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Correlation and Regression Studies in Sugarcane (*Saccharum officinarum* L.)

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Abstract

Correlation and regression studies carried out in sugarcane as affected by levels of phosphorus and sulfur application during spring seasons of 2003-04 and 2004-05 revealed that cane yield was positively and significantly correlated with growth parameters viz. number of tillers (0.993), plant height (0.951), leaf area (0.989) and total dry matter (0.976). Significantly positive correlation was also observed between cane yield and yield attributes like number of millable canes (0.986), cane girth (0.969) and single cane weight (0.991). Similarly nutrient uptake viz. P (0.997) and S (0.995) was also showed significant correlation with cane yield.

Key words : Correlation, Regression, Sugarcane.

Sugarcane is one of the important cash crop of India, which contributes greatly in rural economy of India in the form of sugar, jaggery, ethanol, liquor and various other products. Yield of a crop is the manifestation of its growth and developmental characters that are influenced by many environmental factors in which the crop is grown. The inter relationship among various characters, not only give the extent of association between them but also their net resultant outcome. Phosphorus by its contribution in various metabolic activities and vegetative growth of plants, registered significant improvement in yield attributing characters and the integration of all these favorable yield components. For optimum growth and production plant tissues must contain sufficient concentration of sulfur only then, the plants can produce carbohydrates, proteins and vitamins to their full potential. Studies on correlation and regression coefficient are necessary tools for crop improvement and to understand the potentiality of agronomic practices in increasing the sugarcane yield. Many workers have reported similar results (1, 2). Thus, the present investigation was undertaken to study the degree of association of cane yield with growth, yield attributes and nutrient uptake in sugarcane.

Methods

A field experiment was conducted during the spring seasons of 2003-04 and 2004-05 at Sugarcane Research Institute Farm, Pusa, Samastipur, Bihar. The soil was sandy loam, alkaline in reaction (pH 8.4), Calciorthents (free $CaCO_3$ 29.8%) with lower organic carbon (0.44%), available nitrogen (199 kg/ha), phosphorus (19.8 kg/ha), potassium (100 kg/ha) and sulfur (10.9 ppm). Sixteen treatment combinations which include : Absolute control (T_1) ; 40 kg S/ha (T_2) ; 80 kg S/ha (T_3) ; 120 kg S/ha (T_4) ; 17.5 kg P/ha (T_5) ; 17.5 kg P/ha + 40 kg S/ha (T_6) ; 17.5 kg P/ha + 80 kg S/ha (T_7) ; 17.5 kg P/ha + 120 kg S/ha (T_8) ; 35.0 kg P/ha (T_9) ; 35.0 kg P/ha + 40 kg S/ha (T_{10}) ; 35.0 kg P/ha + 80 kg S/ha (T_{11}) ; 35.0 kg P/ha + 120 kg S/ha (T_{12}) ; 52.5 kg P/ha (T_{13}) ; 52.5 kg P/ha + 40 kg S/ha (T_{14}) ; 52.5 kg P/ha + 80 kg S/ha (T_{15}) and 52.5 kg P/ha + 120 kg S/ha (T_{16}) were tried in randomized block design and replicated thrice. The crop received recommended dose of nitrogen (150 kg/ha) and potassium (50 kg/ha) through urea and muriate of potash, respectively. Phosphorus and sulfur based on treatment were applied in the form of diammonium phosphate and phosphozypsum, respectively. The total rainfall during crop season was 1,435.5 mm in 2003-04 and 912.3 mm in 2004-05. Simple correlation coefficient (*r* values) and regression coefficient (*b* values) along with coefficient of determination (R^2) values were computed between cane yield as response variable and various plant characters and nutrient uptake as predictor variables. Inter correlation between various growth and yield contributing characters were also worked out based on the procedure described by Snedecor and Cochran (3).

Table 1. Correlation matrix for yield vs growth, yield attributes, P and S uptake of sugarcane as influenced by levels of phosphorus and sulfur. All the correlation coefficient values are significant at 1% level of significance.

	Growth/yield parameters	1	2	3	4	5	6	7	8	9	10
1	Cane yield	1.000	0.993	0.951	0.989	0.976	0.986	0.969	0.991	0.997	0.995
2	No. of tillers		1.000	0.970	0.996	0.988	0.994	0.981	0.993	0.991	0.987
3	Plant height			1.000	0.968	0.982	0.979	0.957	0.971	0.948	0.943
4	Leaf area				1.000	0.983	0.995	0.979	0.985	0.991	0.987
5	Total dry matter					1.000	0.980	0.983	0.991	0.980	0.959
6	No. of millable canes						1.000	0.970	0.987	0.981	0.987
7	Cane girth							1.000	0.975	0.977	0.953
8	Single cane weight								1.000	0.988	0.980
9	P uptake									1.000	0.988
10	S uptake										1.000

Results and Discussion

Data on correlation matrix showed that growth parameters viz. number of tillers (0.993), plant height (0.951), leaf area (0.989) and dry matter accumulation (0.976) had positive and highly significant correlation with cane yield (Table 1). The yield attributes viz. number of millable canes (0.986), cane girth (0.969) and single cane weight (0.991) also had positive and highly significant correlation with cane yield. Similarly nutrient uptake, phosphorus (0.997) and sulfur (0.995) had positive and highly significant correlation with cane yield. The results indicate that the yield of sugarcane is highly dependent on these parameters. Similar results also reported by Chandrakant et al. (4) in sugarcane and Kumar et al. (1) in soyabean.

The regression coefficient (*b*) showed similar trend as that of correlation matrix. The critical examination of relationship between response factor i.e. cane yield and predictor factor such as growth and yield characters showed significant contribution to cane yield as it is evident from their respective simple regression coefficient (*b* values). Among growth characters leaf area and number of tillers contribute more to the cane yield followed by dry matter accumulation and plant height (Table 2). Similarly influence of

Table 2. Simple regression coefficient for cane yield of sugarcane as influenced by levels of phosphorus and sulfur (pooled data of 2003-04 and 2004-05) *a* = Pure constant ; SE*a* = Standard error of pure constant, *b* = Regression coefficient ; SE*b* = Standard error of regression coefficient.

	Components type	*a*	SE*a*	*b*	SE*b*	R^2 value (%)
A	**Growth Character**					
	Number of tillers	-117.44	5.16	1.10	0.03	98.01
	Plant height	-21.15	17.57	0.43	0.08	90.25
	Leaf area	-51.76	2.85	30.95	0.73	98.78
	Total dry matter	-0.45	6.62	0.27	0.03	93.69
B	**Yield Attributes**					
	Number of millable canes	-52.97	6.50	0.96	0.05	97.18
	Cane girth	-73.80	7.66	72.77	15.08	97.23
	Single cane weight	-73.97	5.06	0.26	0.01	97.95
C	**Nutrient Uptake**					
	P	23.90	0.54	2.94	0.03	99.52
	S	15.22	0.95	1.92	0.03	99.02

yield contributing characters viz. number of millable canes, cane girth and single cane weight were also significantly influenced on cane yield. The influence of number of millable canes, cane girth and single cane weight had significant influence on the cane yield as the value of coefficient of determination (R^2 = 97.18, 97.23 and 97.95%, respectively) was high which indicates that these parameters can be easily manipulated by agronomic practices like nutrient management. Shinde and Saraf (5) also reported similar results.

It could be concluded that number of tillers, plant height, leaf area and dry matter are major growth parameters that influence the cane yield. While number of millable canes, cane girth and single cane weight contributed greatly to yield. Similarly P and S uptake also had highly positive impact on yield of sugarcane which needs to be exploited in realizing full production potential of sugarcane.

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