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Original Research Article

Genetic Variability, Heritability and Genetic Advance for Seed Quality Parameters in some of the Land Races of Sorghum

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A B S T R A C T

Ninety-nine landraces of kharif sorghum were evaluated for six seed quality characters. The study revealed that the characters grain mold rating and seed hardness showed high GCV and PCV values indicating thereby large amount of variation in these characters. All the characters showed close GCV and PCV values indicating less influence of environment of these characters. The high heritability estimates were observed for all the characters indicating that these characters would respond positively to selection. The high values of expected genetic advance over mean were recorded for the characters like threshed grain mold rating, seed hardness and electrical conductivity. The threshed grain mold rating and seed hardness exhibited high heritability along with high value of expected genetic advance per cent over mean which indicated the importance of these traits for selection. High values of heritability along with low value of expected genetic advance were observed for the characters like electrical germination percentage of seed, vigour index of seed and specific gravity of seed and heterosis breeding can be fruitfully exploited improving these characters.

Keywords

GCV, Genetic advance heritability, PCV, Sorghum

Introduction

Sorghum is one of the important crops of dry land agriculture. In a systematic breeding programme, collection and evaluation of germplasm is the first step. The adequacy of germplasm collection is determined by the amount of genetic variability with their nature and magnitude in it. Variability is the prerequisite for the effective selection. In order to broaden the genetic base, there is need to exploit the unused germplasm and the land races. The land races are the varieties nurtured and cultivated by the farmers though traditional method of selection by over the decades. The land race is a primitive cultivar grown by the farmers and their successors since ancient times. These land races are

store houses of the genetic variability and ordinarily are adapted to local soil types, climatic conditions etc. They are sources of many valuable genes including those for adaptation. So there is need to conserve and study the characteristic of land races and their further utilization in the breeding programme.

Therefore, the present study was undertaken to study the genetic parameters such as variance, coefficient of variation, heritability and genetic advance in the kharif sorghum land races.

Materials and Methods

Ninety-nine land races of kharif sorghum received from Directorate of Sorghum Research (DSR), Hyderabad were sown at Sorghum Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS) during kharif 2011-2012. Material was sown in randomized block design. Observations were recorded on the six characters like seed hardness (kg/cm^2), threshed grain mold rating (%), specific gravity of seed (g/ml), germination percentage of seed, vigour index of seed and electrical conductivity (dsm^{-1}). Seed hardness was measured as the physical strength required in kg/cm2 to break the kernel using kiya hardness tester.

Grains of same moisture content were used for observations. Five kernels of each genotype were tested for their strength to break and mean was calculated and hardness is expressed in kg/cm^2. Electrical conductivity of the grain leachates was measured using the method of Hendricks and Tylorson (1976). Analysis of variance was done as per the method suggested by Panse and Sukhatme (1967). Genotypic and phenotypic coefficients of variation were estimated as per formulae given by Burton (1951). Heritability and genetic advance were estimated as per Johnson *et al.*, (1955).

Results and Discussion

The analysis of variance indicated highly significant differences among the genotypes for all the characters under study. High magnitude of variation in the experimental material was also reflected by wider range for all the characters under study (Table 1). Seed hardness ranged from 4.03 to 10.13 kg/cm^2 (Table 1). Lowest seed hardness of 4.03 kg/cm^2 was observed in genotype EB-6 and highest seed hardness was exhibited by the genotype GGUB-57 (10.13 kg/cm^2). Threshed grain mold rating ranged from 3.06 to 11.36 %. The lowest rating of 3.06 % was recorded in genotype GGUB-57 and highest rating was recorded in genotype GGUB-21(11.36 %). Specific gravity of seed varied from 0.98 to1.08 g/ml. Minimum specific gravity of seed was shown by the genotype EA-10 (0.98 g/ml) and maximum specific gravity of seed was shown by the genotype GGUB-57(1.08 g/ml). Germination percentage of seed ranged from 71.50 to 86.00. Lowest germination was observed in the genotype GGUB-21 (71.50%) and the highest germination was observed in the genotype E-106 (86.00%). Vigour index of seed varied from 10.01 to 16.84. Minimum vigour index of seed was observed in the genotype GGUB-51 (10.01) and maximum vigour index of seed was observed in the genotype ERN-11 (16.84). Electrical conductivity ranged from 0.79 to 1.46 dsm^{-1}. Lowest electrical conductivity was observed in the genotype GGUB-21 (0.79 dsm-1) and highest electrical conductivity was observed in the genotype GUB-29 (1.46 dsm^{-1}). The Genotypic coefficient of variation, Phenotypic coefficient of variation, Heritability in broad sense and Expected Genetic Advance per cent over mean for various characters are presented in Table 2. The genotypic coefficient of variation (GCV) ranged from 1.66 to 38.97 % for different character under study (Table 2). The highest

order value of genotypic coefficient of variation was observed for threshed grain mold rating (38.97%) followed by seed hardness (26.78%), electrical conductivity (15.75%), vigour index of seed (11.23%), germination percentage of seed (4.30%) and specific gravity of seed (1.66%). The phenotypic coefficient of variation (Table 2) ranged from 2.00 to 39.15 percent for various characters under study. Highest phenotypic coefficient of variation was observed for the character Threshed Grain Mold Rating (39.15%) followed by seed hardness (27.25%), plant height (20.20%), electrical conductivity (15.99%), vigour index of seed (13.07%), germination percentage of seed (4.64%) and specific gravity of seed (2.00%).

The characters threshed grain mold rating and seed hardness showed high GCV and PCV values indicating thereby large amount of variation for these characters. Low GCV and PCV values were found for the characters electrical conductivity, vigour index of seed, germination parentage of seed and specific gravity of seed indicating small amount of variation. For threshed grain mold rating similar results were obtained by Rathod (2005) and Deepalaxmi and Ganeshmurty (2007). For seed hardness Rathod (2005) recorded the similar results. Low GVC and PCV for electrical conductivity, germination percentage of seed and specific gravity of seed were reported by Rathod (2005). All the characters showed close GCV and PCV values indicating less influence of environment of these characters. With the genotypic coefficient of variation, it is difficult to determine the relative amounts of heritable and non heritable components of variation present in the population. Estimates of heritability and genetic advance would supplement this parameter. The heritability in broad sense ranged from 69.28 to 99.08 percent (Table 2). The highest heritability estimate in broad sense was observed for threshed grain mold rating (99.08%) followed by electrical conductivity (97.08%), seed hardness (96.53%), germination percentage of seed (75.56%), vigour index of seed (73.81%) and specific gravity of seed (69.28%) (Table 2). These characters would respond positively to selection because of their high broad sense heritability. High heritability estimates for threshed grain mold rating were reported by Rathod (2005) and Deepalaxmi and Ganeshmurty (2007). For character electrical conductivity and seed hardness, high heritability estimates were reported by Rathod (2005). For the character germination percentage of seed, similar results were reported by Thorat *et al.,* (2005). High heritability estimates in broad sense for the character specific gravity of seed, was reported by Rathod (2005) and Thorat *et al.,* (2005).

Expected genetic advance over mean ranged from 2.85 to 79.90% (Table 2). The high values of expected genetic advance over mean were recorded for the characters threshed grain mold rating (79.90%), seed hardness (54.19%) and electrical conductivity (31.97). For the character threshed grain mold rating results were in conformity with results of Rathod (2005), Deepalaxmi and Ganeshmurty (2007) and Godbharle *et al.,* (2010). For seed hardness similar results were obtained by Rathod (2005).

In general, high heritability accompanied with high expected genetic advance for characters suggest that the genes governing these characters may have additive effect. It can be mentioned here that characters threshed grain mold rating and seed hardness exhibited high heritability values along with high values of expected genetic advance. The phenotypic expression of these characters may be governed by the gene acting additively and thereby indicating the importance of these characters for selection.

Table.1 Range, mean and the best genotype for different characters

S No	Character	Range	Mean	Best genotype
1	Seed hardness (kg/cm^2)	4.03 -10.13	7.08	GGUB-57
2	Threshed grain mold rating (%)	3.06 - 11.36	7.21	GGUB-57
3	Specific gravity of seed (g/ml)	0.98 -1.08	1.03	GGUB-57
4	Germination % of seed	71.50 – 86.00	78.75	E-106
5	Vigour index of seed	10.01-16.84	13.42	ERN-11
6	Electrical conductivity (dsm^{-1})	0.79 - 1.46	1.12	GGUB-21

Table.2 Estimation of genetic parameters –GV, PV, GCV, PCV, h^2 and EGA

S No	Character	Genotypic variance	Phenotypic variance	Genotypic coefficient of variation	Phenotypic coefficient of variation	h^2 %	EGA as % over mean
1	Seed hardness (kg/cm^2)	3.517	3.643	26.78	27.25	96.53	54.19
2	Threshed grain mold rating (%)	5.599	5.561	38.97	39.15	99.08	79.90
3	Specific gravity of seed (g/ml)	0.0003	0.0004	1.66	2.00	69.28	2.85
4	Germination % of seed	11.446	15.150	4.30	4.64	75.56	7.70
5	Vigour index of seed	2.474	3.353	11.23	13.07	73.81	19.88
6	Electrical conductivity (dsm^{-1})	0.030	0.0316	15.75	15.95	97.08	31.97

For threshed grain mold rating similar finding were reported by Godbharle *et al.,* (2010) for high heritability estimates along with high values of expected genetic advance. For seed hardness similar findings were reported by Rathod (2005).

Moderate values of expected genetic advance percent over mean was observed for the character vigour index of seed (19.88) while low values for germination percentage of seed (7.70) and specific gravity of seed (2.85). For the character specific gravity of seed, similar results were reported by Rathod (2005) and Thorat *et al.,* (2005). High values of heritability along with low value of expected genetic advance were observed for the characters like germination percentage of seed, vigour index of seed and specific gravity of seed. Regarding these characters, the heritability is mainly due to non additive gene effect (dominance and epitasis) hence the expected genetic advance would be low.

Since the characters are mainly governed by non additive component of variation which is non fixable, heterosis breeding can be fruitfully exploited improving these characters. Thorat *et al.,* (2005) reported high value of heritability along with low values of expected genetic advance for specific gravity of seed.

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