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Variability Estimates for Yield and Yield Components in Sorghum (*Sorghum bicolor* (L.) Moench)

Key words: *sorghum , variability and yield component traits.*

Sorghum (*Sorghum bicolor*) is the world's fifth most important cereal, after wheat, rice, maize, and barley (Motlhaodi, 2014). Globally sorghum is grown in an area of 44.96 million ha with grain production of 68.93 million tonnes in 2016 (FAOSTAT, 2016). India stands second globally for the area under sorghum cultivation of 5.62 million hectares and its production of 4.56 million tonnes in 2017 (INDIASTAT, 2017). In India, sorghum is cultivated as dual purpose crop in more than 8.3 million ha, ranking fourth among all cereals (Yadav *et al.,* 2011). It is now recognized worldwide as a smart crop capable of providing food, feed, fodder and fuel especially under moderate inputs and water-deficit environments. Assessment of genetic diversity becomes an essential prerequisite for identifying potential parents for hybridization. Diverse parents are expected to yield higher frequency of the heterotic hybrids in addition to generating a broad spectrum of variability in segregating generations. Genetic improvement for quantitative traits depends upon the nature and amount of variability present in the genetic stock and the extent to which the desirable traits are heritable. The yield component does not act independently and in general, they are interrelated with each other that ultimately bring about the grain yield. Moreover, most of the yield component traits are quantitative in nature and the variability present in them is both heritable and non-heritable (Stuber, 1987). Thus, the knowledge of genetic variability present in a given crop species for the character under improvement is of paramount importance for the success of any plant breeding program (Hub, 2011). Heritability of a trait is important in determining its response to selection. The broad sense heritability is the relative magnitude of genotypic and phenotypic variance for the traits and it gives an idea of the total variation accounted to genetic effect (Allard, 1960). Hence, the present study was conducted to assess the genetic variability, heritability and genetic advance (GA) in 122 genotypes.

The experimental material comprised of 104 land races and 18 improved sorghum genotypes. The experiment was laid out in folded randomized block design with two replications during *Rabi* 2015-16 at the Agricultural college farm, Bapatla.. Each genotype was sown three rows of 4 m length with a spacing of 45 cm between rows and 15 cm between plants within rows. All the recommended agronomic and cultural measures were taken up in conducting the experiment. Observations were recorded on five competitive plants in each genotype in each replication for seven characters *viz.,* days to 50 per cent flowering, plant height (cm), panicle length (cm), panicle weight (g), 100 grain weight (g), grain yield per panicle (g) and fodder yield/plant (g). The mean values were used for statistical analysis. The data was analyzed statistically for genotype and phenotype coefficients of variation (Burton and Devane (1953), Heritability (Allard, 1960) genetic advance as per cent of mean were calculated as suggested by Johnson *et al.* 1955.

The analysis of variance for different characters is furnished in Table 1. A wide range of variation was observed among one hundred and twenty two genotypes for seven characters. This indicated presence of variability among the lines being evaluated and ample scope of improvement by selection. The range was highest for plant height (72 cm – 217.1 cm) followed by panicle weight (3.85- 86.7), fodder yield/plant (8-86), grain yield/plant (3.4- 61.53), days to 50% flowering (45-79), panicle length (7-29.05) and 100 grain weight (1.31-4.72)

The estimate of genotypic coefficient of variation (GCV) was lower than phenotypic coefficient of variation for all the traits studied (Table 2). Although, the phenotypic coefficient of variation was greater than genotypic coefficient of variation, the difference between them were of lower magnitude. The character studied in the present investigation is under genetic control but influenced by environment. Among all the characters under study, grain yield/plant showed higher estimates of GCV (74.39) and PCV (76.44) followed by fodder yield/plant, panicle weight, panicle length, 100 grain weight and plant height therefore, simple selection can be practiced for further improvement of these characters. Sharma *et al.* (2006) reported that high GCV and PCV values for grain yield/plant and Rekha Chittapur and Biradar (2015) for panicle length,

Table 1: Analysis of variance for yield and yield components in Sorghum

Source	Replication	Treatments	Error
Degrees of freedom	1	121	121
Mean squares			
Days to 50% Flowering	1.8	63.33**	2.01
Plant height (cm)	2.2	1640.02**	2.01
Panicle Length (cm)	0.02	52.33**	41.71
Panicle weight (g)	0.07	493.64**	1.16
100 grain Weight (g)	0.02	0.85**	7.2
Grain Yield/ Plant (g)	0.05	292.80**	7.96
Fodder yield/ plant	1.8	676.97**	11.6

Table 2: Mean variability, heritability and genetic advance as per cent of mean for yield components in Sorghum

Character	Mean	Range		Coefficient of variation (%)		Heritability (broad sense)`	Genetic advance as percent of mean (5%) level
		Minimum	Maximum	GCV %	PCV %		
Days to 50% Flowering	56.70	45.00	79.00	9.14	9.77	78	19.49
Plant height (cm)	130.95	72.00	217.10	21.59	22.14	81	13.35
Panicle Length (cm)	17.69	7.00	29.05	28.60	29.24	86	57.61
Panicle weight (g)	31.22	3.85	86.70	49.95	50.68	97	101.4
100 grain Weight (g)	2.70	1.31	4.72	24.05	24.41	72	48.81
Grain Yield/ Plant (g)	16.04	3.40	61.53	74.39	76.44	83	65.17
Fodder yield/ plant	35.88	8.00	86.00	50.83	51.71	74	82.94

panicle weight and grain yield/plant. However, low GCV (9.14) and PCV (9.77) values were recorded for days to 50 % flowering. Similar results were reported earlier by Mallinath *et al.* (2004).

The effectiveness of selection for any character depends not only on the extent genetic variability but also in the extent to which it will be transferred from one generation to next generation. In the present study high estimates of heritability were recorded for all the characters. High heritability suggests high component of heritable portion of variation that can be exploited by breeders in selection of superior genotypes on the basis of phenotypic performance. These findings were in consonance with the reports made earlier by Rekha Chittapur and Biradar (2015) for days to 50% flowering, plant height, panicle length, panicle weight, 100 grain weight.

The genetic advance is a useful indicator of the progress that can be expected as result of exercising selection on the pertinent population. High heritability coupled with high genetic advance would give a more reliable index of selection value (Johnson *et al*. 1955). High heritability coupled with moderate genetic advance were obtained for days to 50% flowering and plant height indicates the role of both additive and non additive gene action in its inheritance. High heritability coupled with high genetic advance were obtained for panicle length, panicle weight, 100 grain weight, grain yield/ plant and fodder yield/ plant indicating that these traits are predominantly under the control of additive gene action and hence these characters can be improved by selection. Similar observations were recorded by Biradar (1996) for panicle weight and Tiwari *et al*. (2003) for test weight in sorghum

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