contributed to its positive significance on yield. Hence simultaneous selection of number of grains per rachis be effective in obtaining superior genotypes.

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(Received : March 1995 Revised : January 1996)

Madras Agric. J., 83(10): 628-631 October 1996
https://doi.org/10.29321/MAJ.10.A01067

# GENETIC VARIABILITY, CORRELATION AND PATH CO-EFFICIENT ANALYSIS OF JAGGERY YIELD AND RELATED ATTRIBUTES IN SWEET SORGHUM

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## ABSTRACT

The range of variation for different characters indicated wide differences among the genotypes both in main and ratoon crop. The phenotypic and genotypic co-efficient of variation was high for stem girth, length of fourth internode, total soluble solids and green stalk yield in main crop. High heritability and high genetic advance as per cent of mean for plant height, stem girth, length of fourth internode, green stalk yield, juice yield and jaggery yield both in main and ratoon crop indicated the presence of additive genes for these characters. Non-additive gene action was predominant for number of internodes in both main and ratoon crop. Juice yield showed strong positive correlation with jaggery yield in both main and ratoon crops. The juice yield had high positive direct effect in both main and ratoon crops. Hence, selection for high juice yield might be effective in achieving higher jaggery yield in sweet sorghum.

KEY WORDS : Sweet Sorghum, Yield, Jaggery Yield, Correlation, Path- analysis

Sorghum is mainly grown as rainfed crop and sweet sorghum (*Sorghum bicolor* (L.) Moench) is a special type used in preparation of jaggery. Jaggery can be manufactured from sweet sorghum stalks after harvesting the grain which provides additional income to the farmers. The stalks have been used upto 15 days after grain harvest without appreciable loss in quantity or quality of jaggery produced (Ghanekar, 1986). So, a thorough knowledge of existing genetic variation and extent of association between contributing characters is essential for developing high jaggery yielding genotypes. The observed variability is a combined measure of genetic and environmental causes. It is only the genetic variability that is heritable from generation to generation. Correlation and path analysis will establish the extent of association between jaggery yield and related attributes. It wil also bring out relative importance of their direct and indirect effects and give a clear idea of their association with jaggery yield. Thus it can help in selection and improvement of the traits. The present investigation in sweet sorghum is an attempt in this direction.

**Table 1. Variability estimates for eight characters in sweet sorghum main crop (M) and ratoon crop (R)**

| Characters | | GCV | PCV | Heritability % | Genetic Advance (GA) | GA (as % of mean) |
|---|---|---|---|---|---|---|
| Plant height (cms) | M | 19.92 | 20.10 | 99.73 | 1.04 | 40.86 |
| | R | 17.27 | 17.86 | 93.51 | 0.63 | 34.22 |
| Stem girth (cms) | M | 49.57 | 124.61 | 88.97 | 1.49 | 71.2 |
| | R | 22.20 | 23.52 | 89.09 | 0.61 | 43.12 |
| No. of internodes | M | 13.49 | 13.74 | 96.55 | 4.56 | 26.59 |
| | R | 11.89 | 12.97 | 84.11 | 2.37 | 22.45 |
| Length of the fourth internode from the top (cms) | M | 30.85 | 31.15 | 98.11 | 8.56 | 62.87 |
| | R | 28.77 | 29.36 | 95.99 | 5.08 | 57.47 |
| Total soluble solids (%) | M | 27.98 | 29.53 | 94.76 | 5.00 | 22.10 |
| | R | 4.93 | 5.50 | 80.61 | 2.32 | 9.12 |
| Green stalk yield (t/ha) | M | 29.87 | 29.96 | 99.37 | 20.16 | 61.11 |
| | R | 32.65 | 31.18 | 98.40 | 11.62 | 53.27 |
| Juice yield (t/ha) | M | 39.14 | 40.13 | 95.13 | 5.30 | 78.53 |
| | R | 56.13 | 57.34 | 95.86 | 3.33 | 112.21 |
| Jaggery yield (kg/ha) | M | 41.20 | 44.89 | 84.21 | 0.24 | 77.69 |
| | R | 55.54 | 79.30 | 49.06 | 0.12 | 79.87 |

GCV : Genotypic coefficient of variation; PCV : genotypic coefficient of variation

## MATERIALS AND METHODS

Fifteen cultivars including the check variety was grown at the Agricultural Research Station, Vellore under irrigated condition during *rabi*, 1991-92 season. They were raised in a randomised block design replicated thrice in the plot size of 3.0 x 2.7 m with 45 x 15 cm spacing. The observation on plant height (cm), stem girth (cm), length of the fourth internode from the top (cm), number of internodes per plant, total soluble solids (%), green stalk yield (t/ha), juice yield (l/ha), and jaggery yield (kg/ha) was recorded in the main crop of sweet sorghum. The crop was harvested and the green stalk yield was recorded after removing the leaves and earhead. The juice yield was recorded by crushing the stalks in the mini sugarcane crusher. The jaggery was prepared from the juice by local method followed for sugarcane.

The main crop was left for ratooning after harvesting. On tenth day, the side shoots were thinned to one plant per hill and nitrogen was applied at 40 kg/ha and given irrigation. Observations was recorded as in the main crop. The data were recorded from 10 randomly selected plants. Co-efficients of variation (Burton, 1952), heritability in board sense (Lush, 1940), genetic advance and phenotypic correlation co-efficients (Johnson *et al.*, 1955) and path analysis (Dewey and Lu, 1959) were worked out.

## RESULTS AND DISCUSSION

The values of mean, range and components of variation for characters under study are presented in Table 1. The range of variation for different characters indicated wide differences among the genotypes both in main and ratoon crop. The maximum range of variation was observed for almost all the characters studied both in main and ratoon crop. The phenotypic and genotypic co-efficient of variation was high for stem girth, length of fourth internode, total soluble solids, green stalk yield, juice yield and jaggery yield in main crop. In ratoon crop, it was high for length of fourth internode, green stalk yield, juice yield and jaggery yield. The extent of genetic variability for jaggery yield and related attributes was greater both in main and ratoon crop offering scope for improvement through selection and other appropriate breeding methods. High genotypic variability was observed earlier for green stalk, juice and jaggery yield (Bapat *et al.*, 1987).

High heritability was recorded for all the characters in the main crop. In ratoon crop also, similar trend was observed except jaggery yield which showed moderate heritability estimates. Genetic advance as per cent of mean was high for stem girth, length of fourth internode, green stalk yield, juice yield and jaggery yield. It was moderate for plant height, number of internodes and total soluble solids in main crop. In ratoon crop, high

**Table 2. Correlation co-efficient between jaggery yield and related attributes in sweet sorghum main crop (M) and ratoon crop (R)**

| Characters/stages | | Stem girth | No. of internodes | Length of fourth internodes | Total soluble solids | Green stalk yield | Juice yield | Jaggery yield |
|---|---|---|---|---|---|---|---|---|
| Plant height | M | 0.189 | 0.243 | 0.398 | -0.260 | 0.385 | 0.074 | 0.053 |
| | R | 0.620* | 0.724* | 0.333 | -0.086 | 0.379 | -0.125 | - 0.113 |
| Stem girth | M | | 0.723* | -0.270 | -0.364 | -0.151 | 0.348 | 0.329 |
| | R | | 0.799** | 0.219 | -0.037 | 0.558* | 0.009 | - 0.012 |
| No. of internodes | M | | | -0.413 | -0.016 | - 0.172 | 0.319 | 0.353 |
| | R | | | 0.339 | -0.052 | 0.424 | -0.087 | - 0.107 |
| Length of fourth internode | M | | | | 0.073 | 0.495 | 0.117 | 0.077 |
| | R | | | | 0.033 | 0.538* | 0.254 | 0.340 |
| Total soluble solids | M | | | | | - 0.184 | 0.025 | 0.058 |
| | R | | | | | 0.097 | 0.078 | 0.180 |
| Green stalk yield | M | | | | | | 0.140 | 0.114 |
| | R | | | | | | 0.260 | 0.312 |
| Juice yield | M | | | | | | | 0.978** |
| | R | | | | | | | 0.984** |

genetic advance as percent of mean was observed for juice yield followed by jaggery yield and length of fourth internode. The lowest value was recorded for total soluble solids in both main and ratoon crop (Table 2).

The characters such as plant height, stem girth length of fourth internode, green stalk yield, juice yield and jaggery yield having high heritability estimates and genetic advance as percent of mean both in main and ratoon crop indicated that additive effects had a major role in the expression of these characters. High heritability estimates for number of internodes with low genetic co-efficient of variability implied the role of non-additive gene action for this character in the main and ratoon crops. As a result of low genetic advance as percent of mean, this character's response to selection would be poor. Similar findings was also reported by pederson (1981) in forage sorghum. High heritability estimates, genetic co- efficient of variation and genetic advance as percent of mean for the total soluble solids in the main crop indicated the presence of additive gene action, but in ratoon crop it recorded high heritability estimates with low genetic co-efficient of variation and genetic advance as percent of mean and this sould indicate the importance of both additive and non-additive gene action for this character.

**Table 3. Path co-efficients showing the direct and indirect effects of the yield components in sweet sorghum main crop (M) and ratoon crop (R)**

| Characters/stages | | Plant height | Stem girth | No. of internodes | Length of fourth internodes | Total soluble solids | Green stalk yield | Juice yield | Jaggery yield |
|---|---|---|---|---|---|---|---|---|---|
| Plant height | M | -0.032 | -0.018 | 0.029 | 0.002 | 0.003 | - 0.003 | 0.072 | 0.053 |
| | R | 0.035 | -0.009 | -0.059 | 0.032 | -0.008 | 0.013 | - 0.117 | -0.113 |
| Stem girth | M | 0.006 | -0.097 | 0.086 | -0.001 | 0.005 | 0.011 | 0.319 | 0.329 |
| | R | 0.022 | -0.015 | -0.065 | 0.021 | -0.003 | 0.018 | 0.008 | -0.012 |
| No. of internodes | M | 0.007 | -0.070 | 0.105 | -0.002 | 0.001 | 0.001 | 0.311 | 0.353 |
| | R | 0.025 | -0.012 | -0.082 | 0.032 | -0.005 | 0.014 | - 0.081 | 0.107 |
| Length of fourth internodes | M | 0.012 | 0.016 | -0.029 | 0.005 | 0.001 | 0.004 | 0.070 | 0.077 |
| | R | 0.011 | -0.003 | -0.029 | 0.098 | 0.003 | 0.018 | 0.238 | 0.340 |
| Total soluble solids | M | 0.008 | 0.035 | 0.002 | 0.001 | - 0.014 | 0.002 | 0.024 | 0.058 |
| | R | 0.003 | 0.001 | 0.004 | 0.003 | 0.093 | 0.003 | 0.073 | 0.180 |
| Green stalk yield | M | 0.012 | 0.014 | 1.121 | 0.002 | 0.002 | 0.008 | .055 | 0.114 |
| | R | 0.013 | -0.008 | -0.034 | 0.054 | 0.009 | 0.034 | 0.244 | 0.312 |
| Juice yield | M | 0.002 | -0.033 | 0.032 | 0.001 | -0.001 | 0.001 | 0.976 | 0.978 |
| | R | 0.004 | -0.001 | 0.002 | 0.024 | 0.007 | 0.009 | 0.939 | 0.984 |

Residual effect M - 0.1943 R - 0.0915

Jagery yield showed strong and positive association with juice yield alone. In the inter correlation studies, green stalk yield showed positive and significant association with length of fourth internode and stem girth in the ratoon crop alone. Similarly plant height also showed positive and significant association with stem girth and number of nodes in ratoon crop (Table 2). Juice yield showed high positive direct effect which was reflected in its positive and significant correlation with jaggery yield both in main and ratoon crop (Table 3). Other than juice yield, no other character had high positive direct effect with jaggery yield and this was exhibitd by their non significant association with jaggery yield. It can be inferred from the variability studies, genotypic correlation co-efficients and path co-efficient analysis that juice yield which recorded significant positive association having high positive direct effect on jaggery yield might be regarded as the prime character for selection. This might be effective in obtaining superior genotypes.

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(Received : March 1996 Revised : June 1996)

Madras Agric. J., 83(10): 631-633 October 1996

# EVALUATION OF $F_2$ RATOON CROP OVER MAIN CROP IN FODDER SORGHUM

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**ABSTRACT**

In fodder sroghum, mean performance of the ratoon crop over the main crop was assessed in the $F_2$ generation of the cross between Co-27 and *Sorghum halepense* (2n=40). The results revealed that there was reduction in biomass yield in ratoon crop, even though it had increase in number of tillers. The intergeneration correlation study showed that there was no relationship between $F_2$ main crop and ratoon crop.

KEY WORDS : Fodder Sorghum, Ratoon Crop, Evaluation

Evolving a multicut fodder type is the main objective in the fodder sorghum breeding programme. The hybrids should have high regeneration ability and should show increase in their vegetative characters while ratooning. Keeping this in view, the present study was formulated to study the ratooning ability of the interspecific hybrid derivatives ($F_2$ generation of the cross between Co-27 and *Sorghum halepense* (2n=40)) in sorghum by assessing the mean performance of the ratoon crop over the main crop. Further, the bearing of the main crop on its successive ratoon crop was also assessed by estimating the inter generation correlation and heritability in the ratoon crop.

## MATERIALS AND METHODS

The experimental material consisted of 20 open pollinated and 10 self pollinated earheads of $F_1$ in the cross between Co-27 and *S. halepense* (2n=40). Seeds collected from each earhead were grown as individual $F_2$ families in a randomised