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Heritabiliy Studies In Some Sweet Sorghum (*Sorghum Bicolor.* L. Moench) Genotypes

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Abstract
Studies were carried out to estimate the extent of heritability in some cultivated genotypes of sweet sorghum (*Sorghum bicolor* L. Moench). Thirty genotypes were used for the evaluation. The phenotypic coefficient of variation (PCV) was greater than the genotypic coefficient of variation (GCV) for most traits studied. Days to 50% flowering (DTF) had low PCV and GCV. Head weight had low GCV but higher PCV. 1000 grain weight was also low for PCV and GCV. Moderate GCV was observed within the range of 11.7 (stem thickness) to 19.8 (number of nodes). High GCV was observed within the range of 22.3 (panicle length) to 31.5 (sugar content). Moderate PCV ranged from 13.3 (stem thickness) to 16.6 (number of nodes) and PCV ranged from 20.0 (number of nodes) to 43.3 (head weight). But the GCV was near to PCV for traits like DTF, plant height, number of nodes, number of leaves, grain yield and sugar content, indicating a highly significant effect of genotype on phenotypic expression for these traits with very little effect of environment. The genotypes studied showed high heritability for eight (8) traits out of the 10 traits studied in the range of 69.4 (plant height) to 97.3 (number of nodes). Moderate heritability of 55.9 was observed for 1000 grain weight and low heritability of 1.5 for head weight.
Keywords: heritability, GCV, PCV, genotypes.

Introduction

Sweet Sorghum, a drought-tolerant cereal, has been identified as one source for industrial bio-ethanol production. Sweet stem sorghum cultivars that can accumulate high levels of stem sugars with potential for bio-ethanol production have been reported (Prasad *et al.*, 2007; Gnansounou *et al.*, 2005; FAO, 2002; Woods, 2001). Sweet sorghum is a versatile and a high value crop grown in the semi arid tropics in sub Saharan Africa and India (Rooney *et al.*, 2000). Compared to grain sorghum, sweet sorghums features more rapid growth, higher biomass production, wider adaptation, and have greater potential for ethanol production (Reddy *et al*., 2007). Like other sorghums, sweet sorghums are tolerant to drought, water-logging conditions and saline/alkali soils (Reddy and Reddy,2003; Ali *et al*., 2008).

For any progress in plant breeding, there is the need to study the genetic variability which cannot easily be quantified. Genetic improvement for quantitative traits depends on the nature and amount of variability present in any genetic stock and the extent to which the desirable traits are heritable. Sorghum in general possesses wide range of genetic variability (Sharma *at al.,* 2006). Dual purpose sorghum cultivars, which combine high grain yield and high stem sugar content, can be used to generate both grain for food and stem sugar for bioethanol production with possible multiplier effects in marginal areas. This can lead to sustainable rural development, renewable energy production, improved health standards through cleaner fuels, and improved food security (Woods, 2001). Biofuels production will redistribute fuel to cut across all the geopolitical zones of Nigeria (Tanimu *et al.,* 2008). This alternative has not been extensively explored by research and the cultivar options are not available in Africa, in spite of the potential to boost rural income. Studies elsewhere have shown communities to have benefited from biofuel plants that had been established in those communities (Selfa *et al.,* 2010). Elsewhere studies in genetic variability has been reported (Ahnert *et al,*.2000; Soltani *et al,*. 1998; Basu, 1981). The extent of variability is measured by GCV and PCV which provides information about relative amount of variation in different characters. According to Roychowdhury and Tah (2011) the extent of variability is measured by GCV and PCV which provides information about relative amount of variation in different traits studied. The main trust of the present study is to provide information on heritability of genetic parameters on the available germplasm to evolve suitable cultivars with appreciable increase in grain yield and sugar for breeding of dual purpose sorghum in Nigeria. Hence, this study is aimed to provide information on heritability present in the sweet sorghum genotypes studied.

Materials and Methods

The Research was conducted at the Institute for Agricultural Research (IAR) farm, under 2011 rain fed condition in 2 locations: Samaru at which is located on latitude $11^0 11^1$N and longitude $07^0 38^1$E in the Northern Guinea Savannah Ecological zone of Nigeria (Olanuga, 1979). The rainfall characteristics here is seasonal with an annual mean of about 1060mm (Owonubi *et al.*, 1991). The second site which was Kadawa, located on latitude $11^0$39N and longitude $08^0$02E in the Northern Sudan Savannah Ecological Zone, of Nigeria. Rainfall here is seasonal with an annual mean of 884mm (Kowal & Knabe, 1972). Thirty sweet sorghum genotypes/varieties were grown in a Randomized Complete block Design with three replications. Each genotype was grown on four rows of 5 meters long, spaced at 75m between rows and 30cm within rows.

Land preparation was done by harrowing, ploughing and Ridging. Planting was done on hills with 30cm spacing between hills, and seeds were treated with Apron Star before planting. The seeds were sown and after emergence thinned to three plants per stand. 3-4 bags of N. P. K. fertilizer was applied 2-3 weeks after sowing and urea was applied 7-8 weeks after sowing per hectare. Data was taken on the following traits: days to 50% flowering, plant height, stem thickness, panicle length, head weight, number of nodes, number of leaves, grain yield, 1000 grain weight and sugar content. Analysis of variance was carried out following the standard procedures using the generalized linear model (SAS Institute, 1985). The genotypic and phenotypic coefficients of variation (GCV) and (PCV) were computed according to the method advocated by Singh and Chaudhary (1985). Heritability in broad sense was determined according to the methodology given by Allard (1960).

Results and Discussion

The results in Table 1 show the estimates of heritability, genotypic and phenotypic coefficients of variation. High heritability estimates were observed for number of nodes (97.3) followed by grain yield (93.6), sugar content (93.1), number of leaves (85.3), 50% days to flowering (82.5) and plant height (69.4). However low heritability estimates were observed for head weight (1.5) and moderate heritability obtained for 1000 grain weight (55.9). The high heritability estimates for days to maturity and plant height suggest that these traits are likely to respond to direct selection. Dadheech (1997) reported similar estimates of heritability for these traits. The high heritability obtained for most of the traits is in agreement with the findings of (Ahmed *et al.* 2011,; Bello *et. al.,* 2007; Aba *et al.,* 2001; Totok 1997; Eckebil *et al.,* 1977). Head weight showed very low heritability among the traits which suggests that it would not respond to selection. The GCV was highest for sugar content (31.5) followed by grain yield (22.5), plant height (22.4), panicle length (22.3) in that order. Moderate values were observed for number of nodes (19.8), number of leaves (16.4) and stem thickness (11.7) respectively. Low heritability values were observed in head weight (5.2), 1000 grain weight (7.2) and 50% days to flowering (8.3). The PCV was highest for head weight (43.3) followed by sugar content (32.6), panicle length (25.3), plant height (23.7). Moderate values were obtained for stem thickness (13.3) and number of leaves (16.6). However lowest values were observed on head weight (5.2), 1000 grain weight (7.2) and 50% days to flowering (8.3). High GCV and PCV were also observed in some traits, these show that the traits have a broad base genetic background as well as good potential to respond well to selection in breeding programs. Similar results were observed by Bello *et al.,* (2007) in their study of genetic variability in cultivated sorghum cultivars in Adamawa, similarly by Ahmed *et al.,* (2012) in their evaluation of some local sorghum genotypes in rain fed production and also by William *et al.,* (1987) also had similar results while studying the effects of environment on yield components in sorghum. However low GCV and PCV for days to flowering was similarly reported by Mallinath *et al.,* (2004). Generally, the GCV are lower in magnitude than the PCV. The effectiveness of selection for any character depends not only on the extent of genetic variability but also on the extent to which such traits can be transferable from one generation to the next.

Table 1 parameters of genetic variability for yield and yield components (check the decimal places)

Traits	genotypic variance	phenotypic variance	GCV%	PCV%	heritability%
DTF	37.5	45.4	8.3	9.1	82.5
plant height	1908	2149.8	22.4	23.7	69.4
stem thickness	0.5	0.7	11.7	13.3	77.3
no of nodes	2.7	2.8	19.6	20.0	97.3
no of leaves	2.8	2.9	16.4	16.6	85.3
head weight	0.1	6.1	5.2	43.3	1.5
panicle length	24.5	31.4	22.3	25.3	77.9
1000 grain weight	3.2	5.8	7.2	9.6	55.9
grain yield	0.1	0.1	22.5	23.2	93.6

Conclusion

The success of any breeding program depends upon the genetic variation in the materials at hand. The greater the genetic variability, the higher would be the heritability, hence the better the chances of success to be achieved through proper selection. In this study most of the traits showed high heritability indicating the possibility of positive response to selection. This indicates the likelihood of transferring the heritable components from parents to offspring during breeding processs.

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