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Genetic Parameters and Character Association in Single Cut Sorghum (*Sorghum bicolor* (L.) Moench).

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Research Article

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ABSTRACT

The present study was carried to know the variability parameters and character association in single cut sorghum varieties under the arid and semi arid condition of Gujarat. Genotypic coefficient of variation (GCV) was maximum for green fodder yield followed by dry fodder yield and their per day productivity. High heritability coupled with high genetic advance and high GCV was observed for green fodder yield followed by dry fodder yield and their per day productivity, leaf breadth and plant height. The green fodder yield showed positive and significant correlation with dry fodder yield, green and dry fodder yield per day, number of leaves per plant, plant height, leaf length and stem girth. It was also observed that characters that exhibited positive associations with fodder yield have also showed positive associations among themselves. The characters like green and dry fodder yield per day and number of leaves per plant were exerted positive direct effects on green fodder yield. Whereas the plant height, leaf length and stem girth showed negative direct effect with green fodder yield, which may be a result of the indirect effect of these traits via other traits.

INTRODUCTION

Low fodder production and lesser-feed availability is the major limiting factor for increasing livestock productivity in India. Improvement in livestock production depends on the proper quality and quantity of feed and fodder. It is estimated that the 60-70% of total cost in livestock production is due to feed and fodder. In India hardly 5% of the cropped area is utilized to grow fodder. India is deficit in dry fodder by 11%, green fodder by 35% and concentrates feed by 28%. The common grazing lands too have been deteriorating quantitatively and qualitatively [2]. This situation leads to poor feeding of the animal, resulting in low milk and meat yields. Due to low per capita availability of the quality products from livestock, our nation is facing the problems of malnourishment, high disease incidence and low life expectancy. Demand for animal products for human consumption is increasing day by day because of expanding human population and improvement in life style of citizens.

Sorghum (*Sorghum bicolor* L.) is one of the most important fodder crop in the rainfed conditions of India as well as in Gujarat. Sorghum being a short duration, drought and salt tolerant, well adaptive to arid regions is considered promising crop to overcome the fodder shortages in uncertain barani areas. It is a palatable and nutritious fodder crop for animals and there is enormous demand for green and dry fodder particularly during lean winter and summer season in the arid and semi arid region. It is estimated that sorghum fodder constitutes 20-45 per cent of the total dry weight of feed of dairy animals during normal season and upto 60 per cent during lean summer and winter season. During the last 30 years the role of sorghum as a major source of fodder has not diminished while its importance as a forage crop has increase[10].The average fodder yield of sorghum in Gujarat is low because major area covered by local and out-dated varieties and selection which are not responsive to improved cultural and fertility practices. Keeping in view the importance of sorghums as fodder crop, the present study was therefore initiated to know the variability and select high fodder yielding varieties for North Gujarat.

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MATERIALS AND METHODS

Sixteen varieties of single cut sorghum were evaluated for study the variability parameters, character association and path analysis at the Sorghum Research Station, Sardarkrushinagar Dantiwada Agricultural University, Deesa (Gujarat), India during *kharif* 2010-11 and 2011-12. Deesa is situated at latitude of 24.5° N and longitude 72° E and at an elevation of 136 M above the Mean Sea Level. The soil of the field was sandy in texture with pH value of 7.5 to 8.00 having good physical and chemical properties (Organic Carbon= 0.23, EC dsm- = 0.232, K20= 259.9 kg/ha and P205= 46.2 kg/ha).The experimental was conducted in complete randomized block design with three replications with the two-row plot of 4 m long, spaced at 0.30 m apart. NPK 120:40:00 kg fertilizers was applied as half basal dose of nitrogen and full dose of phosphorus at the time of sowing and half nitrogen applied after one month of sowing. The all other recommended agronomical practices were followed to raise a good crop in both the seasons. Data were collected on Plant Height (cm), No. of leaves/ plant, Leaf stem ratio, Leaf Length (cm), Leaf Breadth (cm) and Stem Girth (cm) by selecting 10 plants at random within each treatment at 50% flowering and then average was worked out. Green fodder yield (q/ha), green fodder yield /Day (q/ha), dry fodder yield (q/ha), dry fodder yield /Day (q/ha) and Early vigour were recorded on whole plot basis. The green fodder was sun dried and weighed by spring balance again to record air-dry fodder yield. The data were statistically analyzed as per standard statistical process. Variability parameters were calculated according to the standard statistical procedures [1, 3, 4, 7].

RESULTS AND DISCUSSION

Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) was maximum for green fodder yield followed by green fodder yield per day, dry fodder yield and their per day productivity. It was medium to low for other traits viz., leaf breadth, plant height, leaf stem ratio, early vigour, leaf length, stem girth and number of leaves per plant. The Differences between GCV and PCV found to be less for all the traits except stem girth. The narrow differences between PCV and GCV suggested their relative resistance to environmental alterations whereas magnitude of phenotypic coefficient of variation (PCV) was higher than the corresponding genotypic coefficient of variation (GCV) denoting environmental factors influencing their expression to some degree or other (Table 1). The high values of GCV and PCV for green and dry fodder yield suggested that there is a possibility of improvement of fodder yield through direct selection. The estimate of GCV and PCV alone is not much helpful in determining the heritable portion. The amount of advance to be expected from selection can be achieved by estimating heritability along with coefficient of variability [11].

Table 1: Genetic parameters for different characters in nineteen varieties of single cut sorghum

Characters	GCV	PCV	h^2 (Broad Sense)	Genetic advance	Gen.Adv as % of Mean
GFY (q/ha)	29.79	31.84	87.6	219.60	57.45
GFY/Day (q/ha)	29.77	31.81	87.6	219.60	57.41
DFY(q/ha)	28.86	31.41	84.40	81.05	54.64
DFY/Day (q/ha)	28.84	31.39	84.40	0.95	54.58
Early vigour	13.18	13.60	93.90	0.86	26.32
Plant Height (cm)	17.34	17.35	99.90	60.81	35.70
No. of leaves/ plant	9.38	9.42	99.10	2.17	19.24
Leaf stem ratio	14.58	19.09	58.30	0.07	22.94
Leaf Length (cm)	10.71	10.84	97.70	15.37	21.80
Leaf Breadth (cm)	21.37	21.37	100.0	1.98	44.02
Stem Girth (cm)	9.94	17.77	31.30	0.35	11.45

Burton [3] also suggested that GCV and heritability estimate would give better information about the efficiency of selection. The heritability in broad sense was observed to be moderate to high 31.30 (stem girth) to 100.00 (leaf breadth) for all the traits which had significant differences among the accessions in both the seasons. The high degree of heritability estimates for most of the traits suggested that the characters are under genotypic control. High heritability coupled with high genetic advance and high GCV was observed for green fodder yield followed by dry fodder yield and their per day productivity, leaf breadth, and plant height indicating that these characters are controlled by additive gene action and phenotypic selection for these characters will be effective. It is inferred that simple selection among the genetic material of sorghum can bring about significant improvement in these traits as the heritability and estimated genetic advance were high. Similar result was also reported by earlier workers [8,9].

The genotypic and phenotypic correlation coefficients worked out among different characters including fodder yield per plant revealed that in general the phenotypic correlation coefficient were similar to genotypic correlation coefficient (Table 2). In some cases the phenotypic correlation was slightly higher than the genotypic correlation coefficients, which may be a result of modifying effect of environments on the association of the

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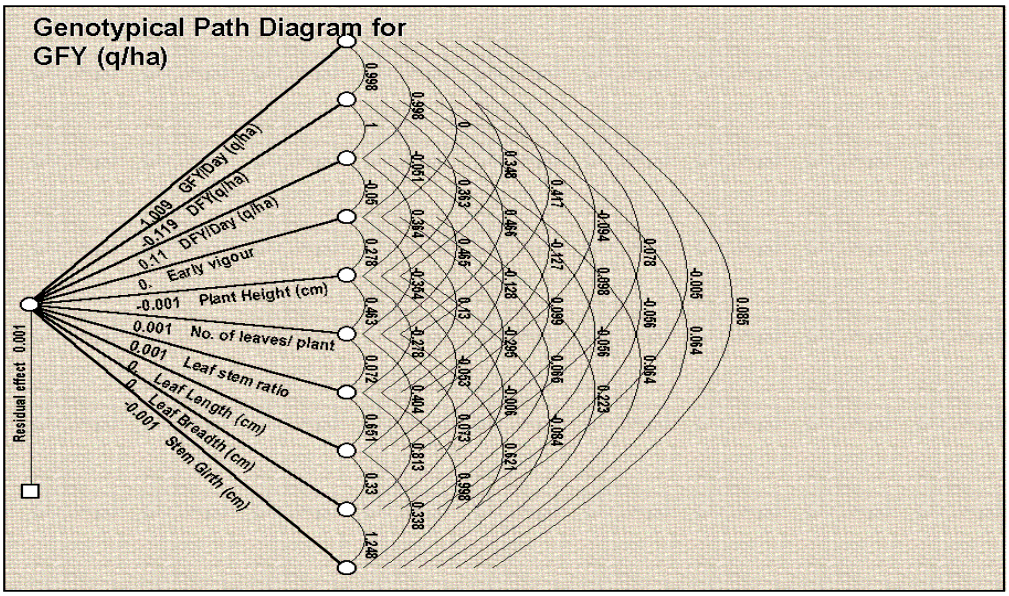
characters. The green fodder yield showed positive and significant correlation with dry fodder yield, green and dry fodder yield per day, number of leaves per plant, plant height, leaf length and stem girth. It is also noticed that characters that exhibited positive associations with fodder yield have also showed positive associations among themselves. Out of these traits some traits like leaf breadth and plant height are having the high broad sense heritability with high expected genetic advance should be used in selection programme. Similar views have been reported by earlier workers [6, 8].

Table 2: Phenotypic correlation coefficient between different characters in nineteen varieties of single cut sorghum

Characters	DFY (q/ha)	DFY/ Day (q/ha)	Early vigour	Plant Height (cm)	No. of leaves / plant	Leaf stem ratio	Leaf Length (cm)	Leaf Breadth (cm)	Stem Girth (cm)	GFY (q/ha)
GFY/Day (q/ha)	0.998**	0.998**	-0.0004	0.348**	0.417**	-0.093	0.077	-0.005	0.084	1.00**
DFY(q/ha)	1.00	1.00**	-0.0512	0.363**	0.465**	-0.127	0.098	-0.056	0.064	0.998**
DFY/Day (q/ha)		1.00	-0.050	0.364**	0.465**	-0.129	0.099	-0.056	0.064	0.998**
Early vigour			1.00	0.278*	-0.354	0.130	-0.294*	0.066	0.223*	-0.0004
Plant Height (cm)				1.00	0.463**	-0.278*	-0.056	-0.006	-0.084	0.348**
No. of leaves/ plant					1.00	0.0724	0.404**	0.073	0.622**	0.417**
Leaf stem ratio						1.00	0.651**	0.813**	0.998**	-0.094
Leaf Length (cm)							1.00	0.330**	0.338**	0.078
Leaf Breadth (cm)								1.00	1.248**	-0.005
Stem Girth (cm)									1.00	0.085
GFY (q/ha)										1.00

* Significant at 5% and ** Significant at 1%

Figure 1: Path diagram for green fodder yield in nineteen varieties of single cut sorghum



Correlation co-efficient indicates only the general associations between any two traits without tracing any possible causes of such associations. In such situations, the path coefficient analysis at phenotypic level (Table 2) is done to partition the correlation coefficients in to direct and indirect effects. Green fodder yield per plant was taken as dependent variable while computing the path coefficient. The path coefficient analysis revealed that the characters like green and dry fodder yield per day and number of leaves per plant which had positive significant association with green fodder yield also exerted positive and high direct effects on green fodder yield (Fig. 1). This confirms the role of these traits in determining the green fodder yield and therefore, their values in constructing the selection criterion. Whereas the plant height, leaf length and stem girth showed positive significant association with green fodder yield but the direct effect of these traits was negative with green fodder yield, which may be a result of the indirect effect of this trait via other traits. A similar result was also reported by Jain *et al*. [6, 8].

Differences among plant heights of the sorghum varieties were significant with maximum plant height of 257.00 cm recorded in variety SSG 59-3. Leaves per plant of the different varieties ranged significantly from a minimum of 8.89 (SSV-84) to a maximum of 13.54 (HC-308). Differences among green fodder yields of all varieties were significant. Maximum green fodder yield of 616.62 q ha-1 was obtained from variety CO (FS) 29, followed by from varieties Ramkel (553.43 q ha-1) and CSV 21 F (527.04 q ha-1). Differences in dry fodder yield of the varieties were also significant, with a maximum dry fodder yield of 240.96 q ha-1 recorded for variety CO (FS) 29, followed by Ramkel (220.0 q ha-1) and CSV 21 F (218.82 q ha-1).

The conclusion that can be reached from the variability, correlations and path coefficient is that the number of leaves per plant, leaf length, leaf breadth and stem girth are the most important component traits for green and dry fodder yield. From the preceding results it is be concluded that different sorghum varieties have different capability of performing in agro-climatic condition of North Gujarat.

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