

Rate of Germination, Seedling Vigour and Field Emergence in Pearl Millet Hybrids and their Parents

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Abstract Hybrids and the cytoplasmic male sterile lines had the same germination percentage, but the hybrids showed higher germination index and the rate as well. Hybrids also had higher dry weight per seedling, vigour index and seedling vigour in the field. Significant and positive correlations were found between standard germination and field emergence, and also between dry weight per seedling, vigour index and seedling vigour.

Key words Emergence, germination, pearl millet, vigour index

Seed quality is assessed by standard germination under optimum conditions. Field conditions are rarely optimum for seedling emergence and plant stand. Thus standard germination is often over-estimated by the field emergence. Data on germination rate can be used for the evaluation of seedling vigour in crops, particularly in pearl millet. Genotypes with similar standard germination, however, vary in germination rate. Fast seedling growth in pearl millet has been found to be associated with early seedling establishment and maturity which in turn can contribute favourably to grain yield and drought conditions. The present study provides information on rate of germination, seedling vigour and field emergence in pearl millet.

Materials and Methods

Seeds of five hybrids (Pusa 23, HHB 50, HHB 60, HHB 67 and MH 179), three male sterile lines (81A, 841A, and 843A) and four restorer lines (D 23, ICMP 451, H 90 4-5 and H 833-2) were used for the study. Fifty seeds of each genotype were kept between papers in the germination chamber at $25 \pm 1^\circ\text{C}$ in three replications. Normal seedlings were counted on the seventh day and were recorded as standard germination (ISTA 1976). Root and shoot length of five randomly selected seedlings were measured on the seventh day. The seedlings were dried in hot air oven at 80°C for 24 hours and their dry weight recorded. Vigour index was calculated

from, $(\text{Root length} + \text{shoot length}) \times \text{seedling dry weight}$ (Grabe 1976).

In another experiment, seedlings with at least 2 mm radicle or plumule were counted daily after sowing up to the 7th day, for all the genotypes. Germination index and rate were calculated as described by Maguire (1962).

A field experiment was also conducted in a randomized block design with three replications during *kharif*, 1990. In well pulverised soil, 100 seeds were sown and the seedlings which emerged were counted on the seventh day of planting. Twenty seedlings in each genotype were selected randomly and on 25th day of planting, seedling heights were measured at the highest point of an extended leaf to obtain seedling vigour in the field.

Results and Discussion

Germination percentage, index rate and field emergence of five hybrids, three cytoplasmic male sterile (CMS) lines and four restorer lines are given in Table 1 to illustrate the use of rate of germination in the evaluation and selection for field emergence and vigour. Hybrids and CMS lines had the same germination percentage, but hybrids germinated and emerged faster as was indicated by the higher germination index and rate which may be related to hybrid vigour. Field emergence was higher in hybrid Pusa 23, male sterile line 841A and restorer line H 833-2. These genotypes also had higher germination rate.

Table 1 Percentage, index and rapidity of seed germination and field emergence in pearl millet

Genotypes	Germination			Field emergence (%)
	Per cent	Index	Rate	
Pusa 23	95	268.00	22.12	57.30
MH 179	68	199.67	21.29	32.00
HHB 50	82	263.33	21.70	52.70
HHB 60	86	240.00	19.87	33.70
HHB 67	87	255.67	20.91	48.70
Mean	83	245.34	21.18	44.88
81A	86	230.67	18.86	33.70
841A	80	266.33	21.94	34.00
843A	86	231.33	18.70	28.30
Mean	84	242.78	19.83	32.00
D23	78	220.00	20.72	36.70
ICMP 451	56	198.33	16.49	21.30
H 90/4-5	86	268.67	22.05	40.30
H 833-2	84	276.33	22.63	60.00
Mean	76	240.83	20.47	39.58
C.D. at 5%	2.80	24.20	2.45	4.28

Vanangamudi & Natarajaratnam (1984) recorded relatively high values for germination, rate of germination and vigour index for high yielding genotypes as compared to the medium and low

yielders.

Hybrids showed relatively higher values for dry weight per seedling, vigour index, seedling

Table 2 Dry weight seedling, vigour index and seedling vigour of hybrids, male sterile and restorer lines of pearl millet

Genotypes	Dry weight (g seedling ⁻¹)	Vigour index	Seedling vigour	Grain yield per plant (g)
Pusa 23	8.0	234.4	64.3	41.6
MH 179	9.7	224.4	56.6	34.3
HHB 50	9.7	260.8	50.4	37.0
HHB 60	9.0	251.6	56.4	32.0
HHB 67	12.0	321.9	66.0	39.3
Mean	9.6	260.4	58.7	36.8
81A	5.8	144.6	40.6	12.0
841A	6.5	149.1	41.3	21.6
843A	7.7	176.1	43.1	14.6
Mean	6.6	156.6	41.6	16.1
D23	8.7	209.2	48.5	16.6
ICMP 451	8.4	191.8	43.6	30.3
H 90/4-5	7.0	147.6	38.6	11.6
H 833-2	7.5	161.8	42.3	14.0
Mean	7.9	177.6	43.2	18.1
C.D. at 5%	1.6	42.0	2.9	3.3

Table 3 Correlation coefficients between germination field emergence and other seedling traits in pearl millet

	Germination	Field emergence	Dry weight seedling ¹	Vigour index	Seedling vigour	Grain yield/plant
Germination	1.0000	0.5823*	-0.2181	0.0466	0.1637	0.1503
Field emergence		1.0000	0.1443	0.2721	0.2811	0.0629
Dry weight seedling ¹			1.0000	0.9100**	0.7400**	0.6743**
Vigour index				1.0000	0.8827**	0.5525*
Seedling vigour					1.0000	0.7947**
Grain yield/plant						1.0000

** , * = Significant at $p = 0.01$ and 0.05 levels, respectively.

vigour and grain yield as compared to A and R lines in Table 2. Result of present findings are similar to that of Woodstock & Feeley (1965) in corn. Qualls & Cooper (1968) also concluded that the seedling vigour is usually characterised by the weight of the seedling after a certain period of growth. Among the hybrids, HHB 67 had higher values for these parameters. Similar was the case with male sterile line 843A and restorer line D23.

Simple correlation coefficients are indicated in Table 3 above. A significant and positive correlation was observed between standard germination and field emergence. Thus standard germination can be used reliably for working out the field germination. Dry weight per seedling had positive correlation with vigour index and seedling vigour. Vigour index recorded in laboratory had significant positive correlation with seedling vigour in the field. Significant positive correlations were observed between grain yield per plant and dry weight per seedling, vigour index and seedling vigour. Accordingly the dry weight per seedling and vigour index are important

in screening out superior genotypes for dryland areas. Similar results were also obtained by Vanangamudi & Natarajaratnam (1984) and Aswathaiah & Ramaswamy (1987). The earlier view that standard germination over-estimates the field germination, needs investigation.

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