Correlation and path coefficient analysis in sugarcane

Anand Prakash Tyagi[*] and Praduman Lal[2]
Department of Biology, School of Pure and Applied Sciences, The University of the South Pacific, Suva, Fiji
Tyagi_ap@usp.ac.fj

ABSTARCT
Correlation and path coefficient analysis was undertaken among agronomic and bio-chemical characters of importance in sugarcane. Correlation between agronomic characters revealed positive and significant (P = 0.01) correlation between plant volume and number of millable stalks (0.874), plant volume and weight per stalk (0.812), plant volume and weight of millable stalks (0.962), plant volume and stalk thickness (0.842), number of millable stalks and weight of millable stalks (0.889) and other agronomic characters. There was a non-significant but positive correlation between number of millable stalks refractrometer brix (0.05), number of millable stalks and stalk height (0.285) and other characters. In case of bio-chemical characters, positive and significant (P = 0.01) correlation was recorded between Pure Obtainable Cane Sugar (POCS) and pol (0.901), POCS and purity (0.763) and pol and purity (0.780). Negative but non-significant correlation was observed between POCS and fibre. Correlation studies indicate that for sugarcane yield plant volume, plant height, number of millable stalks per stool, stalk thickness and weight of millable stalks are the most important characters. However, for biochemical characters POCS, pol and purity are the most important characters. Path coefficient analysis in the case of agronomic characters showed revealed that the weight of millable stalks was the most important character with the highest direct effect on sugarcane yield followed by stalk height, number of millable stalks and stalk thickness among agronomic traits. In bio-chemical characters highest direct effect was on percent POCS followed by percent purity and percent fibre. In nutshell correlation and path coefficient analysis in present study suggests that clones or varieties with high plant volume, plant height, and other agronomic characters should be used in hybridization programme.
Keywords: *Correlation coefficient, path coefficient, cane yield, refroctometer brix, polerimetric,POCS.*

1 INTRODUCTION

Several factors contribute towards an efficient running of any sugarcane breeding program. One of the important factors is the choice of parents used in cross combinations. Selection of parents for the crossing program is a vital part of any breeding program. Decisions such as which clones should be planted in the parent collection and which clones should be chosen as the female and male parent of a cross would form the foundation of any crossing program (Hogarth *et al*. 1981; Hogarth and Skinner 1987). For any breeder it is essential to realize that the ultimate goal of any breeding program is the production of improved varieties over the existing commercial varieties. Therefore, it is important choosing superior clones for parent collection and for making crosses. There is no point in making crosses and producing sugarcane seeds because the two clones happen to flower simultaneously.

In recent years a number of research workers have endeavoured to refine procedures with a more formal genetic analysis. The way is now clear to study the heritability of all major characters of sugarcane, their genetic correlation, and thus, make a more rational selection of parents and prediction of selection gain.

In sugarcane agronomic characters are quantitatively inherited and are highly influenced by the environment. Correlation coefficient analysis can provide some guide to breeders for selecting best parents. However, correlation coefficients, sometimes, may be misleading and thus, need to be partitioned into direct and indirect effects. Thus, it is important for a breeder to know how other characters influence a particular character before selecting the parental material for crossing purposes. A path coefficient analysis can successfully be used to partition correlation coefficient into direct and indirect effects. The direct effect of a character on yield and indirect contribution through other characters can be calculated using path coefficient analysis.

The path coefficient method (Wright 1921, 1923, 1934) provides a simple and flexible method of handling a wide variety of inbreeding problems. It has since emerged as a general statistical method for cause and effect analysis in a system of correlated variables.

A path coefficient is simply a standardized partial regression coefficient. It measures the direct influence of one variable upon another. If the cause and the effect relationships are well defined, it is possible to represent the whole system of variables in the form of a diagram known as a path diagram.

On the basis of direct and indirect effects of independent characters on the dependent character, a plant breeder can apply an appropriate selection method so as to take care of the direct and indirect effects and reach a compromise wherever required. The present study was undertaken to calculate correlation and path coefficients in sugarcane using line x tester mating design.

2 MATERIALS AND METHODS

2.1 CENSORING

Sugarcane flowers are bisexual but crop is highly cross-pollinated due to differential maturity of pollen and receptivity of stigma. This information is vital in determining the male and female parents for making crosses. Aiwa, Mana and Kaba

varieties were used female (lines) and Mentor, Vatu and Yasawa as male tester parents. For making crosses the

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older leaves were removed from the stalks while the younger leaves were half cut. The sulfurous acid technique was used for the preservation of sugarcane flowers. The cut flowering stalks of female and male clones were placed in buckets containing acid solution. The acid solution was a mixture of ortho-phosphoric acid and sulphur dioxide solution and was prepared as follows: 25 ml of ortho-phosphoric acid was mixed with 2.5 litres of sulphur dioxide solution. Forty ml of the resulting solution was added to 4.5 litres of water. Solution was changed every three days. Inflorescence were covered with muslin cloth and shaken from time to time until anthesis (about two weeks) and hence pollination and fertilization was complete. Fuzz (sugarcane seeds) was collected, dried and stored in a refrigerator until planted in trays to raise seedlings.

2.2 GROWING FUZZ

The fuzz was sown in perforated iron trays measuring 50 cm in length, 35 cm in width and 10 cm in depth. The trays were filled with fumigated soil and the fuzz was spread evenly on top of the soil. To flatten the fuzz to the soil surface water was sprinkled lightly. The trays were then labeled and kept in the glasshouse where the temperature and humidity was controlled and the environment was made conducive for seed germination. After 5 – 6 days when the seeds started to germinate, the trays were kept in the glasshouse for further one week before it was transferred to the hardening frame.

2.3 TRANSPLANTING AND GROWING OF SEEDLINGS

The seedlings were transplanted into the 3" x 5" plastic bags filled with soil in three replications during mid-September, 1996. From each family 45 seedlings were transplanted in each replication. The seedlings were watered regularly and fertilizer was applied every two weeks for two months. The leaves of the seedlings were clipped off to produce thicker and stronger seedlings. The seedlings were raised in the nursery for three months before planting in the field. Once the seedlings were well established in the field, normal cultural practices (Gowander Pers. Comm) were followed and the trial was managed much like the regular plant cane crop of sugarcane.

2.4 PLANTING FIELD EXPERIMENT

The trial design for the experiment was randomized complete block design with three replications The site where the trial was established was on flat land. The initial soil analysis results at this site were pH = 6.7, P = 13.3 ppm, K = 68 ppm and Ca = 3302ppm. The trial for the present study was carried out at the Sugarcane Research Centre in Lautoka. Seedlings were manually planted. The trial was planted on the 24 December 1996. The seedlings were removed from the 3"x 5" plastic bags and held upright in the and the roots of the seedlings were pressed firmly in the furrows and were later covered with soil. From a total of 45 seedlings for each cross in the nursery, 20 seedlings from each replication were selected and planted in three replications. The seedlings were planted with a row spacing of 1.37m and 0.6m between seedlings in a well-prepared weed free field. There were 9 rows (plots) in each replication with 20 seedlings in each row. One row (plot) in each replication represented one family. All recommended cultural practices were used for raising the crop.

2.5 CHARACTERS STUDIED

The trial was harvested in November 1997 when the age of the crop was 11 months. Data were recorded on the following characters in November 1997.

2.5.1 AGRONOMIC CHARACTERS

i). Number of millable stalks per stool

Individual stalks per stool for each of the crosses in all the three replications were counted and the data were recorded.

ii). Stalk thickness (cm)

For each stalk in each of the stools, the thickness was measured approximately in the middle of the stalk using a vernier caliper. The mean stalk thickness was then calculated.

iii). Stalk height (cm)

For each stalk in each of the stools, the height of the stalk was measured using the measured. The measurement was taken from the ground level to the third dewlap. The mean stalk height was then calculated.

iv). Refractormeter brix

Field brix was measured from each of the stalks per stool using the refractormeter. The mean brix was then calculated.

v). Weight of the millable stalks (kg)

All the number of millable stalks per stool was weighed to give the weight of the millable stalks per stool.

vi). Weight per stalk (kg)

Weight per stalk was calculated by dividing weight of millable stalks by number of millable stalks.

vii). Plant volume (cm^3)

Plant volume was calculated by using the formula:

$$V = \pi D^2 \times L \times N$$

Where: V = plant volume (an index of vigor), D = stalk diameter (cm), L = stalk length (cm) and N = number of millable stalks per stool

2.5.2 BIO-CHEMICAL CHARACTERS

i). Percent pol (polerimetric reading)

ii). Percent purity
iii). Percent fibre
iv). Percent Pure Obtainable Cane Sugar (POCS)
v). Brix (% sugar in stalks)

2.6 STATISTICAL ANALYSIS

i) Correlation coefficient analysis between agronomic and quality characters

ii) The data obtained on different characters was analysed for correlation coefficient using statistical software (GenStat) for calculating correlation coefficients.

iii) Path coefficient analysis was carried out for the estimation of direct and indirect effects of various agronomic characters on yield (4). The procedure used is as follows:

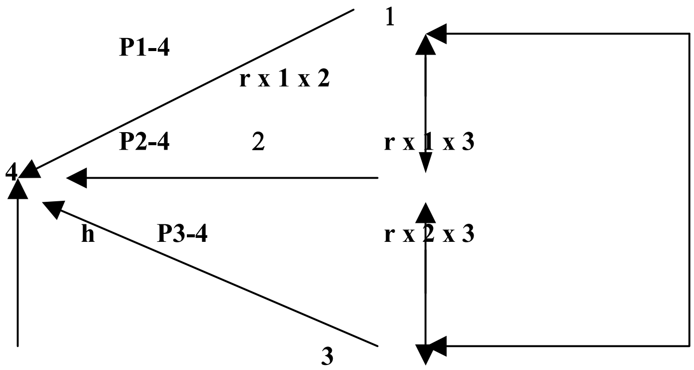

Figure 1. Path Diagram

From the above path diagram, the following simultaneous equations were written:

$r14 = P14 + r12P24 + r13P34$
$r24 = r21P14 + P24 + r23P34$
$r34 = r31P14 + r23P24 + P34$

Note that:

$P14 = a$, $P24 = b$ and $P34 = c$

r14 = correlation coefficient between character 1 and character 4

r24 = correlation coefficient between character 2 and character 4

r34 = correlation coefficient between character 3 and character 4

r12 = correlation coefficient between character 1 and character 2

r23 = correlation coefficient between character 2 and character 3

r13 = correlation coefficient between character 1 and character 3

Residual effect is calculated as follows:

$1 = P^2 r4 + P^2 14 + P^2 24 + P^2 34 + 2P14r12p24 + 2P14r13P34 + 2p24r23P34$
(Singh and Chaudhary 1985)

3 RESULTS

3.1 CORRELATION – AGRONOMIC CHARACTERS

Correlation coefficients between the different pair of agronomic characters were calculated to find the relationship among the various characters studied. The values of correlation coefficient are presented in Table 1.

From Table 1 it can be seen that there was a strong positive and significant correlation (P = 0.01) between plant volume and number of millable stalks,plant volume and weight per stalk, plant volume and weight of millable stalks, plant volume and stalk thickness, number of millable stalks and weight of millable stalks, number of millable stalks and weight per stalk, number of millable stalks and stalk thickness, weight of millable stalks and weight per stalk, weight of millable stalks and stalk height, weight per stalk and stalk height.

Positive and significant correlation (P=0.05) was found between the characters plant volume and stalk height. Positive and non-significant correlation was found between number of millable stalks and refractor meter brix, number of millable stalks and stalk height, weight of millable stalks and refractor meter brix, weight per stalk and refractor meter brix and refractor meter brix and stalk height. Plant volume and refractor meter brix and stalk thickness and refractor meter brix were found to have a negative correlation.

3.2 CORRELATION – BIOCHEMICAL CHARACTERS

Correlation coefficients between the different bio-chemical characters were calculated to find the relationship among them. The values of correlation coefficients are presented in Table 2. From Table 2 it can be observed that there was a positive and significant correlation (P = 0.01) between percent POCS and percent pol, percent POCS and percent purity and percent pol and percent purity, brix and percent pol and brix and percent POCS. A negative correlation was recorded between percent POCS and percent fibre, percent pol and percent fibre and brix and percent fibre

3.3 PATH COEFFICIENT ANALYSIS – AGRONOMIC CHARACTERS

The correlations between plant volume on one hand and the various characters on the other have been partitioned into direct and indirect effects as shown in Table3. The relative influence of all the agronomiccharacters on plant volume is shown by the direct-effect component of the partitioned total correlation Although the correlation coefficient was positive between plant volume and three agronomic characters namely; number of millable stalks, weight per stalk, refractor meter brix and stalk thickness but their direct effect was negligible on plant volume. Thus indirect effects seem to be the cause of the correlation (Table 3). For plant volume vs weight of millable stalks and plant volume vs. stalk height the correlation coefficient between the casual factor and the effect is almost equal to its direct effect. Thus, correlation explains a true relationship between these two characters. For instance, the direct effect of weight of millable stalks on plant volume (P14 = 0.932) accounted for total correlation between them (r14 = 0.972).

Table1. Correlation coefficients between different agronomic characters

Characters	No. of Millabl e Stalks	Weight of Millable Stalks (kg)	Weight Per Stalk (kg)	Refractor meter Brix	Stalk Thickness (cm)	Stalk Height (cm)
Plant Volume (cm^3)	0.874**	0.962**	0.812**	-0.038	0.842**	0.483*
No. of Millable Stalks		0.889**	0.573**	0.050	0.604**	0.285
Weight of Millable Stalks (kg)			0.861**	0.089	0.721**	0.598**
Wight per Stalk (kg)				0.163	0.714**	0.852**
Refractor meter brix					-0.516*	0.292
Stalk Thickness (cm)						0.319

* P = 0.05, ** P = 0.01

Table 2. Correlation coefficients between different bio-chemical characters

Characters	*Pol	* Purity	% Fibre	% POCS
Brix	0.649**	0.108	-0.064	0.640**
% Pol		0.780**	-0.062	0.901**
%Purity			0.066	0.763**
% Fibre				-0.108

* P = 0.05, ** P = 0.01

From the path coefficient analyses, it is evident that weight of millable stalks was the most important component of plant volume followed by stalk height, number of millable stalks and stalk thickness. Weight per stalk seems to have no effect on plant volume.

3.4 PATH COEFFICIENT ANALYSIS – BIO-CHEMICAL CHARACTERS

Path coefficient analyses, using the four basic components of bio-chemical analyses in sugarcane that is percent POCS, percent pol, percent purity, percent fibre and brix are presented in Table 4. The relative influence of the bio-chemical characters on percent POCS is shown by the direct-effect component of the partitioned total correlation.

For percent POCS vs percent pol the correlation coefficient between the two characters is quite close to its direct effect. Thus, this correlation explains a true relationship and a direct selection for POCS through this trait will be effective. In the case of percent POCS and percent purity and percent POCS and brix the correlation was positive but the direct effect is negligible. However, the indirect effect through % pol seems to be the cause of correlation. Thus, in the above case percent pol seems to be the cause of the correlation (Table 4). From the path coefficient analyses, it is evident that percent pol was the most important component of percent POCS followed by percent purity and brix.

4 DISCUSSION

4.1 CORRELATION – AGRONOMIC CHARACTERS

If the correlation coefficient between a casual factor and the effect is almost equal to its direct effect, then correlation explains the true relationship and a direct selection through this trait will be effective. If the correlation coefficient is positive, but the direct effect is negative or negligible, the indirect effects seem to be the cause of correlation. Correlation coefficient may be negative but the direct effect is positive and high. Under such circumstances restrictions are to be imposed to nullify the undesirable indirect effects in order to make use of the direct effect.

Estimates of correlation between a pair of character indicate the inherent relationship that exists between the characters (Heinz 1987). If there is a high positive genotypic /Phenotypic correlation between two characters, selection for one of the characters should result in selection for the other character.

Comstock and Robinson (1952) emphasized the importance of genotype correlation. They pointed out that traits not under selection may deteriorate and those under selection may show little response due to negative genotype correlation. Phenotypic correlation which are approximations of genotypic correlation have been reported by many authors including James and Falgout (1969), James (1971), Reimers *et al.* (1982) and Wu *et al.* (1983).

In the present study (Table 1) yield measured by plant volume was more closely correlated with weight of millable stalks followed by number of millable stalks, stalk diameter, weight per stalk and stalk height. This has important implications for selection of varieties to be used as parental material for crossing purposes. The above information indicates that cane yield is affected by the above characters but the degree at which each character affects yield is dependent upon the degree of association of that character to cane yield. In this case selecting for the character weight of millable stalks would produce maximum yield as compared with any of the other characters. Brown *et al.* (1969). Hogarth (1971b), James (1971), Mariothi (1972) and Rao *et al.* (1983) found that cane yield was more closely correlated with stalk population than weight per stalk or stalk diameter.

Hogarth (1971a) found that number of stalks per stool and weight per stalk were negatively correlated. However, both stalks per stool and weight per stalk were positively correlated with weight per stool. The conclusion from the above correlation was that neither stalks per stools nor weight per stalks would be a suitable criterion in selecting for yield of cane and that selection should be based on weight per stool

A positive and significant correlation existed between weight of millable stalks and weight per stalk, followed by stalk thickness and stalk height, weight per stalk and stalk thickness and weight per stalk and stalk height (Table 1). This indicated that selection through thicker and taller stalks would result in increase in weight per stalk, thus increasing cane yield.

A strong negative correlation was found between refractor meter brix and stalk thickness indicating that these characters were associated in an undesirable manner. However, selection through the character stalk thickness would produce varieties with lower brix. James and Falgout (1969) found negative correlation between stalk diameter and brix but the association was not high enough to be of particular concern.

4.2 CORRELATION – BIO-CHEMICAL CHARACTERS

In the present study percent POCS was closely correlated with percent pol, percent purity and brix. On the other hand strong significant correlation was found between percent pol and percent purity and brix and percent pol (table 2). This indicated that selection through percent pol, percent purity and brix would produce varieties with high levels of percent POCS.

The measures for sucrose content (brix and percent POCS) were found to be negatively correlated with percent fibre. This indicates that these characters were associated in an undesirable manner. James and Falgout (1969) found positive association between brix and fibre, which indicated that selection for high brix would lead to high fibre in the selected population

The path coefficient analysis in the present study showed that diameter of millable stalk and stalk heights

were the most important components with direct influence on plant volume. Punia *et al.* (1983), Kang *et al.* (1989) and Singh *et al.* (1994) also reported that number of millable stalks per stool and weight of stalks were the most important components of cane yield per stool.
On the other hand, Singh and Sharma (1983) reported that number of millable stalks per plot and stalk diameter were the most important components of cane yield. Hooda et al. (1988) observed that millable stalks per stool and single cane weight were the most important trait influencing cane yield. Choudhary and Singh (1994) reported that number of millable stalks and individual cane weight made the greatest direct contribution to cane yield.

The influence of each basic variable on plant volume due to association with the other basic variables in the system is shown in Table 4 by the indirect components in the partitioning of the observed total correlation. For example, the total correlation for plant volume vs number of millable stalks, 0.874, is composed of the direct effect of number of millable stalks, 0.045, and the indirect effects of weight of millable stalks, 0.829, and weight per stalk, 0.00. The character weight per stalk did not contribute towards plant volume (Table 4). This clearly indicated that millable stalks contributed directly towards plant volume and very little indirectly via other characters.

The residual effect determines how best the casual factors account for the variability of the dependent factor; plant volume in this case. The residual estimate being 0.232, the variable number of millable stalks, weight of millable stalks, and weight per stalk explains 78.8 percent of the variability in plant volume. Since the residual effect accounts for only 23.2 percent of the variability, it means that most of the factors which influence the dependent character (plant volume) has been considered.

The present study shows that for number of millable stalks, weight per stalk and stalk thickness, the correlation coefficient is positive but the direct effect is negligible. Moreover, weight per stalk does not contribute towards plant volume either directly or indirectly. However, number of millable stalks affect plant volume indirectly via weight of millable stalks and stalk thickness affects plant volume indirectly via stalk height but the contribution towards plant volume is quite low.

Table 3. Direct and indirect effects of agronomic characters on plant volume

Plant volume (cm³) vs, number of millable stalks	
Direct effect	**0.045**
Indirect effect via, weight of millable stalks (kg)	**0.829**
Indirect effect via, weight per stalk (kg)	**0.000**
Total (direct and indirect) effects	**0.874**
Plant volume (cm³) vs, weight of millable stalks (kg)	
Direct effect	**0.932**
Indirect effect via, number of millable stalks	**0.040**
Indirect effect via, weight per stalk (kg)	**0.00**
Total (direct and indirect) effects	**0.972**
Plant volume (cm³) vs, weight per stalk (kg)	
Direct effect	**0.000**
Indirect effect via, number of millable stalks	**0.026**
Indirect effect via, weight of millable stalks (kg)	**0.802**
Total (direct and indirect) effects	**0.828**
Plant volume (cm³) vs, refractor meter brix	
Direct effect	**-0.137**
Indirect effect via, stalk thickness (cm)	**-0.046**
Indirect effect via, stalk height (cm)	**0.151**
Total (direct and indirect) effects	**-0.032**
Plant volume (cm³) vs, stalk thickness (cm)	
Direct effect	**0.009**
Indirect effect via, refractor meter brix	**0.707**

Indirect effect via, stalk height (cm)	**0.165**
Total (direct and indirect) effects	**0.881**
Plant volume (cm³) vs stalk height (cm)	
Direct effect	**0.518**
Indirect effect via, refractor meter brix	**-0.040**
Indirect effect via, stalk thickness (cm)	**0.003**
Total (direct and indirect) effects	**0.481**

Table 4. Path coefficient analyses of POCS vs. four components of POCS

%POCS vs. Brix		**POCS vs. Purity**	
Direct effect	**0.089**	Direct effect	**0.105**
Indirect effect via %pol	**0.540**	Indirect effect via Brix	**0.009**
Indirect effect via %purity	**0.011**	Indirect effect via pol	**0.649**
Total (direct & indirect effects)	**0.640**	Total (direct & indirect effects	**0.763**
POCS vs. POL		**POCS vs. Fibre**	
Direct effect	**0.832**	Direct effect	**-0.075**
Indirect effect via Brix	**0.058**	Indirect effect via pol	**-0.047**
Indirect effect via purity	**0.082**	Indirect effect via purity	**0.012**
Total (direct & indirect effects)	**0.972**	Total (direct & Indirect effects)	**-0.110**

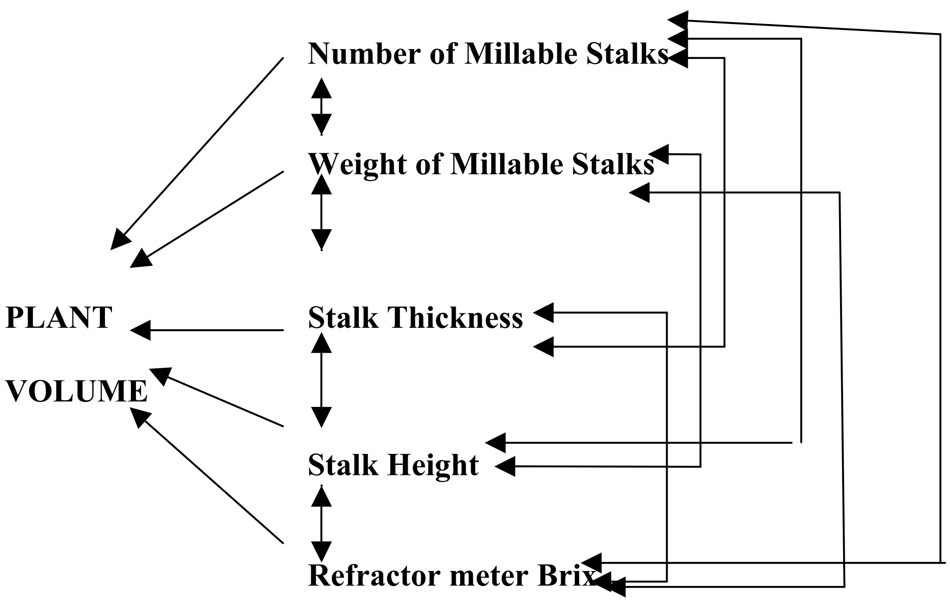

Figure 2. Path diagram showing casual relationship of various characters to plant volume. Double-arrow lines indicate association between characters as measured by correlation coefficients, and single-arrow lines represent the direct influence as measured by path coefficients.

4.3 PATH COEFFICIENT ANALYSIS – AGRONOMIC CHARACTERS

A path diagram showing the casual relationship among plant volume, stalk height, number of millable stalks, stalk thickness, and refractor meter brix is shown in Figure 2.

4.4 PATH COEFFICIENT ANALYSIS – BIO-CHEMICAL CHARACTERS

The relative influence of the bio-chemical characters on percent POCS is shown by the direct-effect component of the partitioned total correlation.

For present POCS vs. percent pol the correlation coefficient between the two characters is quite close to its direct effect. Thus, this correlation explains a true relationship and a direct selection through this trait will be effective. In the case of percent POCS and percent purity and percent POCS and brix the correlation is positive but the direct effect is negligible. However, the indirect effects seem to be the cause of correlation. Thus, in the above percent pol seems to be the cause of the correlation (Table 6).

The residual estimate being 0.235, the variables percent pol, percent purity, fibre and brix explain 76.5 percent of the variability in POCS. Since residual effect accounts for 23.5 percent of the variability it means that most of the factors which influence the dependent character (percent POCS) has been considered.

Battan *et al.* (1985) reported that brix and pol percentages were the most reliable characters in selecting for high commercial cane sugar genotypes.

Hooda *et al.* (1990) carried out path coefficient analysis on percentage brix, pol, purity and reducing sugars and reported that although correlation were generally high for all traits, direct effects affecting commercial cane sugar was low or negative. The present study showed that percent fibre is the least important components of POCS. Similar results were obtained by Kang *et al*. (1989).

Although it is desirable to select directly from important characters, selection is often made of correlated characters on which selection is more economical. For example, during early stages of selection the breeder measures brix with a hand refractor meter in order to select for sugar content. Since brix measures the total soluble solids in the juice and a high proportion of these solids consist of sucrose, the correlation is usually high enough to make brix a very useful correlated character for selection.

Singh *et al.* (1994) studied direct and indirect effects of characters affecting cane yield of five sugarcane crosses. Information on six traits which include number of millable stalks, stalk weight, stalk height, stalk diameter, brix percentage and sucrose percentage were collated. Path coefficient analysis showed that number of millable stalks followed by stalk weight had the greatest direct effect on cane yield. The direct effects of stalk height, stalk diameter, brix percentage and sucrose percentage on cane yield was generally very low.

Patel *et al.* (1993) indicated that the most important component of cane sugar productivity was commercial cane sugar, which showed the greatest direct effect. Juice sucrose percentage, commercial cane sugar percentage and number of inter-nodes produced the greatest positive indirect effect through commercial cane sugar on cane yield. Das *et al.* (1997) carried out experiments on character association and path analysis of sugar yield in sugarcane. The data revealed that individual cane weight, stalk diameter, commercial cane sugar and sucrose percentage indirectly influenced sugar yield.

The general objective of a cane improvement program is to release varieties, which would increase profits of growers and millers over long periods of time. High production of sugar per unit area (e.g. tones of sugar per hectare) is the most important character, being the character most closely correlated with economic value. Significant positive correlation coefficients were recorded in the present investigation among agronomic and bio-chemical characters. Path coefficient analysis also showed highest direct effect of agronomic characters such as plant volume, number of millable stalks, stalk height and weight of stalk per stool in sugarcane yield. These results are applicable to parents studied in that particular environment. These parents can be used to produce high cane yielding and better sugar producing varieties of sugarcane in Fiji. In fact new varieties of sugarcane are being tested at FSC Lautoka as a results of crosses generated from the present study.

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