Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(2): 781-783
Received: 12-01-2019
Accepted: 14-02-2019

K Imtiaz Ahmed
Department of Genetics and Plant Breeding, College of Agriculture Dharwad, Karnataka, India

Sanjay B Patil
Principal Scientist, Department of Genetics & Plant Breeding, ARS Sankeshwar, Karnataka, India

Narayan B Moger
Associate Professor, Department of Biotechnology, College of Agriculture Dharwad, Karnataka, India

Hanumaratti NG
Principal Scientist, Department of Genetics & Plant Breeding, AICRP Sorghum, MARS, Dharwad, Karnataka, India

BT Nadgouda
Associate Professor, Department of Agronomy, ARS, Sankeshwar, Karnataka, India

Correspondence
K Imtiaz Ahmed
Department of Genetics and Plant Breeding, College of Agriculture Dharwad, Karnataka, India

Correlation and path analysis in sugarcane hybrid clones of proven cross

K Imtiaz Ahmed, Sanjay B Patil, Narayan B Moger, Hanumaratti NG and BT Nadgouda

Abstract
Correlation and Path analysis were carried out with 38 clones selected from clonal-I ratoon population derived from a cross Co 7204 x Co Pant 97222 and 7 commercial sugarcane genotypes on different yield and its component traits. Character association analysis revealed the significant and positive association of brix yield, commercial cane sugar yield, single cane weight, number of millable canes, green top yield, cane height, girth of cane, plant height, number of inter nodes and inter nodal length with cane yield. Path coefficient analysis revealed that sucrose percent showed high positive direct effects followed by brix yield, number of millable canes, cane height, single cane weight, harvest index, green top weight, green top yield, plant height and girth of cane. It was also revealed that number of millable canes, single cane weight, green top weight, cane height, plant height, girth of cane, number of internodes, number of internodal length and commercial cane sugar yield contributed indirectly to cane yield through brix yield. These characters also exhibited highly significant positive association with grain yield as well as among themselves. Hence, simultaneous selection for brix yield, single cane weight, number of millable canes, green top yield, cane height, girth of cane and plant height commercial cane sugar yield will be more rewarding for obtaining the high yielding sugarcane clones.

Keywords: Character association, path coefficient analysis, sugarcane clones

Introduction
Sugarcane (*Saccharum* spp.) is an important cash crop which is a major source of sugar, catering to 70% of the world's requirement. Sugar industry is the second largest agro industry next to textile and it helps to boost national economy by providing direct and indirect employment to the people. For many years, sugarcane has been used mainly for sugar and for alcohol production. Recently, the use of sugarcane alcohol (ethanol) as an auto-motive fuel to replace gasoline has rapidly increased. Pure sucrose is the main commercial product of sugarcane, is an old energy source for human beings and more recently a replacement of fossil fuel for vehicles. It also serves as renewable, natural agricultural resource because it provides sugar, besides biofuel, fibre, fertilizer and myriad of by-products/co products with ecological sustainability.

There lie several constraints in sugarcane production *viz*., low yield, profuse flowering, and extensive adaption of single genotype over different agro-ecological regions, abiotic stresses like drought, soil salinity, biotic stresses like diseases and pests. This is an indication of the incomplete utilization of the genetic potential of the crop without proper management practices. Sugarcane yield is not only polygenically controlled, but also influenced by its component characters. For improvement of yield in sugarcane direct selection is often misleading. The knowledge of existing variability and degree of association between yield contributing characters and their relative contribution to yield is essential for developing high yielding genotypes in sugarcane. Therefore a study was conducted to assess the inter relationship among various yield and yield component characters.

Materials and Methods
The research was conducted at Agricultural Research Station, Sankeshwer during 2017-18. The experimental material for the present investigation consisted of 38 clones selected form clonal-I ratoon population derived from a cross Co 7204 x Co Pant 97222 and 7 commercial sugarcane genotypes. The experiment was laid in RBD with two replications and all the recommended package of practices for cultivation of sugarcane crop was followed. Three clones were selected at random from each replication and data were recorded for characters viz., number of millable canes at 300 days after planting, Single cane weight, Green top weight, Cane height, Plant height, Girth of cane, Number of Internodes, Internodal length,

Harvest Index, Juice extraction percent, Green top yield, Brix percent at 12th month, Sucrose percent (%) at 12th month, Purity percent, Commercial cane sugar percent, Commercial cane sugar yield, Brix yield and Cane yield. The data were statistically analysed to estimate genotypic and phenotypic correlation coefficients (Johnson *et al*, 1955) [5] and path coefficient analysis (Dewey and Lu, 1959) [2]

Results and Discussion

The efficiency of selection for cane yield mainly depends on the direction and magnitude of association between yield and its components and among themselves. Correlation studies provides information on the nature and magnitude of the association of different component characters with cane yield, which is regarded as highly complex trait in which the breeder is ultimately interested in. It also helps us to understand the nature of inter-relationship among the component traits themselves. Ultimately this could help the breeder to design selection strategies to improve grain yield.

Correlation between cane yield and its components (Table 1) reviled that brix yield showed highly significant positive association with cane yield followed by commercial cane sugar yield, single cane weight, number of millable canes, green top yield, cane height, girth of cane, plant height, number of inter nodes and inter nodal length respectively. This indicates improvement in these characters would simultaneously results in the improvement of cane yield and selection based on these characters while be effective. These results are in conformation with Sanjay Kumar and Devendra Kumar (2014) [6] for number of millable canes, girth of cane, number of internodes, inter nodal length, single cane weight and cane height; Esayas Tena *et al.* (2016) [3] for number of millable canes, single cane weight, cane height, number of internodes, internodes length and commercial cane sugar yield and girth of cane; M. M. Pandya and P. B. Patel (2017) for number of millable cnes, single cane weight, number of inter nodes and commercial cane sugar yield. Whereas harvest index and brix percent, sucrose percent, purity percent and commercial cane sugar showed negative non-significant association with cane yield. These result are in accordance with Sanjay Kumar and Devendra Kumar (2014) [6] for brix percent,

The inter correlations among yield and its component characters revealed that brix yield showed positive and significant correlation with commercial cane sugar yield, number of millable, single cane weight, purity percent, cane height, green top yield, girth of cane, plant height, green top weight and number of inter nodes. Similar results were obtained by M. M. Pandya and P. B. Patel (2017) for commercial cane sugar yield and cane height. Whereas it showed non-significant correlation with harvest index, juice extraction percent, brix percent, commercial cane sugar percent, sucrose percent percent.

Commercial cane sugar yield exhibited significant positive association with number of millable, single cane weight, green top yield, girth of cane, cane height, plant height, green top weigh, purity percent, commercial cane sugar per, number of internodes and sucrose percent. Similar results were reported by. M. Pandya for and P. B. Patel (2017) for number of millable, single cane weight, girth of cane, cane height, commercial cane sugar per, number of internodes and sucrose percent.

Commercial cane sugar percent registered significant positive association with sucrose percent, purity percent and brix percent which was earlier reported by Esayas Tena *et al.* (2016) [3]. Similarly purity percent showed positively significant association with sucrose percent, brix percent and cane height (M. Pandya and P. B. Patel 2017 and Esayas Tena *et al.* 2016) [3].

Sucrose percent reviled positive and significant association with brix percent which are in accordance with findings of Esayas Tena *et al.* 2016 [3]. While brix percent recorded positive and significant association with single cane weight. Green top yield recorded positive and significant correlation with green top weight, harvest index, number of millable canes, plant height and juice extraction percent. Similarly juice extraction percent recorded significant positive correlation with girth of cane, cane height, green top weight and single cane weight.

Harvest index exhibited positive and significant association with number of inter nodes. Whereas it showed negative and significant association with green top weight and number of millable canes. Internodel length was found to be significantly and positively correlated with cane height which was earlier reported by Guddadamatt 2013 [4]. While it reviled significantly negative correlation with number of internodes.

Number of internodes recorded positive and significant association with cane height, single cane weight, plant height and girth of cane. Girth of cane and plant height both exhibited significant and positive association with single cane weight, green top weight and cane height. Similarly, green top weight and cane height recorded significant and positive association with single cane weight similar results were obtained by Guddadamatth 2013 [4]. Single cane weight was found to be significantly and negatively correlated with number of millable canes it was earlier observed by Esayas Tena *et al.* 2016 [3].

Correlation coefficients, though gives information regarding the association of different component traits, it does not project the complete picture especially when the casual factors were inter-related, hence path co-efficient analysis helps in understanding the magnitude of direct and indirect contribution of various traits to grain yield (Table 2). All those characters that registered significant association with grain yield were subjected to path analysis to know their direct and indirect effects on grain yield.

Path coefficient analysis revealed that sucrose percent showed high positive direct effects followed by brix yield, number of millable canes, cane height, single cane weight, harvest index, green top weight, green top yield, plant height and girth of cane. Similar findings were reported by Esayas Tena *et al.* 2016 [3] for number of millable canes, single cane weight and sucrose percent; Alam *et al.* 2017 [1], for millable cane, girth of cane and plant height; Sanjay Kumar and Devendra Kumar (2014) [6] numbr of millable canes, girth of cane, cane height, cane weight and green top weight.

On contrary commercial cane sugar percent had shown the highest negative direct effect followed by brix yield, purity percent, number of internodes, internodal length, and commercial cane sugar yield and juice extraction percent. Similar finding were reported by Sanjay Kumar and Devendra Kumar (2014) [6] for intermodal length; Guddadamatth (2013) [4] for number of internodes, intermodal length, juice extraction percent and CCS percent

The characters number of millable canes, single cane weight girth of cane, cane height, plant height, girth of cane, number of inter nodes, inter nodal length, green top yield and commercial cane sugar yield exhibited high indirect effect via brix yield on cane yield. Thus indicating that improvement in

these traits would simultaneously improve cane yield. Hence these traits needs to be considered during selection process.

Based on character association and path analysis, it is concluded that simulations selection for brix yield, single cane weight, number of millable canes, green top yield, cane height, girth of cane and plant height will be more rewarding in selecting desirable sugarcane clones as these characters exhibited highly significant and positive association with cane yield and among themselves besides high positive directs and indirect effect on cane yield.

Table 1: Phenotypic correlation coefficients among eighteen characters in fourty seven genotypes of sugarcane

Traits	NMC	SCW	GTW	CH	PH	GTH	INT	INL	HI	JE	GTY	CB	CP	PTY	CCS%	CSSY	BY	CY
NMC300	1	-0.2221 *	0.0686	-0.0026	0.186	-0.1445	-0.0961	0.1148	-0.2238 *	-0.0419	0.5083***	0.0385	0.0005	0.0308	0.0081	0.5783**	0.6027**	0.583
SCW		1	0.3332 **	0.5569 **	0.3415 **	0.6940 **	0.4303 **	0.1132	0.1922	0.2458 *	0.1588	0.2352*	0.1889	0.0728	0.167	0.5689**	0.6101**	0.651
GTW			1	0.124	0.3042 **	0.2971 **	-0.0297	0.1702	-0.8464 ***	0.2771 **	0.8846***	0.2012	0.0614	0.1016	0.0258	0.2958**	0.2757**	0.322
CH				1	0.4448 **	0.2925 **	0.4961 **	0.4881 **	0.1894	0.3075 **	0.0938	0.0109	0.1296	0.2183*	0.154	0.4088**	0.489**	0.4827
PH					1	0.1118	0.3777 **	0.0752	-0.1391	0.1615	0.3373***	0.0613	0.0668	0.0434	0.0639	0.3791**	0.4041**	0.4148
GTH						1	0.2444 *	0.023	0.0572	0.5912 **	0.1638	0.0873	0.0112	0.0999	0.0328	0.4537**	0.4336**	0.4456
INT							1	-0.4972 ***	0.2641 *	0.178	0.0664	0.0138	0.0847	0.1318	0.0957	0.2287*	0.2734**	0.2763
INL								1	-0.1004	0.1249	0.1848	0.0043	0.0648	0.0894	0.0749	0.1764	0.2113*	0.2067
HI									1	-0.1402	0.8408***	0.0525	0.0831	0.1851	0.1089	0.0391	0.0172	-0.0015
JE										1	0.2078*	0.051	0.0712	0.0551	0.0714	0.1308	0.1465	0.1571
GTY											1	0.1665	0.0446	0.0961	0.0141	0.5008**	0.4855**	0.5188
CB												1	0.7742**	0.2188*	0.6741**	0.0899	0.0258	0.1811
CP													1	0.7861**	0.9894**	0.2174*	0.0163	0.1757
PTY														1	0.8672**	0.2434*	0.0547	0.0995
CCS%															1	0.2328*	0.0252	0.1638
CCSY																1	0.953**	0.9172
BY																	1	0.9776
CY																		1

* Significant at 5% level; ** Significant at 1% level

Number of millable canes (NMC) at 300 days after planting (DAP), Single cane weight (SCW), Green top weight (GTW), Cane height(CH), Plant height (PH), Girth of cane (GTH), Number of Internodes (INT), Internodal length (INL), Harvest Index (HI), Juice extraction percent (JE), Green top yield (GTY), Brix percent (CB) at 12th month, Sucrose percent (%) at 12th month, Purity percent (PTY), Commercial cane sugar percent, Commercial cane sugar yield (CCSY), Brix yield (BY) and Cane yield (CY)

Table 2: Phenotypic path coefficients of yield component on cane yield in sugarcane

Traits	NMC300	SCW	GTW	CHt	PHt	GTH	INT	INL	HI	JE	GTY	CB	CP	PTY	CCS%	CSS Yield	BY	CY
NMC300	**0.0672**	-0.0117	0.0018	-0.0002	0.0005	-0.0002	0.005	-0.0061	-0.0075	0.000	0.0106	-0.0365	0.0015	0.0074	0.0165	-0.1153	0.65	0.583
SCW	-0.0149	0.0527	0.0087	0.0323	0.0008	0.0011	-0.0222	-0.006	0.0064	0.000	0.0033	0.2231	-0.5374	0.0176	0.341	-0.1134	0.6579	0.651
GTW	0.0046	0.0175	0.0263	0.0072	0.0007	0.0005	0.0015	-0.009	-0.0284	0.000	0.0184	0.1908	-0.1748	-0.0245	0.0528	-0.059	0.2973	0.322
CHt	-0.0002	0.0293	0.0033	0.0581	0.0011	0.0005	-0.0256	-0.0259	0.0063	0.000	0.0019	-0.0103	-0.3687	0.0526	0.3145	-0.0815	0.5274	0.4827
PHt	0.0125	0.018	0.008	0.0258	0.0024	0.0002	-0.0195	-0.004	-0.0047	0.000	0.007	0.0581	-0.1902	0.0105	0.1304	-0.0756	0.4359	0.4148
GTH	-0.0097	0.0366	0.0078	0.017	0.0003	0.0016	-0.0126	-0.0012	0.0019	-0.0001	0.0034	0.0828	0.0318	-0.0241	-0.0669	-0.0905	0.4676	0.4456
INT	-0.0065	0.0227	-0.0008	0.0288	0.0009	0.0004	-0.0517	0.0264	0.0088	0.000	-0.0014	0.0131	-0.2411	0.0318	0.1955	-0.0456	0.2949	0.2763
INL	0.0077	0.006	0.0045	0.0284	0.0002	0	0.0257	-0.0531	-0.0034	0.000	0.0038	0.0041	-0.1844	0.0215	0.153	-0.0352	0.2279	0.2067
HI	-0.015	0.0101	-0.0222	0.011	-0.0003	0.0001	-0.0136	0.0053	0.0335	0.000	-0.0175	-0.0498	-0.2365	0.0446	0.2225	0.0078	0.0185	-0.0015
JE	-0.0028	0.0129	0.0073	0.0179	0.0004	0.001	-0.0092	-0.0066	-0.0047	-0.0001	0.0043	0.0483	-0.2026	0.0133	0.1459	-0.0261	0.158	0.1571
CB	0.0342	0.0084	0.0232	0.0054	0.0008	0.0003	0.0034	-0.0098	-0.0282	0.000	0.0208	0.1579	-0.127	-0.0232	0.0288	-0.0999	0.5237	0.5188
CP	0.0026	-0.0124	-0.0053	0.0006	-0.0001	-0.0001	0.0007	0.0002	0.0018	0.000	-0.0035	-0.9482	2.2024	-0.0527	-1.3768	-0.0179	0.0278	-0.1811
PTY	0	-0.01	-0.0016	-0.0075	-0.0002	0	0.0044	0.0034	-0.0028	0.000	-0.0009	-0.7341	2.8448	-0.1895	-2.0209	-0.0434	-0.0176	-0.1757
CCS%	-0.0021	-0.0038	0.0027	-0.0127	-0.0001	0.0002	0.0068	0.0047	-0.0062	0.000	0.002	-0.2074	2.2363	-0.2411	-1.7712	-0.0485	-0.059	-0.0995
CSS	-0.0005	-0.0088	-0.0007	-0.0089	-0.0002	0.0001	0.0049	0.004	-0.0037	0.000	-0.0003	-0.6392	2.8147	-0.209	-2.0426	-0.0464	-0.0272	-0.1638
Yield	0.0389	0.03	0.0078	0.0237	0.0009	0.0007	-0.0118	-0.0094	-0.0013	0.000	0.0104	-0.0852	0.6184	-0.0587	-0.4755	-0.1994	1.0278	0.9172
BY	0.0405	0.0321	0.0072	0.0284	0.001	0.0007	-0.0141	-0.0112	0.0006	0.000	0.0101	-0.0244	-0.0464	0.0132	0.0515	-0.1901	1.0785	0.9776

Residual effect (Phenotypic): 0.426; Bold Direct effects; Normal: Indirect effects; * Significant at P = 0.05; ** Significant at P = 0.01 level

Number of millable canes (NMC) at 300 days after planting (DAP), Single cane weight (SCW), Green top weight (GTW), Cane height(CH), Plant height (PH), Girth of cane (GTH), Number of Internodes (INT), Internodal length (INL), Harvest Index (HI), Juice extraction percent (JE), Green top yield (GTY), Brix percent (CB) at 12th month, Sucrose percent (%) at 12th month, Purity percent (PTY), Commercial cane sugar percent, Commercial cane sugar yield (CSSY), Brix yield (BY) and Cane yield (CY)

References

1. Alam MN, Ujjal Kumar Nath, Karim KMR, Ahmed MM Mitul RY. Genetic Variability of Exotic Sugarcane Genotypes, Scientifica, 2017, 1-9.
2. Dewey DR, Lu KN. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agronomy Journal. 1959; 51:515-518.
3. Esayas Tena, Firew Mekbib, Amsalu Ayana. Correlation and Path Coefficient Analyses in Sugarcane Genotypes of Ethiopia, American Journal of Plant Sciences 2016; 7:1490-1497.
4. Guddadamath SG. Studies on genetic enhancement of Sugarcane (*Saccharum officinarum* L.) Productivity for organic jaggery production. M. Sc. (Agri.), Univ. Agric. Sci., Dharwad, Karnataka (India), 2013.
5. Johnson HW, Robinson HF, Comstock RE. Estimation of genetic and environmental variability in soybean. Agronomy Journal. 1955; 47:314-318.
6. Sanjay Kumar, Devendra Kumar. Correlation and path coefficient analysis in sugarcane germplasm under subtropics, Afr. J Agric. Res. 2014; 9(1):148-153, 2.