

Genetic variability, heritability and genetic advance for grain yield and yield components in sorghum

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ABSTRACT

Twenty six derived lines (named as AKENT number) along with one resistant line and two susceptible lines of Kharif sorghum were evaluated for yield and yield components. High genotypic coefficient of variation was observed for the character fodder yield per plant (27.31%) followed by 1000-seed weight (25.33%) whereas moderate for panicle breadth (15.17%), plant height (14.36%) and grain yield per plant (13.94%) and low for the character 50 per cent flowering (7.96%). High phenotypic coefficient of variation was observed for the character fodder yield per plant (27.86%) followed by 1000-seed weight (26.78%) and panicle breadth (21.25%) whereas moderate for plant height (16.27 %) and grain yield per plant (15.24 %) and low for the character days to 50 per cent flowering (10.94 %). High heritability in broad sense was recorded for fodder yield per plant (96%), 1000-seed weight (89.4), grain yield per plant (83.6) and plant height (77.9), while moderate heritability was recorded for days to 50 per cent flowering (52.9%) and panicle breadth (50.9%). The highest genetic advance percentage over mean was observed for the character fodder yield per plant (55.14%) followed by 1000-seed weight (49.35%), grain yield per plant (26.25%), plant height (26.10%) and panicle breadth (22.32%) while for days to 50 per cent flowering the expected genetic advance was moderate (11.93%). The characters fodder yield per plant, 1000-seed weight, grain yield per plant and plant height exhibited high heritability values along with high values of expected genetic advance. The phenotypic expression of these characters may be governed by the genes acting additively and thereby indicating the importance of these characters for selection.

Keywords: GCV; genetic advance; heritability; PCV; sorghum

INTRODUCTION

Sorghum is one of the important food grain crops of the country. Yield being a polygenic character is highly influenced by the fluctuations in environment. Hence selection of plants based directly on yield would not be very reliable. Improvement in sorghum yield depends on the nature and extent of genetic variability, heritability and genetic advance in the base population (Elangovan et al 2013, Seetharam and Ganeshmurthy 2013). Genetic variability studies provide basic information regarding the genetic properties of the population based on which breeding methods are formulated for further improvement of the crop. These studies are also helpful to know about the nature and extent of variability that can be attributed to different causes, sensitive nature of the crop to environmental influences, heritability of the

characters and genetic advance that can be realized in practical breeding. The progress in any crop improvement venture depends mainly on the magnitude of genetic variability and heritability present in the source material. Since the heritability is also influenced by environment, the information on heritability alone may not help in pin-pointing characters enforcing selection. Nevertheless the heritability estimates in conjunction with the predicted genetic advance will be more reliable (Johnson et al 1955). Heritability gives the information on the magnitude of inheritance of quantitative traits while genetic advance is helpful in formulation of suitable breeding procedures. 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 derived lines.

MATERIAL and METHODS

Twenty six derived lines (named as AKENT number) were selected to study the variability for yield and yield components. These lines had been derived from involvement of at least one resistant parent in their crossing programme and were supposed to be with resistant blood for shoot fly reaction. In addition to these 26 lines, one resistant line (IS 18551) and two susceptible lines (AKMS-14 B, DJ-6514) were used in the present study. Most of the entries were having good agronomic background. The experiment was laid out in randomized block design at Sorghum Research Unit, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra during Kharif 2013. Observations were recorded on six characters like days to 50 per cent flowering, plant height, panicle breadth, 1000-seed weight, fodder yield per plant and grain yield per plant. 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 (Table 1). Days to 50 per cent flowering ranged from 61 (AKENT-116) to 88.67 (IS-18551), plant height from 72.33 (AKENT-115) to 134.66 cm (AKENT-107), panicle breadth from 2.71 (AKENT-104) to 5.32 cm (AKENT-108), 1000-seed weight from 16.50 (AKENT-106) to 50.64 g (AKENT-107), fodder yield per plant from 72.6 (AKENT-115) to 192.6 g (AKENT-117) and grain yield per plant from 40.20 (AKENT-124) to 66.6 g (AKENT-117).

The genotypic coefficient of variation (GCV), phenotypic coefficient of variation, heritability in broad sense and expected genetic advance percentage over mean for various characters are presented in Table 2. The genotypic coefficient of variation ranged from 7.96 to 27.31 per cent for various characters under study. High genotypic coefficient of variation was observed for the character fodder yield per plant (27.31%) followed by 1000-seed weight (25.33%) whereas moderate for panicle breadth (15.17%), plant height (14.36 %) and grain yield per plant (13.94 %).

Character 50 per cent flowering showed low magnitude of genotypic coefficient of variation (7.96 %).

The phenotypic coefficient of variation (PCV) (Table 2) ranged from 10.94 to 27.86 per cent for various characters. High phenotypic coefficient of variation was observed for the character fodder yield per plant (27.86%) followed by 1000-seed weight (26.78%) and panicle breadth (21.25%) whereas moderate for plant height (16.27 %) and grain yield per plant (15.24 %). The character days to 50 per cent flowering showed low magnitude of phenotypic coefficient of variation (10.94%)

The characters fodder yield per plant and 1000-seed weight showed high GCV and PCV values. It indicated that there was greater scope for improvement in these traits either by direct selection among the collection of genotypes or by involving chosen parents in hybridization. For fodder yield per plant similar results were obtained by Godbharle et al (2010) and Arunkumar (2013b). Moderate values of PCV and GCV were recorded for plant height and grain yield per plant indicating that these were amenable for improvement. Similar results were reported by Mahajan et al (2011). Arunkumar (2013a) also reported moderate values of GCV and PCV for grain yield/ha. Low GCV and PCV values were observed for days to 50 per cent flowering which is in agreement with Mahajan et al (2011) and Dhutmal et al (2014).

The genotypic coefficient of variation is not sufficient to determine the amount of variation which is heritable. Burton (1951) also made clear that the heritable variation cannot be estimated through genetic coefficient of variation and as such the genotypic coefficient of variation together with heritability would furnish the most reliable information on the magnitude of genetic advance to be expected from selection. In the light of this explanation heritability was calculated to assist the breeder in choosing the characters that can be relied upon for selection.

The present study revealed high heritability in broad sense for fodder yield per plant (96.0%), 1000-seed weight (89.4), grain yield plant (83.6) and plant height (77.9) indicating that these characters would respond positively to selection because of their high broad sense heritability. Moderate heritability was recorded for days to 50 per cent flowering (52.9%) and panicle breadth (50.9%). For fodder yield per plant high heritability estimates were reported by Jain and

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

Character	Range	Mean	Best genotype
Days to 50% flowering	61.00-88.67	72.97	AKENT-116
Plant height (cm)	72.33-134.66	93.63	AKENT-107
Panicle breadth (cm)	2.71-5.32	3.82	AKENT-108
1000-seed weight (g)	16.5-50.64	35.85	AKENT-107
Fodder yield/plant (g)	72.66-192.6	101.66	AKENT-117
Grain yield/plant (g)	40.2-66.66	48.78	AKENT-117

Table 2. Estimation of genetic parameters

Character	Genotypic coefficient of variation	Phenotypic coefficient of variation	h ² (%)	EGA as % over mean
Days to 50% flowering	7.96	10.94	52.9	11.93
Plant height (cm)	14.36	16.27	77.9	26.10
Panicle breadth (cm)	15.17	21.25	50.9	22.32
1000-seed weight (g)	25.33	26.78	89.4	49.35
Fodder yield/plant (g)	27.31	27.86	96.0	55.14
Grain yield/plant (g)	13.94	15.24	83.6	26.25

Patel (2012). For grain yield per plant and plant height similar high heritability estimates were reported by Seetharam and Ganeshmurthy (2013). Dhutmal et al (2014) also reported high heritability for grain yield per plant. Elangovan et al (2013) reported moderated heritability for days to 50 percent flowering and panicle breadth.

Expected genetic advance percentage over mean was estimated for different characters and it was observed that it was in the range of 11.93 to 55.14 per cent for different characters. The highest genetic advance percentage over mean was observed for the character fodder yield per plant (55.14%) followed by 1000-seed weight (49.35%), grain yield per plant (26.25%), plant height (26.10%) and panicle breadth (22.32 %).

All the characters except days to 50 per cent flowering recorded high genetic advance percentage over mean. For days to 50 per cent flowering the expected genetic advance was moderate (11.93%). For the character fodder yield per plant similar findings were obtained by Godbharle et al (2010). Higher values of genetic advance for grain yield per plant and plant height were reported by Seetharam and Ganeshmurthy (2013) and Dhutmal et al (2014). Higher values of expected genetic advance for plant height and panicle breadth along with moderate value of expected genetic advance for days to 50 per cent flowering are in conformity

with the results of Elangovan et al (2013).

In general high heritability accompanied with high expected genetic advance for the characters suggests that the genes governing these characters may have additive effect. It can be mentioned here that the characters fodder yield per plant, 1000-seed weight, grain yield per plant and plant height exhibited high heritability values along with high values of expected genetic advance. The phenotypic expression of these characters may be governed by the genes acting additively and thereby indicating the importance of these characters for selection. For characters fodder yield and grain yield per plant similar results were reported by Godbharle et al (2010). For 1000-seed weight high heritability accompanied with high expected genetic advance was reported by Mahajan et al (2011). Dhutmal et al (2014) reported similar high heritability along with high expected genetic advance for grain yield per plant. For plant height similar high heritability accompanied with high expected genetic advance was reported by Seetharam and Ganeshmurthy (2013).

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