Performance of Different Sugarcane Strains for Physico-Chemical Characteristics of Jaggery

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ABSTRACT

Evaluation of five sugarcane strains i.e., HSF-240, S98-SP-108, CPHS-35, CP81-1254 and S2001-US-400, considering HSF-240 as standard, was made for two years on the basis of physico-chemical characteristics of jaggery prepared from these strains during 2004-06. Freshly prepared and three months old jaggery was analyzed for different physical and chemical characteristics. The results revealed that highest sucrose (73.77 to 73.49%), jaggery percent cane (13.61%) and jaggery percent juice (22.45%) were obtained in standard strain HSF-240. On the other hand lowest sucrose (69.95 to 69.04%), jaggery percent cane (9.22%) and jaggery percent juice (17.29%) were given by S98-SP-108. The remaining three strains recorded resulted between these limits.

Key Words: Sugarcane; Physical; Chemical; Jaggery; strains

INTRODUCTION

Jaggery (also called gur or gul in native language) is a solid or semi solid product of sugarcane, which is obtained from concentrating cane juice by addition of organic and inorganic purifying substances during manufacturing process. Jaggery making has become an important cottage industry of rural India and Pakistan, because a large number of people are engaged in the form of cane harvesting, jaggery manufacturing, its sale and marketing etc. This is why it is playing a pivotal role in uplifting the economic condition of rural masses. Similarly its production has been increasing for the last few years and its total production is 416.6 thousand tons (Anonymous, 2005). But this product is very much variety oriented. A high sugar recovery variety may be equally suitable for white and brown sugar but it may not be suitable for a good quality jaggery. On the contrary, a variety suitable for jaggery making is also good for sugar manufacturing. So, various physical and chemical characteristics of jaggery are due to cane varietal differences as well as varietal characters.

A few researchers have conducted their work related to evaluation of cane varieties for physico-chemical characteristics of jaggery. Hussain et al. (2003) compared seven sugarcane varieties for their jaggery qualitative characteristics on the basis of jaggery percentage of cane, colorimetric units, net rendements etc. before and after storage for 90 days. Upal and Sharma (1999) studied quality as well as shelf life of jaggery stored in air tight glass and plastic containers. They observed no difference except jaggery color, which was better in air tight glass containers. Khana and Chacravarthy (1955) demonstrated that cane varieties extracting juice with higher phosphate concentration but low in pectin, ash and gum yield good quality jaggery.

Therefore, this investigation was undertaken to evaluate the physical and chemical properties of jaggery production of five sugarcane strains under agro-ecological conditions of Faisalabad, Pakistan.

MATERIALS AND METHODS

The present experiment was conducted at Sugarcane Research Institute, Faisalabad, during two consecutive years 2004-05 and 2005-06. The study was conducted to examine the performance of five spring planted sugarcane strains for physico-chemical characteristics of jaggery. The recommended seed rate and cultural practices were followed to grow the crop. Treatments were replicated thrice under a randomized complete block design. At harvest random sampling of canes was done from different stools of each replication and composite representative samples were crushed for juice extraction and analysis was made according to the standard procedures described in laboratory manual (Anonymous, 1970).

Jaggery, prepared according to the standard procedure laid down in Gur Monograph (Roy, 1951), was stored in gunny bags at room temperature for three months and
analyzed for color, acidity, contents of ash, moisture, net rendements, sucrose and reducing sugars. After 90 days, jaggery was re-analyzed for the same quality parameters as mentioned in Gur Monograph (Roy, 1951). The data thus collected were subjected to statistical analysis to test the differences and superiority of treatment means using LSD at 5% probability levels as proposed by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Quality of cane and cane juice in relation to jaggery production. The data revealed a significant difference among strains except acidity, among means for cane and cane juice analysis (Table I). It is evident from data that maximum brix percent juice (23.54%), pol percent juice (19.17%), jaggery percent juice (22.45%), pol percent cane (11.62%), juice percent cane (60.56%), CCS (13.78%) and sugar recovery (12.95%) were shown by HSF-240 while strain S2001-US-400 gave maximum juice purity (83.32%) as well as bagass percent cane (47.91%). While, the lowest juice purity (81.42%), bagass percent cane (39.44%), were revealed by strain HSF-240. Strain S2001-US-400 produced lowest brix percent juice (18.68%), pol percent juice (15.56%), jaggery percent juice (18.12%), pol percent cane (8.11%), juice percent cane (52.09%), CCS (11.36%) and sugar recovery (10.69%). These observations are in line with those of Hussain et al. (2003) who mentioned similar but different data trend in their experiment.

Ash. Excess of ash adversely affects the jaggery quality. A perusal of data embodied in Table I indicated that all means varied non-significantly with respect ash. A highest percentage of ash after standard HSF-240 (3.10%) was shown by strain CP81-1254 (3.06%), while lowest (2.76%) by the strain S98-SP-108 as compare to the standard (HSF-240). Such genetic variation in jaggery ash contents have already been reported (Hussain et al., 2003).

Color. It is an important physical character of jaggery, because light colored jaggery is preferred. It is evident from the table that there was significant variation among strains for color. S98-SP-108 exhibited lowest colorimetric units before (38.84) and after storage (36.36) as compare to standard HSF-240 (48.25 & 45.43 colorimetric units before & after storage, respectively). Similar results were reported by Uppal and Sharma (1999).

Moisture. Jaggery with high moisture percentage adversely affects the quality (Singh et al., 1975). Significant differences for moisture percentage among various strains were confirmed (Table II). Lowest percentage of moisture (4.69 & 4.44) was recorded in S98-SP-108 before and after storage as compare to the standard strain that showed maximum value (6.27%) before storage and ranked second (4.90%) after storage. These observations are similar to that reported by Patil et al. (1994a).

Net rendements. It shows a combination of all three sugars present in jaggery. The results revealed that strains varied significantly for this parameter of their jaggery (Table II). The maximum values of net rendemants before and after storage (57.95% & 56.56%) were shown by strain S2001-US-400, while minimum value (56.40%) before storage was recorded by CP81-1254 and after storage (56.05%) by strain CPHS-35. The remaining three strains fell within this range. These explanations are in agreement with those revealed by Hussain et al. (2003) who reported a trend analogous to this description.

Acidity. A low pH or high acidity fastens jaggery quality deterioration process by inversion. Regarding the acidity, statistically significant differences were noticed between different strains. Lowest acidity before and after storage (5.63 & 5.51) was observed in the jaggery of strain S98-SP-

Table I. Quality of cane and cane juice in relation to jaggery production

<table>
<thead>
<tr>
<th>Strains</th>
<th>Juice (%)</th>
<th>Cane (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Brix (%)</td>
<td>Pol (%)</td>
</tr>
<tr>
<td>S98-SP-108</td>
<td>19.93c</td>
<td>16.56c</td>
</tr>
<tr>
<td>CPHS-35</td>
<td>19.56c</td>
<td>16.19c</td>
</tr>
<tr>
<td>CP81-1254</td>
<td>20.72b</td>
<td>17.04b</td>
</tr>
<tr>
<td>S2001-US-400</td>
<td>18.68d</td>
<td>15.56d</td>
</tr>
<tr>
<td>HSF-240 (std.)</td>
<td>23.54a</td>
<td>19.17a</td>
</tr>
<tr>
<td>LSD at 5%</td>
<td>0.5662</td>
<td>0.4345</td>
</tr>
</tbody>
</table>

Table II. Physico-chemical composition of raw sugar from different strains during storage

<table>
<thead>
<tr>
<th>Strains</th>
<th>Ash (%)</th>
<th>Color (colorimetric units)</th>
<th>Moisture (%)</th>
<th>Net rendements (%)</th>
<th>Acidity (%)</th>
<th>Sucrose (%)</th>
<th>Reducing sugars (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B.S.</td>
<td>A.S.</td>
<td>B.S.</td>
<td>A.S.</td>
<td>B.S.</td>
<td>A.S.</td>
<td>B.S.</td>
</tr>
<tr>
<td>S98-SP-108</td>
<td>2.76</td>
<td>38.84c</td>
<td>36.36c</td>
<td>4.69e</td>
<td>4.44c</td>
<td>57.20b</td>
<td>55.21b</td>
</tr>
<tr>
<td>CPHS-35</td>
<td>3.01</td>
<td>39.90bc</td>
<td>38.34b</td>
<td>5.40b</td>
<td>5.29a</td>
<td>56.45b</td>
<td>56.06b</td>
</tr>
<tr>
<td>CP81-1254</td>
<td>3.06</td>
<td>40.70b</td>
<td>39.24b</td>
<td>6.22a</td>
<td>5.55a</td>
<td>56.46b</td>
<td>56.08ab</td>
</tr>
<tr>
<td>S2001-US-400</td>
<td>2.96</td>
<td>39.44c</td>
<td>37.87bc</td>
<td>5.34b</td>
<td>4.83b</td>
<td>57.95a</td>
<td>56.56a</td>
</tr>
<tr>
<td>HSF-240 (std.)</td>
<td>3.10</td>
<td>48.25a</td>
<td>45.43a</td>
<td>6.27a</td>
<td>4.90b</td>
<td>56.89ab</td>
<td>55.70ab</td>
</tr>
<tr>
<td>LSD at 5%</td>
<td>N.S.</td>
<td>1.257</td>
<td>1.559</td>
<td>0.3120</td>
<td>0.2849</td>
<td>1.202</td>
<td>1.157</td>
</tr>
</tbody>
</table>

A.S. = After Storage  B.S. = Before Storage  N.S. = Non-Significant  Red. = Reducing  Rec = Recovery  CCS = Commercial Cane Sugar  LSD = Least Significant Difference
108, while these values were highest in the jaggery of strain HSF-240. An increase of acidity after storage was also noticed in all strains. This demonstration is in harmony with those observed by Patil et al. (1994b).

**Sucrose.** Presence of high sucrose contents in jaggery increases its sweetness as well as quality. Minor reduction in sucrose percentage was shown by all strains after storage (Table II). No strain was better than standard HSF-240 as it showed the highest sucrose percentage (73.77% & 73.49% before & after storage, respectively), while strains CPHS-35 and CP81-1254 were similar with respect to their means before and after storage as described by Uppal and Sharma (1999).

**Reducing sugars.** Reducing sugars are already present in jaggery as well as produced by the process of sucrose inversion due to high acidity. Significant differences in the reducing sugars concentration were observed in all. The minimum amount of these sugars was analyzed in jaggery of strain S98-SP-108 before and after storage and it was statistically at par with S2001-US-400. While maximum reducing sugars 6.05% and 6.94%, before and after storage, respectively were recoded in standard HSF-240.

**CONCLUSION**

Strain HSF-240 showed highest jaggery percent juice (22.45%), jaggery percent cane (13.61%) and sucrose (73.77 to 73.49%). Strain CP81-1254 ranked second with respect to these qualitative and quantitative characteristics. So the strains HSF-240 and CP81-1254 have the potential for quality jaggery production.

**REFERENCES**


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