https://doi.org/10.29321/MAJ.10.A02764

Madras Agric. J. 69. (9): 600—604 September 1982

Relative Difference in seed vigour in sized seeds of Hybrid Sorghum CSH 5 and its Parents.

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Studies were carried out with the sized seeds of CSH 5 hybrid and its parents namely CS. 3541, ms. 2077 A and 2077 B. The seeds were size graded using 10, 9, 8, 7 and 5 round perforated metal sieves. The relative difference in seed vigour extant in seed size classes evaluated by a number of vigour tests such as germination energy, brick-grit test, chemical soak test, dry matter production and the vigour index revealed the superiority of the seeds retained by 10, 9 and 8 sieves both in the hybrid as well as in the parents. Seeds of the restorer line and the hybrid were superior to the isogenic male sterile and fertile lines in their vigour potential.

Information on seed size with reference to quality assumes importance while processing seed lots. Black (1957) Hyoung *et al.*, (1974) and Dhillon and Kler (1976) have critically reviewed the role of seed size on seed quality. In the present investigation five seed size classes of hybrid sorghum CSH 5 and its parents namely, CS.3541, ms, 2077 A and 2077 B were studied to bring out the differences in seed vigour adopting a number of vigour parameters

MATERIAL AND METHODS

The studies were carried out with seeds of hybrid sorghum CSH 5 (V_1) and its parents namely, CS.3541 (restorer line V_2) ms.2077 A (male sterile line, V_3) and 2077 B (female line, V_4) The seeds were size graded using 10, 9, 8, 7 and 5 round perforated metal sieves and the seeds retained in each one of the above sieves were designated as G_1 G_2, G_3, G_4 and G_5, respectively.

Seed vigour was evaluated tests, namely germination energy (Maguire, 1962), brick-grit test (Hiltner by the following and Ihssen, 1911), chemical sock test (Vanderlip *etal* , 1973) dry weight of root, shoot and the total seedling weight and vigour index (Abdul-Baki and Anderson. 1973).

RESULTS AND DISCUSSION

The results of statistical analysis o the data showed the existence of significant difference between size grades for the vigour parameters studied, namely germination energy, percentage of normal seedling in the brick-grit test, germination of seeds after soaking in ammonium chloride solution root and shoot weight of seedling, dry matter content of seedling and vigour index in all the varieties (Table 1 and 2). The singnificant interactiod between varieties and size grades obtained for germination after soaking in ammonium chloride solution. root and shoot weight, dry matter content and vigour index established superiority of the topf three grades.

The G_1 and O_2 seeds recorded significantly higher germination over

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other size grades. V_2 recorded significantly higher percentage than others. The interaction between seed size and varieties was significant (Table 1). The mean percentage of germination after soaking the seeds in ammonium chloride ranged from 10 to 61, 24 to 87, 9 to 69 and 10 to 51, respectively in V_1, V_2, V_3 and V_4. In G_1, G_2, and G_3 the mean germination was 59.2, 58.0 and 57.5 per cent, respectively. V_2 registered 59.0 per cent mean germination as against 40.2, 38.0 and 37.6 per cent recorded by V_1, V_3 and V_4, respectively.

The mean root weight of G_2 and G_3 seeds was 138 and 132 mg, respectively and was superior to G_1, G_4 and G_5. The mean root weight of V_1 was 114 mg and was distinctly higher than the values for V_2, V_3 and V_4. The mean shoot weight values were 362. 295, 222, 178 and 87 mg, respectively for G_1, G_2, G_3, G_4 and G_5. The mean dry matter content of seedlings from G_1 seeds was significantly more than those from other seed size grades.

The highest vigour index value of 38762 was recorded by G_1 seed. G_1 was superior to G_2, G_3, G_4 and G_5. The vigour potential of V_2 seed was significantly higher than those of V_1, V_3 and V_4.

Germination energy, a function of seed vigour, decreased with seed size and the values was very low for the last two grades. Higher values obtained for the first three grades elegantly brought out the higher vigour potential in them. Kneebone and Cramer (1955) in forage grasses, Maguire (1962) in aree seeds, Gordon (1969) in cereals and Egli and Tekrony (1973) in soybean suggested the usefulness of totality of germination and the rate with which the seedling emerged as a good measure of seed vigour. The seeds of the hybrid and restorer line had higher vigour potential than the isogenic lines.

The percentage of seedlings that were capable of emerging through a layer of brick-grit, indicated the physiological stamina of the seeds (Isley, 1957). The emergence was significantly more in the 10 and retained seeds as compared with others. The restorer line followed by the hybrid recorded higher percentage of normal seedlings suggesting their superiority over the isogenic lines.

The results obtained from the chemical soak test, projected an almost indentical picture. in which, the seeds from the top three grades withstood the injurious effects of ammonium chloride salt and putforth higher percentage of normal seedlings. As in the previous instances, the restorer line followed by the hybrid were able to endure the rigorous conditions better than others. The utility of this test to correlate the laboratory germination with field stand was suggested by Yayock *et al.*, (1975) and to bring out the incipient vigour differences in seeds (Vanderlip *et al.*, 1973).

The dry matter production which in turn depends upon the root and shoot growth indicated the rapidity with which the seedlings were able to grow and reach the autotrophic stage. The significant variations observed in these parameters was the reflection of the role of seed size in determining seedling growth. Slaci

(1957) noticed a greater absolute dry weight increase during early growth phases due to increase in seed size in subterranean clover. He suggested that the significance of seed size lay in the direct relationship between seed size and cotyledon area so that larger the seed size, greater the initial photosynthetic area which had contributed to increased dry weight. Similar trends were reported by Mc Daniel (1969) and Boyd *et al.* (1971) in barley, Gelmond (1972) in cotton, Singh *et al.* (1972) in soybean and Ries and Everson (1973) in Wheat.

The vigour index value arrived at by multiplying the field emergence percentage and the total dry matter content also yielded corroborative results. Abdul-Baki and Anderson (1973) had adopted this concept to differentiate the vigour potential of seed lots. The vigour potential of the hybrid and the parental lines resolved from each one of these parameters amply suggested the superiority of the restorer line closely followed by the hybrid over the isogenic male sterile and female lines.

REFERENCES

ABDUL-BAKI, A.A. and J.D. ANDERSON. 1973. Vigour determination in soybean seed by multiple criteria. *Crop Sci., 13* : 630-33.

BLACK, J.N., 1957. The early vegetative growth of three strains of subterranean clover (*Trifolium subterraneum* L.) in relation to seed size. *Aust. J. Agric. Res., 8* : 1-14.

BOYD, W. J. R., A. G. GORDON and L.T. LACROIX. 1971. Seed size, germination resistance and seedling vigour in barley. *Can. J. Pl. Sci., 51* : 93 - 99.

DHILLON, G. S, and R. S. KLER. 1976. Crop production in relation to seed size. *Seed Res., 4* : 143 - 55.

EGLI, D. B. and D. M. TEKRONY. 1973. Laboratory measurements of soybean seed quality for predicting field emergence. *Agron. Abstr.*, 52.

GELMOND, H. 1972. Relationship between seed size and seedling vigour in cotton (*Gossypium hirsutum*). *Proc. Int. Seed. Test. Ass.*, *37* : 797 - 802.

GORDON, A. G. 1969. The interaction of dormancy and water sansitivity of barley with temperature. *J. Inst. Brew.* 74 : 355.

HILTNER, W. and G. IHSSEN, 1911. Uber das schlechte Auflaufen and die Auswinterung des Getreides Infolge Befalls duch Fusarium Landwirtsch. *Fb. Bayern. 1* : 20 - 60.

HYOUNG, W. S., A. J. CASADY and R. L. VANDERLIP. 1974. Influence of sorghum seed weight on the performance of the resulting crop. *Crop. Sci., 14* : 835 - 36.

ISLEY, D. 1957. Vigour tests. *Proc. Ass. Off. Seed Anal.*, *47* : 176.

KNEEBONE, W. R. and C. L. CRAMER, 1955. The relationship of seed size to seedling vigour in some native grass species. *Agron. J., 47* : 472 - 77.

MAGUIRE, J.D. 1962. Speed of germination-aid in selection and evaluation for seedling emergence and vigour. *Crop. Sci. 2* : 176 - 77.

McDANIEL, R.G. 1969. Relationship of seed weight, seedling vigour and mitochondrial metabolism in barley. *Crop Sci., 91* : 823 - 27.

RIES, S.K. and E.H. EVERSON. 1973. Protein content and seed size relationship with seedling vigour of wheat cultivars. *Agron. J. 65* : 884 - 87.

SINGH, J.N., S.K. TRIPATHI and P.S. NEGI, 1972. Note on the effect of seed size on germination, growth and yield of soybean. *Indian J. Agric.*, : 82 - 86.

VANDERLIP, R.L., F.E. MOCKEL and H. JAN. 1973. Evaluation of vigour tests for sorghum seeds. *Agron. J* 65 : 486 - 88.

YAYOCK, J.Y., H. JAN and R.L. VANDERLIP, 1975. Temperature, time and NH_4C_1 concentration in vigour testing of sorghum seed *Agron. J.* 67: 241-42.

Table 1: Influence of seed size on germination energy, germination in brick-grit test and in ammonium chloride soak test in four cultivars of sorghum.

Seed Size	Germination energy					Brick-grit test (Germination % values transformed)					Chemical soak test (Germination % (valued transformed)				
	V_1	V_2	V_3	V_4	Mean	V_1	V_2	V_3	V_4	Mean	V_1	V_2	V_3	V_4	Mean
G_1	57.2	68 5	59.4	43.2		60.00	71.56	60.67	54.33	61.64	51.35	49.60	56.17	44.43	50.39
G_2	60.4	71.6	47.0	49.0	58.5	56.17	73.57	58.05	58.05	61.46	44.43	65.65	46.15	43.85	50.02
G_3	67.9	69.3	44.8	40.3	55.8	51.35	65.65	57.42	52.53	50.32	45.57	68.87	39.23	45.57	49.81
G_4	48.9	24.9	35 3	33.4	35.6	53.13	82.72	44.43	40.98	50.32	33.21	40.93	25.10	34.45	33.44
G_5	25.3	13.4	17.1	16.9	18.1	25.84	47.87	25.10	25.84	31.16	18.44	29.33	17.46	18.44	21.30
Mean	53.1	49.5	40.7	37:2		49.30	64.27	49.13	46.35		38.60	50.90	36.82	37 35	
C.D. (P — 0.05)	Grades				4.46	Grades				3.64	Grades				2.09
	Varieties				3.99	Varieties				3.26	Varieties				1.66
	Varieties X Grades				8.92						Varieties X Grades				4.16

Values in paranthesses are the respective arcsin transformations of the germination percentage, the corresponding CD values (arc-sin) are also given in peranthesis.

Table 2: Influence of seed size on root weight, shoot weight, total dry matter content and vigour index of four cultivars of sorghum.

Seed Size	Root weight (mg)					Shoot weight (mg)					Total dry matter content (mg)					Vigour index				
	V_1	V_2	V_3	V_4	Mean	V_1	V_2	V_3	V_4	Mean	V_1	V_2	V_3	V_4	Mean	V_1	V_2	V_3	V_4	Mean
G_1	186	135	110	96	132	345	325	386	393	362	531	460	483	489	492	43227	35887	37580	38354	38762
G_2	185	134	101	131	138	279	308	256	336	295	464	441	357	468	432	34710	37017	29187	40222	35284
G_3	95	113	92	108	102	190	250	224	224	222	285	361	315	331	323	24598	28470	24949	23577	25398
G_4	68	77	67	72	71	192	178	169	171	178	259	254	238	243	248	16965	19138	11665	12139	14977
G_5	34	71	29	29	41	92	96	86	75	87	126	167	115	103	128	6929	7817	4523	3334	5651
Mean	144	106	80	87		220	231	224	240		333	337	303	327		24286	25666	21581	23525	

C.D.	Grades	7.6	Grades	18.3	Grades Varieties	2.09	Grades	2307
(P=0.05	Varieties	7.0	Varieties x Grades	36.5		18.7	Varieties	2064
							Varieties x Grades	
	Varieties X Grades	15.7			Varieties X Grades	41.8		4615