Study of Variability in Ethanol Producing Characters in Sweet Sorghum

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Abstract—*A study conducted to estimate variability among forty six genotypes of Sweet Sorghum during kharif-2008, at Navsari Agricultural University, Navsari, showed that sweet sorghum bears great potential for production of ethanol from extracted juice. It was evident from result of the study that the significant variation were found for characters contributing to ethanol production such as juice extraction per cent, green cane yield, reducing sugars, grain yield and non-reducing sugars. Also, high heritability was observed in all these characters. High heritability estimates associated with high genetic advance was observed for juice extraction per cent, green cane yield and reducing sugars. Further, study revealed that Sweet sorghum is ideal crop for ethanol production which can be effectively used as echo friendly fuel.*

1. INTRODUCTION

Sweet sorghum [*Sorghum bicolor* (L.) Moench] is very water use efficient plant as compared to sugarcane and even maize. The cost of production of sweet sorghum is also very less as compared to sugarcane and sweet sorghum can be grown with the less irrigation and rainfall and purchased inputs compared to the sugarcane. There is strong association among ethanol producing traits and ethanol production. Juice extracted from the stems of sweet sorghum can be used for syrup, jaggery and sugar production or can be fermented to produce ethanol.

Use of ethanol extracted from sweet sorghum in automobiles holds a great promise for reducing air pollution from Co_2 and So_2. Thus ethanol from sweet sorghum may be used as a non-conventional energy source. Besides, sweet sorghum can also be used for development and utilization of cellulose. With this background the present experiment was planned to estimate the magnitude of genetic variability in the base population among important ethanol enhancing traits.

2. MATERIAL METHOD:

Variability was estimated among the 46 genotypes of sweet sorghum which was carried out at College farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari during the *kharif* season of 2008. Variability among the traits such as juice extraction per cent, green cane yield, reducing sugars, Brix (%) at 60 DAS, Brix (%) at 50 per cent flowering, and non-reducing sugars were estimated. The determination of reducing sugar was carried out by using DNS method and data for different characters were subjected to analysis of variance commonly applicable to the Randomized Block Design

3. RESULT AND DISCUSSION:

Analysis of variance showed the highly significant differences among genotypes for all the characters under investigation indicating the presence of considerable amount of variability in the material (Table No.1). The wide range of phenotypic variation observed for brix percentage (%) at 60 DAS, brix percentage (%) at physiological maturity, brix percentage (%) at 50 per cent flowering, reducing sugars (%) at physiological maturity, non-reducing sugars (%) at physiological maturity, juice extraction per cent at physiological maturity, green cane yield at physiological maturity on an average of five plants (kg) indicates the feasibility of effective selection for these traits for ethanol production [3, 1, 9, 7].

Table No. 1

Source	d.f.	B60	B50	BM	JE	RS	NRS	GCY
Replication	**2**	0.0684	0.0948	0.2890	2.3977	0.004	0.394	0.0001
Genotypes	**45**	4.7466**	15.117**	26.5615**	286.253**	1.589**	24.063**	0.028**
Error	**90**	0.098	0.174	0.344	2.796	0.003	0.119	0.0008

Very wide range of phenotypic character among 46 genotypes of sweet sorghum was observed for all the characters under study (Table No.2). Further, high heritability estimates obtained for all the characters studied suggested that selection for these traits will be effective, as they were least affected by the environment. High heritability result for green stalk yield was obtained by Sankarapandian [8] and Patankar [3]. The characters juice extraction per cent, reducing sugars, cane yield and grain yield showed high genetic advance as per cent of mean pointing out that these characters were controlled

mostly by additive gene action indicating that selection for these traits would be effective for ethanol production [8,3]. Genetic advance was moderate for non-reducing sugars indicating both additive and non-additive gene action; hence hybridization followed by selection would be proficient for developing new strains with improved vigor which ultimately enhance ethanol production capacity of crop. Moreover heritability estimates in conjunction with genetic advance were reliable for predicting the resultant effect for selecting the best individual [2].

Table No.2

Characters	Phenotypic Range	General mean	Heritability (%)	GA % of mean
B60	9.25 – 18.06	11.56	94.07	21.52
B50	11.09 - 20.2	15.71	96.62	28.77
BM	10.79 - 25.18	15.58	96.21	38.35
JE	6.66 - 46.96	20.81	97.13	94.81
RS	0.57 - 3.45	1.90	99.51	78.86
NRS	5.01 -16.61	12.36	98.53	46.73
GCY	0.08 - 0.5	0.25	92.37	76.42

B60 : Brix (%) at 60 DAS
B50 : Brix (%) at 50 per cent flowering
BM : Brix (%) at maturity
JE : Juice extraction per cent
RS : Reducing sugar (%)
NRS : Non Reducing sugar (%)
GCY : Green cane yield per plant (kg)

Note: All the characters were recorded at physiological maturity except for DF, B60 and B50

High heritability coupled with high genetic advance were observed in juice extraction per cent, reducing sugars, cane yield and grain yield indicating that these traits were governed mostly by additive gene action, hence selection for these traits would be effective. Similar results were observed by Sankarapandian [8] for dry green stalk yield per plant, Rao and Patil [5] for grain yield. For grain yield and green cane yield similar results were obtained by Patankar [3].

High heritability coupled with low genetic advance were observed in brix percentage (%) at 60 DAS, brix percentage (%) at 50 per cent flowering, brix percentage (%) at physiological maturity, indicating the role of non-additive gene action, hence heterosis breeding would be effectual for these traits.

As there is strong association among the ethanol producing characters and ethanol production [4], selection for this characters ultimately results in to strengthening of ethanol production capacities in Sweet Sorghum crop.

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