# ESTIMATES OF GENOTYPIC AND PHENOTYPIC VARIATION, HERITABILITY AND GENETIC ADVANCE UNDER SELECTION OF SOME CHARACTERS OF SUGARCANE CLONES.

**M. A. Khaleque Mian and A. Awal,**
Sugarcane Research Institute, Ishurdi, Pabna, Bangladesh.

## SUMMARY

An experiment was conducted in the year 1976-77 with 9 promising suargcane clones from advance selection stage and one standard variety at Sugarcane Research Institute, Ishurdi, Pabna. The genotypic and phenotypic variation, co-efficient of variability, heritability and genetic advance under selection were determined for germination percentage, tillering per clump, stalk height, stalk diameter, yield of cane per acre, recoverable sucrose content and per acre sugar yield.

The difference between phenotypic and genotypic variances were very small in all the cases except germination percentage, indicating that the environmental infllluence on germination was very prominent.

Yield of sugar per acre, germination percentage, yield of cane per acre and tillering per clump exhibite high degrees of genotypic and phenotypic co-efficient of variability. High heritability percentage in broad sense was observed in case of sugar yield per acre, recoverable sucrose content, yield of cane per acre and germination percentage.

High values of genetic advance expressed as percentage of mean values were observed in case of sugar and cane yield per acre and germination percentage of the clones.

Yield of sugar and cane per acre and germination percentage demonstrated high degrees of genetic variability, heritability and genetic advance under selection and were amenable to selection.

## INTRODUCTION

The aim of any plant breeding programme is to develop commercial varieties having greater production potential. This potentiality of the materials may be due to inherent genetic superiority in yield or quality, resistance to pests and diseases, improved agronomic characters or to a combination of such factors. Under plant improvement programme breeders' problem is to breed new variants and to select genetically superior ones for further testing. Genetic variants normally vary due to genetic and environmental factors. Combined variation due to the above two factors of a particular character is the phenotypic variance. Genotypic variance is the effect of the particular assemblance of genes possessed by the individual and environmental deviation is the value of non-genetic circumstances that affect the phenotype. And the proportion of the total phenotypic variance that is to genotypic is measured by heritability.

As cross-pollinated crop, sugarcane has a wide range of variability between clones. In order to select suitable genotypes it is necessary to partition the observed variability into its heritable and non-heritable components with the help of suitable parameters.

The purpose of this investigation was to estimate the genetic and environmental component of variance, heritability, co-efficient of variability and expected progress from selection in some characters of sugarcane clones.

## MATERIALS AND METHODS

### Field experiments and data collection

The experiment was conducted at Sugarcane Research Institute, Ishurdi, Pabna during the cropping year 1976-77. The experimental materials included 10 sugarcane clones (9 promising strains and 1 standard variety). The experiment was laid out in randomized complete block design with four replications. Each clone was grown in a plot of 30 x30 maintaining 4' row to row distance. Normal cultural practices were followed :

Data on the following characters were recorded.

1. Germination percentage at 75 days of plantation.
2. Tillering per clump at 150 days of plantation.
3. Stalk height (in ft.) and diameter (in cm) at harvest.
4. Yield in TCA (Ton Cane per acre)
5. Recoverable sucrose content (in percentage)
6. Yield in TSA (Ton sugar per acre)

Data on germination percentage, tillering per clump and yield of cane were recorded on the whole plot basis. The rest of the data were noted from 10 randomly selected plants taken from the middle rows.

### Statistical Analysis

Analysis of variance as a randomized block design was performed for the characters measured in the from given below :

| Sources of variation | Mean Sum Square | Expectation |
|---|---|---|
| Replication | $MS_1$ | $\delta^2 e + g\delta^2 r$ |
| Genotypes | $MS_2$ | $\delta^2 e + \delta^2 g$ |
| Error | $MS_3$ | $\delta^2 e$ |

Components of variances, heritability, co-efficient of variability and expected gain under selection were calculated on the basis of the procedure outlined by Skinder ,1972).

Genetic variance $(\delta^2 g) = (MS_2 - MS_3)/r$

Where r=number of replications.

Broad sense heitability $(H) = \delta^2 g / (\delta^2 g + \delta^2 e / r)$

Phenotypic co-efficient of variability $= (\delta^2 ph \times 100)/\bar{X}$

Where $\delta$ ph=Square root of $\delta^2 ph$

$\bar{X}$ =Mean of the trait under consideration.

Genotypic co-efficient of variability $= (\delta g \times 100)/\bar{X}$

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Expected gain under selection ($\Delta G$)=K$\delta$pH

Where K was selection differential used here was 2.06 on the assumption that the top 5% of the population were chosen (Lush, 1945), $\delta$p was the standard deviation and H was the heritability.

## RESULTS AND DISCUSSION

Analysis of variances indicated the existance of sufficient genetic variability among the strains for all the characters studied (Table 1). Calculated F values for all the characters studied indicated that the genotypes differed significantly. Similar results have been reported by allam **et al** in estimating heritability in sugarcane.

The variability estimated recorded a small difference between genotypic and phenotypic variances in all the characters (Table 2). Only the characters germination percentage-showed comparatively larger difference between phenotypic and genotypic variances. This indicated that the enviromental influence upon the various traits studied except germination percentage-was low. Table-2 also recorded the low phenotypic and genotypic variances for all the traits except germination percentage and yield of cane. Larger value of genotypic variance for any character is always helpful for effective selection.

Broad sense heritability for all the characters were high (Table-2). Yield of cane & sugar, germination percentage and recoverable sucrose content recorded the highest values. Allam **et. al.** in estimating heritability in sugarcane also observed higher values with respect to yield of cane and sugar. Tillering per clump showed the lowest heritability value (66.67%) which indicated that maximum environmental effect exist on the expression of the genes controlling this trait.

Highest amount of genotypic and phenotypic co-efficient of variability was observed for yield of sugar indicating the wider scope of selection for this trait (Table-3). There was also observed a considerable amount of both genotypic and phenotypic co-efficient of variability for the traits germination percentage, yield of cane, tillering per clump and recoverable sucrose content followed by stalk heigh. and stalk diameter. Low value of variability for any character indicated the difficulty in improving the character by selection as reported by Mangelsdorf (1959). Large amount of variability in respect of yield of sugar have also been observed by N. Balasundarum and K. V. Bhagyalakshmi (1978) in studying variability and heritability of sugarcane.

Yield of sugar and germination percentage showed high levels of genetic advance i.e. 24.72% and 22.10% respectively, followed by yield of cane (17.48%), tillering per clump (13.78%) and recoverable sucrose content (11.86%). Stalk hight and stalk diameter showed the lowest values of genetic advance (Table-3) confirming the low levels of genetic variability in these characters which indicates the difficulty in improving them through selection. Similar results in case of stalk height was also observed by N. Balasundaram and K. V. Bhagyalakshimi, (1978).

**Table-1 Estimates of phenotypic variation for different characters in sugarcane clones.**

| Characters | Mean | Range | Calculated F. |
|---|---|---|---|
| Germination% | 45.97 | 34.20-50.91 | 6.40** |
| Tillering per clump | 4.21 | 3.56- 4.87 | 3.09* |
| Stalk height | 10.01 | 9.41-10.52 | 4.71** |
| Stalk diameter | 2.00 | 1.90- 2.13 | 3.33** |
| Yield in TCA | 39.02 | 30.35-43.43 | 7.14** |
| Recoverable sucrose Content | 11.30 | 10.46-12.58 | 10.79** |
| Yield in TSA | 4.41 | 3.56- 5.46 | 14.44** |

*Significant at 5% level.
**Significant at 1% level.

**Table-2 Estimates of components of variance and heritability for different characters in sugarcane clones.**

| Characters | Variances | | | Heritability% |
|---|---|---|---|---|
| | Phenotypic | Genotypic | Error | |
| Germination % | 34.16 | 28.82 | 5.34 | 84.37 |
| Tillering/clump | 0.18 | 0.12 | 0.06 | 66.67 |
| Stalk height | 0.17 | 0.13 | 0.04 | 76.47 |
| Stalk diameter | 0.005 | .003 | 0.002 | 70.00 |
| Yield in TCA | 14.83 | 12.75 | 2.08 | 85.97 |
| Recoverable Sucrose content | 0.52 | 0.47 | 0.05 | 90.38 |
| Yield in TSA | 0.32 | .30 | 0.02 | 93.80 |

**Table-3 Estimates of genotypic and phenotypic co-efficient of variations along with genetic advance for different characters in sugarcane clones.**

| Characters | Genotypic co-efficient of variation (%) | Phenotypic co-efficient of variation (%) | Genetic advance on % of mean. |
|---|---|---|---|
| Germination % | 11.70 | 12.07 | 22.10 |
| Tillering/clump | 8.23 | 10.08 | 13.78 |
| Stalk height | 3.60 | 4.10 | 6.49 |
| Stalk diameter | 2.80 | 3.60 | 5.00 |
| Yield in TCA | 9.20 | 9.90 | 17.48 |
| Recoverable sucrose content | 6.10 | 6.40 | 11.86 |
| Yield in TSA | 12.40 | 12.80 | 24.72 |

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