Correlation coefficient of agronomic attributes on sweet sorghum [Sorghum bicolor (L.) Moench]

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ABSTRACT

Correlation coefficient analysis was carried out to elucidate inter relationship on sweet sorghum among growth parameters (plant height, leaf area index, mid stem diameter; leaf: stem ratio) with yield parameters (stalk, juice, sugar, ethanol, fodder, crude protein content and in vitro dry matter digestible yield). Quality parameters (juice percent, brix percent, juice purity coefficient and sucrose percent) were also correlated to each other and yield parameters (cane yield, sugar yield, juice yield and ethanol yield). Positive correlations were observed between growth, yield and quality parameters.

Key words: Sweet sorghum, Correlation coefficient, IVDMD yield, Ethanol yield.

Materials and Methods

A field experiment was conducted during rainy (kharif) season of 2009 at the research farm of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttrakhand. The experiment was conducted using a factorial randomized block design with four replications. Four levels of nitrogen (0, 60, 120 and 180 kg N/ha) with three seed rates (5, 10 and 15 kg/ha) were the treatment combination imposed on sweet sorghum variety ‘SSV-84’. The soil of experimental site was silty clay loam in texture with pH of 7.30, available N, P, K were 282, 26.5, 245.4 kg/ha and 0.85% organic carbon. As per N treatment, ½ of the N in form of urea, the full recommended dose of phosphorus (60 kg P2O5/ha) in the form of single super phosphate and recommended dose of potassium (40 kg K2O/ha) in the form of muriate of potash were applied as basal application. The remaining of the ¼th N was applied at 35th DAS and rest ¼th at 70 DAS. Crop was sown on 15 June in 2009 at 60 cm row-to-row spacing as per seed rates. The mean annual rainfall was 1369 mm of which 90 per cent was received from June to October. One irrigation was
Table 1. Correlation coefficient among agronomic parameters of sweet sorghum.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Juice purity coefficient (%)</th>
<th>Brix (%)</th>
<th>Sucrose (%)</th>
<th>Available sugar (%)</th>
<th>Cane yield (t/ha)</th>
<th>Sugar yield (t/ha)</th>
<th>Juice yield (kl/ha)</th>
<th>Ethanol yield (l/ha)</th>
<th>Forage yield (t/ha)</th>
<th>Dry matter yield (t/ha)</th>
<th>Crude protein yield (kg/ha)</th>
<th>In vitro digestible yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant height (cm)</td>
<td>0.923*</td>
<td>0.729</td>
<td>0.902*</td>
<td>0.651</td>
<td>0.689</td>
<td>0.946*</td>
<td>0.841</td>
<td>0.970*</td>
<td>0.842*</td>
<td>0.958*</td>
<td>0.963*</td>
<td>0.980*</td>
</tr>
<tr>
<td>Mid stem diameter (cm)</td>
<td>0.823</td>
<td>0.690</td>
<td>0.816</td>
<td>0.639</td>
<td>0.670</td>
<td>0.779</td>
<td>0.738</td>
<td>0.839</td>
<td>0.734</td>
<td>0.779</td>
<td>0.857</td>
<td>0.805</td>
</tr>
<tr>
<td>Leaf area index</td>
<td>0.957*</td>
<td>0.847</td>
<td>0.953*</td>
<td>0.768</td>
<td>0.809</td>
<td>0.967*</td>
<td>0.912*</td>
<td>0.967*</td>
<td>0.911*</td>
<td>0.976*</td>
<td>0.996*</td>
<td>0.990*</td>
</tr>
<tr>
<td>Leaf : stem ratio</td>
<td>0.589</td>
<td>0.577</td>
<td>0.741</td>
<td>0.495</td>
<td>0.536</td>
<td>0.711</td>
<td>0.639</td>
<td>0.606</td>
<td>0.737</td>
<td>0.595</td>
<td>0.716</td>
<td>0.589</td>
</tr>
<tr>
<td>cane weight (g/m row length)</td>
<td>0.946*</td>
<td>0.858</td>
<td>0.879</td>
<td>0.623</td>
<td>0.767</td>
<td>0.912*</td>
<td>0.921*</td>
<td>0.858*</td>
<td>0.960*</td>
<td>0.960*</td>
<td>0.945*</td>
<td>0.946*</td>
</tr>
<tr>
<td>Juice (%)</td>
<td>0.607</td>
<td>0.918*</td>
<td>0.834</td>
<td>0.873</td>
<td>0.944*</td>
<td>0.978*</td>
<td>0.936*</td>
<td>0.935*</td>
<td></td>
<td></td>
<td></td>
<td>0.94*</td>
</tr>
<tr>
<td>Juice Purity coefficient (%)</td>
<td>---</td>
<td>----</td>
<td>0.776</td>
<td>0.973*</td>
<td>0.993*</td>
<td>0.869</td>
<td>0.832</td>
<td>0.965*</td>
<td>0.964*</td>
<td>0.94*</td>
<td>0.94*</td>
<td>0.94*</td>
</tr>
<tr>
<td>Brix (%)</td>
<td>---</td>
<td>----</td>
<td>0.646</td>
<td>0.712</td>
<td>0.867</td>
<td>0.905*</td>
<td>0.804</td>
<td>0.801</td>
<td>0.94*</td>
<td>0.94*</td>
<td>0.94*</td>
<td>0.94*</td>
</tr>
<tr>
<td>Sucrose (%)</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>0.994*</td>
<td>0.842</td>
<td>0.774</td>
<td>0.957*</td>
<td>0.956*</td>
<td>0.94*</td>
<td>0.94*</td>
<td>0.94*</td>
<td>0.94*</td>
</tr>
<tr>
<td>Available sugar (%)</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>0.858</td>
<td>0.805</td>
<td>0.966*</td>
<td>0.965*</td>
<td></td>
<td></td>
<td></td>
<td>0.94*</td>
</tr>
</tbody>
</table>

* Significant at 5 percent level (p<0.05)
given at 10 DAS. To obtain the crude protein yield pooled ground samples were analyzed for nitrogen content by Micro-Kjeldahl method (Jackson, 1973). In vitro dry matter digestible yield was estimated with the help of nylon bag method given by Lowery (1969). Sucrose percent and available sugar percent were measured with Spencer and Meade (1955) method. Sugar yield was observed to multiply sugar percent with juice yield and divided by 100.

Ethanol yield = Sugar yield × 3.78 × 1000 × 0.8.

Results and Discussion

Perusal of data presented in Table 1 revealed that the correlations among parameters viz. plant height, leaf area index, mid stem diameter and leaf stem ratio, cane weight per meter row length had positive correlation (p<0.01) with juice percent, brix percent, juice purity coefficient, sucrose percent, available sugar percent, stalk yield, juice yield, sugar yield, ethanol yield, forage yield, crude protein yield and in vitro dry matter digestible yield. Singh (2009) and Lattief (2011) also showed positive correlation among variables. However, plant height had significant positive correlation (p<0.05) with juice percent (r = 0.923), cane yield (r = 0.946), juice yield (r = 0.970), ethanol yield (r = 0.842), forage yield (r = 0.958), dry matter yield (r = 0.963), crude protein yield (r = 0.980) and in vitro dry matter digestible yield (r = 0.981). Leaf area index had significant positive correlation (p<0.05) existed with juice percent (r = 0.957), brix percent (r = 0.953), cane yield (r = 0.967), sugar yield (r = 0.967) juice yield (r = 0.911), ethanol yield (r = 0.911), forage yield (r = 0.976), dry matter yield (r = 0.996), crude protein yield (r = 0.990) and in vitro dry matter digestible yield (r = 0.942). Cane weight g per meter row length had significant positive correlation (p<0.05) existed with juice percent (r = 0.946), cane yield (r = 0.912), sugar yield (r = 0.921), juice yield (r = 0.858), ethanol yield (r = 0.960), forage yield (r = 0.960), dry matter yield (r = 0.945), crude protein yield (r = 0.946) and in vitro dry matter digestible yield (r = 0.912). Carbon skeletons produced by photosynthesis are variously used to form organic compounds for cane yield, dry matter yield, sugar yield, amino acid biosynthesis for crude protein and IVDMD yield. Dagar et al. (2004) also observed significant and positive correlation coefficient on sugarcane crop.

Correlation among juice qualities (Juice percent, purity coefficient percent, sucrose percent and brix percent) and yield attributes (cane yield, juice yield, sugar yield and ethanol yield) were positively correlated (p<0.01). However, significant correlation (p<0.05) was found between juice percent with brix percent (r = 0.918), stalk yield (r = 0.944), juice yield (r = 0.936), sugar yield (r = 0.978) and ethanol yield (r = 0.935). Juice purity coefficient with sucrose percent (r = 0.973), available sugar percent (r = 0.993), juice yield (r = 0.965), and ethanol yield (r = 0.964). Sucrose per cent with available sugar percentage (r = 0.994), juice yield (r = 0.957), and ethanol yield (r = 0.956). Available sugar percentage were correlated with juice yield (r = 0.966) and ethanol yield (r = 0.965). Roodogi et al., (2001) also found similar correlation coefficient on sweet sorghum.

References


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