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CHARACTER ASSOCIATION FOR ALCOHOL YIELD IN SWEET SORGHUM

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ABSTRACT

Correlation of characters contributing to alcohol yield in sorghum was studied using hybrids obtained from a partial diallel cross of six sweet sorghum and one grain sorghum types. The interrelationship among the characters at genotypic level indicated that alcohol yield had significant positive correlation with total sugar, sucrose per cent, brix, juice yield, cane yield and girth of the stem. Low reducing sugar content is also essential for high alcohol extraction. Selection for high total sugars, sucrose content and brix will lead to high alcohol production.

KEY WORDS : Sweet sorghum, Alcohol yield, Character association.

To cope up with the energy crisis, alternative sources of bio- energy are being searched in the country. The plant breeders have identified high energy sweet sorghum genotypes, capable of yielding normally high grain yield but also suitable for alcohol extraction. It is necessary to understand the genotypic relationship between different biometric characters that contribute towards high alcohol yield. For identifying a suitable plant type for high alcohol production, basic information on character association between alcohol and its yield contributing attributes is essential. Since there were limited studies on alcohol production using sorghum genotypes, the present study was undertaken.

MATERIALS AND METHODS

Forty two cross combinations obtained from diallel cross involving six sweet sorghum (SSV 84, SSV 74, SSV 108, AKSS 5, RSSV 3, HES 4) and one grain type (Co 26) were raised in single row plots of 3 m length in a randomised block design with three replications during summer 1992. The inter row and inter plant spacings were 45 cm and 15 cm respectively. Five randomly selected plants were used for recording observations on ten characters *viz.*, number of internodes, girth of the stem, cane yield per plant, juice yield per plant, extractable percentage, brix, total sugars, reducing sugars and sucrose per cent. The alcohol yield per plant was recorded after fermenting the juice with yeast (Pandian, 1988). Genotypic correlations were worked out based on the method suggested by Johnson *et al.* (1955).

RESULTS AND DISCUSSION

The mean performance of the parents and their hybrids for alcohol related characters is presented in Table 1. The results of correlation co-efficients between alcohol and other alcohol related characters and their inter-correlations are furnished in Table 2. At genotypic level, girth of the stem, cane yield, juice yield, brix, total sugars and sucrose per cent showed significant positive correlation with alcohol yield. Among these, the total sugars recorded the highest correlation (0.8053) with alcohol yield followed by sucrose per cent (0.7829). In sugarcane, Pandian (1988) reported a significant association of total sugars of juice with alcohol yield. In sweet sorghum, Selvi (1984) observed positive association of cane yield with juice yield and also with sucrose percentage. In the present study, girth of the stem was found to be positively associated with cane yield, brix, total sugars and sucrose percentage besides alcohol yield. The highest correlation at genotypic level was observed between total sugars and sucrose per cent (0.8845). The reducing sugars had a negative association with most of the characters including alcohol yield.

The association analysis has clearly brought out that among the inherent characteristics of the juice, the total sugar content, brix and sucrose per cent were the most important for increased alcohol production. Among the other characters, cane yield and consequently juice yield are very important. The cane yield will in turn depend on girth of the stem and its length. Low reducing sugars is also essential for high alcohol extraction.

Table 1. Mean performance of parents and first generation hybrids in 7 x 7 diallel set of crosses for different characters.

Entries	Number of internodes /plant	Girth of stem (mm)	Cane yield/ plant (g)	Juice yield/ plant (ml)	Extractable percentage	Brix degrees	Total sugar content (%)	Reducing sugar (%)	Sucrose (%)	Alcohol yield/ plant (ml)
CO26	8.20	13.30	92.33	34.50	44.50	11.03	5.83	3.25	2.36	0.13
SSV74	10.00	16.00	252.00	86.28	51.67	18.21	13.20	3.39	10.13	14.21
SSV108	9.36	15.13	124.33	42.85	31.33	15.20	9.32	3.13	5.98	1.35
AKSS5	11.33	17.03	292.67	108.55	41.00	18.18	11.59	2.72	8.47	10.35
HES 4	9.06	14.53	130.00	56.60	47.00	13.53	10.49	2.72	6.49	3.51
SSV84	10.00	15.97	262.63	100.83	45.23	17.41	12.86	3.02	10.14	12.05
RSSV3	9.63	13.77	260.33	78.50	40.33	16.01	10.57	2.29	8.24	4.25
CO26 x SSV74	10.43	15.83	122.67	48.80	45.00	13.56	9.46	3.40	6.28	2.08
CO26 x SSV108	6.53	16.22	138.67	55.73	51.00	15.52	9.50	2.83	6.35	2.87
CO26 x AKSS5	8.59	17.30	358.00	16.80	55.00	15.49	9.57	3.15	6.28	7.71
CO26 x HES 4	8.13	11.92	158.67	55.51	43.00	14.38	6.07	3.20	3.44	0.19
CO26 x SSV84	9.70	18.27	278.00	111.17	46.67	17.50	6.43	3.51	3.68	1.13
CO26 x RSSV3	10.40	16.06	225.00	81.86	50.33	13.50	7.54	2.25	5.17	1.74
SSV74 x CO26	10.90	16.11	186.33	72.25	44.33	16.24	7.29	3.20	4.19	0.75
SSV74 x SSV108	11.50	20.15	311.67	78.43	31.10	18.42	12.10	3.13	8.89	8.08
SSV74 x AKSS5	10.80	19.40	406.00	178.49	52.67	17.35	12.57	3.29	8.98	19.42
SSV74 x HES 4	10.83	16.14	480.00	167.10	40.00	19.61	10.51	2.99	7.24	10.16
SSV74 x SSV84	11.33	18.98	385.33	147.05	45.23	16.30	10.44	3.01	7.49	9.33
SSV74 x RSSV3	8.53	17.56	498.67	163.11	38.67	20.30	13.71	1.98	11.34	22.90
SSV108 x CO26	10.00	17.07	145.00	56.28	42.00	17.18	6.33	3.29	3.64	0.16
SSV108 x SSV74	9.86	16.17	333.67	84.45	35.67	18.94	13.13	3.24	10.25	11.66
SSV108 x AKSS5	12.16	15.67	238.33	95.63	48.33	15.98	9.96	2.40	7.29	6.35
SSV108 x HES 4	10.33	17.26	187.00	62.77	41.67	17.95	12.46	3.13	9.23	5.82
SSV108 x SSV84	9.46	16.01	194.33	46.37	29.67	19.07	13.64	3.35	10.27	6.61
SSV108 x RSSV3	10.56	16.40	355.33	104.44	37.00	18.95	10.23	3.33	7.22	11.93
AKSS5 x CO26	11.06	14.36	387.67	150.00	45.00	18.57	10.45	3.12	7.18	12.02
AKSS5 x SSV74	10.23	18.13	380.67	159.17	50.33	17.28	13.46	3.10	10.43	20.43
AKSS5 x SSV108	10.40	14.93	304.06	104.97	39.66	16.67	12.38	3.52	8.48	10.83
AKSS5 x HES 4	9.83	15.88	385.33	129.07	41.33	17.00	10.69	3.57	7.34	10.60
AKSS5 x SSV84	10.83	20.65	334.33	143.61	50.33	18.55	14.37	2.08	12.29	20.27
AKSS5 x RSSV3	12.60	16.40	343.67	119.41	41.00	20.29	11.60	3.02	8.43	10.74
HES 4 x CO26	8.67	14.98	165.33	79.50	60.67	10.67	5.45	3.27	2.24	0.28
HES 4 x SSV74	9.36	14.93	266.67	123.38	53.67	15.50	11.86	3.49	8.99	12.16
HES 4 x SSV108	6.63	13.81	287.33	118.02	50.00	17.53	12.12	3.42	8.51	13.18
HES 4 x AKSS5	11.97	17.24	278.00	103.52	42.00	17.47	14.38	1.80	11.12	14.64
HES 4 x SSV84	10.80	20.22	174.67	48.28	34.67	20.75	15.27	1.78	12.83	8.73
HES 4 x RSSV3	11.00	14.87	361.00	124.01	45.00	18.28	10.59	2.12	8.10	8.16
SSV84 x CO26	11.53	14.88	186.00	76.44	45.67	16.65	10.29	3.52	6.31	5.85
SSV84 x SSV74	11.10	17.30	354.67	145.50	46.67	17.78	12.02	3.20	9.48	14.55
SSV84 x SSV108	10.63	14.96	208.33	48.31	46.00	18.18	12.64	3.20	10.19	5.63
SSV84 x AKSS5	10.43	16.26	221.33	85.02	28.00	18.58	13.75	3.54	9.44	11.34
SSV84 x HES 4	10.70	18.13	414.00	171.91	43.00	20.83	16.62	3.34	12.44	32.10
SSV84 x RSSV3	9.36	15.77	275.67	108.54	51.67	16.52	12.62	1.77	9.63	11.69
RSSV3 x CO26	10.50	15.33	187.00	70.69	46.00	15.50	8.28	3.05	5.45	2.74
RSSV3 x SSV74	9.37	15.67	381.67	102.08	47.00	16.25	14.40	2.95	10.77	16.66
RSSV3 x SSV108	10.26	20.81	268.00	77.10	36.67	17.50	10.15	2.39	7.38	4.43
RSSV3 x AKSS5	11.37	17.83	208.67	68.33	35.67	17.54	11.20	2.66	8.18	5.83
RSSV3 x HES 4	9.53	15.64	299.33	115.80	41.33	17.04	11.56	3.24	8.57	7.96
RSSV3 x SSV84	11.70	20.23	406.67	105.01	43.00	18.68	11.53	2.15	8.47	10.66
S.E. ±	0.1414	0.2407	5.7714	0.4598	0.7428	0.1270	0.1701	0.1066	0.1270	0.1490
C.D. at 5%	0.3970	0.6758	16.2150	1.2906	2.0852	0.3556	0.4775	0.2991	0.3566	0.4182
C.D. at 1%	0.5257	0.8947	21.4497	1.7087	2.7607	0.4708	0.6322	0.3950	0.4721	0.5537

Table 2. Genotypic correlation coefficients among alochol yield characters

Character	Number of internodes	Girth of stem	Cane yield/ plant	Juice yield/ plant	Extractable percentage	Brix	Total sugars	Reducing sugars	Sucrose (%)	Alcohol yield/ plant
Number of internodes	1	0.4286**	0.2625	0.2789	-0.2427	0.4210**	0.2466	-0.1906	0.2634	0.1778
Girth of stem		1	0.3651**	0.2711	-0.1222	0.4914**	0.3848**	-0.3300*	0.4208**	0.3630*
Cane yield/ plant			1	0.8151**	-0.0058	0.5926**	0.4656**	-0.1287	0.4773**	0.7465**
Juice yield/ plant				1	0.2390	0.4535**	0.3970**	-0.637	0.4005**	0.7454**
Extractable percentage					1	-0.4175**	-0.2291	0.1237	-0.2513	0.1223
Brix						1	0.6923**	-0.1616	0.7140**	0.6055**
Total sugars							1	-0.2352	0.9845**	0.8053**
Reducing sugars								1	-0.3327	-0.1191
Sucrose (%)									1	0.7829**
Alcohol yield										1

** - Significant at 0.01 level. * - Significant at 0.05 level.

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CHARACTER ASSOCIATION FOR GRAIN YIELD IN SWEET SORGHUM

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ABSTRACT

Seven sweet sorghum parental lines and their forty two hybrids were used for studying the genotypic correlation among grain yield and its related characters. The results showed that panicle weight had the highest positive correlation (0.9784) with grain yield followed by panicle length. Hence, for improving grain yield in sweet sorghum, selection should largely depend upon panicle weight and panicle length.

KEY WORDS : Sweet Sorghum, Correlation, Grain Characters.

For selection of an ideal plant type with high grain yield, knowledge of character association between yield and its component characters is essential. The expression of a complex character such as grain yield depends upon the interaction of a number of component attributes. New genotypes of sweet sorghum suitable for energy harvest are being introduced in the country now. These are duel purpose types from which both grain and alcohol can be obtained. In these high energy sweet sorghums, the grain yield is also an important factor for commercial utilisation of alcohol or sugar. This study was undertaken with different sweet sorghum genotypes to find out the intensity of association of dufferent characters with the grain yield.

MATERIALS AND METHODS

Forty two hybrids were obtained by crossing six sweet sorghum varieties and one grain sorghum variety in a 7x7 diallel mating system. The hybrids along with parents were grown in a randomised block design with three replications in summer 1992. Observations were recorded on five random