.5	45	66
IS 699	88	14.0	14.9	47.5	55	35
AS 5218	94	13.1	14.4	66.5	55	49
AS 5157	80	18.0	15.8	95.5	6	103
IS 3541	96	16.1	13.8	80.0	0	67
IS 3139	70	15.9	15.1	65.5	33	77
IS 3053	68	14.2	12.7	48.0	27	60
AS 5158	92	13.9	12.2	83.0	22	46
AS 5823	86	12.3	13.8	53.5	3	47
AS 520	40	14.8	16.4	58.0	0	81
CD (P = 0.05)	12.0	2.8	2.3	9.6	6.9	10.2

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