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QUANTITATIVE VARIABILITY IN THIN AND THICK SOWN FODDER SORGHUM (Sorghum dochna)

A. AMIRTHADEVARATHINAM and R. SANKARAPANDIAN

Agricultural Research Station, Kovilpatti

ABSTRACT

Thickly sown sorghum was characterised by reduced mean for all characters other than plant stand, fodder yield, total soluble solids and days to 50% flowering. In spite of the reduction in mean for majority of characters in thickly sown sorghum, there was 11% increase in the total dry matter production mostly accounted by an increased number of plants. Thinly sown sorghum had a high harvest index (19.1) indicating the efficient partitioning of the dry matter more in favour of grain formation as compared to 10.7 in thickly sown sorghum. Plant height, stem thickness, leaf length, total soluble solids and days to 50% flowering had a high degree of genotypic variability in both the thin and thick sown sorghum. The genetic coefficient of variability varied with the character and also with the thin or thick sowing. Differential heritability values in thin and thick sown sorghum were recorded for fodder yield, earhead length, earhead weight and stem thickness. Total soluble solids in both the thin and thick sown sorghum and grain yield and stem thickness in thick sown sorghum had high heritability combined with high genetic advance and this indicated that individual plant selection would be effective in improvement of these characters.

KEY WORDS : Fodder Sorghum, Variability.

Information on the performance of fodder sorghum with a much less dense population due to adoption of a low seed rate (15 kg/ha) would help examining the the possibility of obtaining higher grain and fodder production. The present study was undertaken with the object of assessing the performance of fodder sorghum under thin seed sowing and compare the same with thick seed sowing with reference to a set of thirteen characters of fodder and grain yield.

MATERIALS AND METHODS

Thirty genotypes of fodder sorghum comprised of local cultivars, improved strains and breeding lines were grown in a randomised block design with three replications in plots of 4.0 x 2.7 m during the north-east monsoon season of 1987-88 (Oct.-Jan) in the farm fields at the Agricultural Research Station, Kovilpatti. A seed rate of 15 kg/ha for thin and 100 kg/ha for thick seed sowing was adopted. Seeds intended for thin seed sowing were hand drilled in rows spaced at 45 cm, followed by thinning after seven days of germination leaving one seedling at every 15 cm in the row. For thick seed sowing, seeds were broadcasted and left as such on germination with no thinning. Plant stand was recorded as the actual number of plants in an area of 1 m^2 in each plot. Fodder yield grain yield and days to 50% flowering were recorded on plot basis. Total soluble solids was recorded. Analysis of variance was done using the mean values. The genetic coefficient of variation, heritability in broad sense and expected genetic gain as per cent of mean were calculated following the methods by Burton (1952), Hanson *et al.*, (1956) and Johnson *et al.*, (1955) respectively.

RESULTS AND DISCUSSION

A wide range of variation was observed for all characters except plant stand in thin sown sorghum. The range of variability was substantial and high for plant height, stem thickness, leaf length, total soluble solids and earhead length in both the thin and thick sown sorghums. Fodder yield in thin and plant stand in thick sowing were also found with higher range of variability. Plant

stand, fodder yield, total soluble solids and days to 50% flowering had greater base level of range and also mean in thick sown sorghum and for rest of the nine characters the base level of range and mean were greater in thin sown sorghum. The extent of reduction in mean ranged from 17% in earhead length to 67% in stem thickness. Earhead weight, earhead width, grain yield, plant height, Leaf length, leaf width and number of leaves were other characters that were found with noticeable reduction in mean values. Though thick sowing had reduced mean for many characters relating to fodder and grain yield, the total dry matter production increased by 11% compared to thin sowing, mostly due to an increased number of plants. Thin sowing with a harvest index of 19.1 was far superior in partitioning the dry matter more in favour of grain formation than thick sowing with a low harvest index of 10.7. If only the height of the thin sown sorghum can be reduced considerably by means of adoption of a higher seed rate than for normal sowing, it may certainly possible to advance the harvest index along with the maintenance of the level of production of fodder combined with thinness of straw, an attribute most preferred in fodder sorghum. The differences in between the mean values in thin and thick sown sorghum were significant for all characters excepting total soluble solids pointing out to the influence of environment, particularly the plant population.

Based on mean values for different characters, thin sown sorghum was found to be distinctly different from thick sown sorghum. Similar was the case with the genotypes, sown either thin or thick, that exhibited highly significant differences for all the thirteen characters under study. Plant height, stem thickness, leaf length, total soluble solids, plant stand and days to 50% flowering had a high degree of genotypic variability in both the thin and thick sown sorghums. As regards the magnitude of genotypic variability, it was nearly the same in both the thin and thick sown sorghum for fodder yield, number of leaves, earhead weight and leaf width. The genotypic variance for plant height and earhead length was greater in thin than in the thick sown sorghum. Similarly, the estimates for total soluble solids, days to 50% flowering, leaf length and stem thickness were greater in thick than in thin sowing (Table 1).

The genetic coefficient of variation varied with the character and also with the thin or thick sowing (Table 2). Days to 50% flowering recorded the lowest and total soluble solids the highest genetic coefficient of variability in both the thin and thick sowing. The estimate of genetic coefficient of variability for plant height and earhead length was nearly the same in both. The estimated genetic coefficient of variation for earhead width was greater in thin sown sorghum and for rest of the ten characters it was greater in thick sown sorghum. The genetic coefficient of variability would indicate the extent of genetic diversity for a character. The heritability estimates would be of value to the breeder in selecting genotypes based on phenotypic performance. Estimates of heritability (in broad sense) were high for eight characters *viz.*, grain yield, total soluble solids, days to 50% flowering, plant height, number of leaves, leaf length, leaf width and earhead width in both the thin and thick sown sorghums. Even though a vast majority of the characters recorded high estimates of heritability, it varied with the character and it ranged from 61.0% in leaf width in thick sowing to 98.7% in plant height in thin sowing. Differential heritability values were also recorded for fodder yield, earhead length, earhead weight and stem thickness in thin and thick sowings. What was moderate for fodder yield and earhead length in thick sown sorghum and for

Table 1. Mean, range, phenotypic and genotypic variance for different characters in fodder sorghum sown under thin (TN) and thick seeded (TK) conditions.

Characters	Mean		Range		Variety (MSS)		Error(MSS)		Phenotypic variance		Genotypic variance	
	TN	TK	TN	TK	TN	TK	TN	TK	TN	TK	TN	TK
Plant stand/m^2	15.1	37.6**	1.4-1.5	20.9-55.3	10.7**	66.9**	12.1	9.5	NE	28.6	NE	19.2
Fodder yield (kg)	8.8	10.7**	5.3-12.3	8.3-12.5	4.7**	4.3**	0.8	0.9	1.9	2.0	1.2	1.2
Grain yield (kg)	2.1**	1.3	1.8-2.7	0.8-1.9	0.3**	0.5**	0.01	0.01	0.1	0.2	0.1	0.2
Total soluble solid (Brix reading)	9.9	10.0	3.6-18.2	3.8-19.8	37.2**	62.5**	1.7	0.7	13.5	21.3	11.8	20.6
Days to 50% flowering	64.4	66.8**	62.0-67.0	63.0-70.0	4.4**	7.5**	0.6	0.6	1.8	2.9	1.3	2.3
Plant height (cm)	310.9**	210.6	230.0-235.0	158.0-260.0	75.6**	52.6**	25.2	18.0	44.6	933.7	43.62	915.6
Number of leaves	11.2**	9.1	9.0-12.0	8.0-11.0	3.0**	3.2**	0.1	0.2	1.0	1.2	1.0	1.0
Leaf length (cm)	73.9**	51.6	62.0-81.0	36.0-66.0	168.9**	231.3**	1.1	2.0	57.0	78.4	56.0	76.4
Leaf width (cm)	6.1**	4.7	4.0-7.0	3.0-6.0	2.3**	2.2**	0.1	0.4	0.8	1.0	0.7	0.6
Earhead length (cm)	24.8**	20.5	21.8-28.5	14.6-27.4	4.5**	4.6**	0.4	1.5	1.8	2.6	1.4	1.0
Earhead width (cm)	6.2**	3.8	4.8-9.0	1.8-6.3	2.5**	1.7**	0.10	0.1	0.7	0.8	0.5	0.8
Earhead weight (g)	3.2**	1.5	2.4-4.2	0.6-2.6	0.4**	0.5**	0.1	0.1	0.2	0.2	0.1	0.1
Stem thickness(mm)	11.0	3.7	8.8-13.1	3.3-5.0	345.6**	433.6**	76.0	20.4	165.9	158.1	89.8	137.7

NE : Not Estimatable

** : Significant at 1% level of significance.

Table 2. Genotypic coefficient of variability (gcv), heritability (h^2) and expected genetic gain as percentage of mean (ga) for different characters in fodder sorghum sown under thin (TN) and thick (TK) seeded conditions.

Characters	gcv		h^2		ga	
	TN	TK	TN	TK	TN	TK
Plant stand	NE	11.65	NE	66.69	NE	19.64
Fodder yield	8.91	10.00	61.13	57.30	10.30	15.62
Grain yield	14.89	29.72	95.00	93.60	29.92	59.28
Total soluble solide	34.57	45.23	87.22	96.85	64.59	89.10
Days to 50% flowering	1.65	2.28	70.27	80.00	3.04	3.76
Plant height	14.34	14.37	98.69	98.07	28.67	29.31
Number of leaves	8.85	11.13	94.66	85.94	17.74	21.26
Leaf length	10.12	16.92	98.14	97.40	20.65	33.96
Leaf width	13.98	16.72	85.71	61.00	26.62	26.90
Earhead length	4.72	4.91	77.40	39.71	8.55	6.38
Earhead width	14.62	11.94	98.40	78.83	29.88	21.87
Earhead weight	2.37	10.71	55.93	65.38	15.80	17.87
Stem thickness	8.58	31.96	54.10	87.12	14.04	61.45

N . E . : Not Estimable

earhead weight and stem thickness in thin sown sorghum turned out to be high in the respective counterpart. Such differential heritability values under stress and non-stress conditions have also been reported by Majumdar *et al.*, (1969) in groundnut.

Estimates of genetic advance expressed as percentage of mean indicated large differences among the thirteen characters and between the thin and thick sowings. The estimates of genetic advance in all characters were greater in thick than in thin sown sorghum. Total soluble solids in both the thin and thick sown sorghum had high genetic advance. Grain yield and stem thickness in thick sown sorghum also had high genetic advance. Moderate estimates of genetic advance were obtained for plant height, leaf length, leaf width, earhead width; number of leaves and earhead weight in both the thin and thick sown sorghum. Days to 50% flowering had the lowest genetic advance. Those characters *viz.*, total soluble solids in both the thin and thick sown sorghum and grain yield and stem thickness in thiick sown sorghum that had high genetic advance had also high heritability values indicating that high heritability obtained in these characters was due to additive gene effects and individual plant selection would be effective (Panse, 1957). Though days to 50% flowering had high heritability it had low genetic advance pointing out to the operation of nonadditive gene effect in this trait.

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