PHYSICAL AND COOKING CHARACTERISTICS OF SELECTED AROMATIC RICE VARIETIES

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ABSTRACT

The experiment was conducted to know the physical and cooking properties of ten aromatic rice varieties. Among the varieties milling and head rice out-turn ranged from 72.48 to 80.94 and 65.11 to 81.85 per cent respectively. The grain length varied from 4.30 to 7.80 mm, breadth 1.84 to 2.27 mm, L / B ratio 2.02 to 4.22 and grain width 1.54 to 1.88 mm, 1000 grain weight 11.36 to 20.18 g, and bulk density 0.76 to 0.89 (g / ml). Cooking time ranged from 15 to 20 minutes, percent increase in weight 127 to 210, per cent increase in volume 128 to 257, water uptake ratio 15.85 to 39.93, kernel elongation ratio 1.25 to 1.53, per cent curled grain 17 to 61 and dispersed solids 2.63 to 8.46 per cent respectively. Per cent increase in volume and weight, water uptake ratio, and kernel elongation ratio were positively correlated with sensory mean score whereas percent curled grains, and cooking time were negatively correlated with sensory mean score.

Key words: Physical character, Cooking Properties, Aromatic rice.

INTRODUCTION

Rice is consumed as a staple food by over one half of the world’s population with approximately 95 per cent of its production in Asia Anonymous (2002). The aromatic rice varieties are mainly grown and consumed in India, Pakistan, Thailand, Bangladesh, Afghanistan, Indonesia, Iran and United states. Almost every state of India has its own set of aromatic rice that performs well in native areas (Shobha Rani and Krishnaiah, 2001) These aromatic rices also possess exemplary quality traits like aroma, fluffiness and taste. Aromatic or scented rice have occupied a prime position in Indian cuisine owing to their physical characteristics and cooking qualities.

Rice varieties greatly differ in physical and cooking characteristics. Varietal differences in terms of physical, and cooking characteristics need to be investigated. Hence a study on physical and cooking characteristics of different varieties of aromatic rice (Oryza sativa L.) in comparison with a control sample (pusa basmati) was undertaken.

MATERIAL AND METHODS

Ten varieties of paddy (nine aromatic rice varieties and one control) sample were procured from the department of Genetics and Plant breeding, University of Agricultural Science, Bangalore. Milling, physical, cooking, nutritional, and sensory characteristics were assessed in comparison with the control sample.
Milling: Paddy samples were cleaned and dried in sun and then de-husked using a grain man miller at the department of Post-harvest Technology, G.K.V.K., Bangalore. Milling yield, head yield, degree of polish and broken yield were recorded for all the varieties selected.

Physical characteristics: The parameters studied under physical characteristics includes grain length, breadth, width, L/B ratio, 1000 kernel weight, bulk density, and chalkiness. Grain length (mm), breadth (mm) and width (mm) was determined by using vernier calipers holding the single grain lengthwise, breadth wise and widthwise, respectively. Length breadth (L/B) ratio was obtained by dividing the length of a single kernel by the corresponding breadth. 1000-Kernel weight (g): one thousand kernels each of the milled rice variety were counted randomly in duplicate and weighed in a electric balance. Bulk Density (g/ml): the volume of 100g of each sample (ml) was determined by gently pouring the grain into a 250 ml graduated cylinder. (Bhattacharya and Pushpa 2000). Chalkiness: the percent area of endosperm chalkiness was determined by using a scale suggested by Anonymous (1991).

Cooking qualities: The method suggested by Bhattacharjee and Kulkarni (2000) was followed to evaluate the cooking quality of different varieties. Weighed sample (2 g) was placed in test tubes containing boiling water (20 ml) and heated on boiling water bath. The characteristics like cooking time, water uptake ratio, kernel elongation ratio, percent curled grains, dispersed solids, and aroma were evaluated.

Sensory evaluation: Ten varieties of rice samples were subjected to sensory evaluation in the cooked form to a panel of ten judges and not more than two samples were presented at a time. Parameters evaluated by judges include color, grain size, texture, taste, and overall acceptability. A five point hedonic scale was used to evaluate the samples.

Statistical analysis: The results were analyzed using a completely randomized design (CRD) to compare the variance. Suitable tests were applied to know the significant differences among the selected rice varieties at P< 0.05 (Gomez and Gomez 1986).

RESULTS AND DISCUSSION
Milling qualities of rice such as milling yield, head yield, degree of polish and broken per cent are presented in Fig 1.
### Table 1: Physical characteristics of aromatic rice varieties.

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Grain length (mm)</th>
<th>Breadth (mm)</th>
<th>L / B</th>
<th>Width (mm)</th>
<th>1000 grain weight (g)</th>
<th>Bulk density (g / ml)</th>
<th>Endosperm chalkiness (scores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IET 19491</td>
<td>7.77</td>
<td>1.84</td>
<td>4.22</td>
<td>1.55</td>
<td>17.02</td>
<td>0.79</td>
<td>1</td>
</tr>
<tr>
<td>IET 18973</td>
<td>6.97</td>
<td>2.02</td>
<td>3.44</td>
<td>1.74</td>
<td>17.19</td>
<td>0.76</td>
<td>1</td>
</tr>
<tr>
<td>IET 18990</td>
<td>7.76</td>
<td>1.92</td>
<td>4.03</td>
<td>1.56</td>
<td>16.94</td>
<td>0.76</td>
<td>5</td>
</tr>
<tr>
<td>IET 19227</td>
<td>6.54</td>
<td>1.90</td>
<td>3.39</td>
<td>1.64</td>
<td>13.69</td>
<td>0.79</td>
<td>5</td>
</tr>
<tr>
<td>IET 19391</td>
<td>7.00</td>
<td>2.24</td>
<td>3.12</td>
<td>1.88</td>
<td>20.18</td>
<td>0.83</td>
<td>0</td>
</tr>
<tr>
<td>IET 19228</td>
<td>5.60</td>
<td>2.27</td>
<td>2.50</td>
<td>1.62</td>
<td>14.42</td>
<td>0.80</td>
<td>5</td>
</tr>
<tr>
<td>IET 19294</td>
<td>4.30</td>
<td>2.12</td>
<td>2.02</td>
<td>1.84</td>
<td>11.36</td>
<td>0.89</td>
<td>5</td>
</tr>
<tr>
<td>IET 19492</td>
<td>7.38</td>
<td>1.90</td>
<td>3.88</td>
<td>1.66</td>
<td>18.30</td>
<td>0.78</td>
<td>0</td>
</tr>
<tr>
<td>IET 18675</td>
<td>5.48</td>
<td>2.08</td>
<td>2.63</td>
<td>1.78</td>
<td>12.97</td>
<td>0.83</td>
<td>5</td>
</tr>
<tr>
<td>Pusa Basmati</td>
<td>7.80</td>
<td>1.90</td>
<td>4.10</td>
<td>1.54</td>
<td>17.12</td>
<td>0.78</td>
<td>1</td>
</tr>
</tbody>
</table>

F value * * * * * * * *
SEm + (0.05) 0.033 0.068 0.063 0.005 0.005 0.005 0.063
CD (0.05) 0.099 0.201 0.188 0.017 0.017 0.017 0.178

* Significant
NS – Non-significant

### Table 2: Cooking characteristics of aromatic rice varieties.

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Cooking time (min.)</th>
<th>Aroma</th>
<th>Percent increase in weight</th>
<th>Percent increase in volume</th>
<th>Water uptake ratio</th>
<th>Length (cm)</th>
<th>Breadth (cm)</th>
<th>L / B</th>
<th>Kernel elongation ratio</th>
<th>Percent curled grains</th>
<th>Percent dispersed solids (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IET 19491</td>
<td>18</td>
<td>Strong</td>
<td>165</td>
<td>206</td>
<td>15.85</td>
<td>1.24</td>
<td>0.37</td>
<td>3.35</td>
<td>1.50</td>
<td>66</td>
<td>8.46</td>
</tr>
<tr>
<td>IET 18973</td>
<td>15</td>
<td>Strong</td>
<td>210</td>
<td>223</td>
<td>24.24</td>
<td>0.90</td>
<td>0.32</td>
<td>2.81</td>
<td>1.52</td>
<td>20</td>
<td>2.83</td>
</tr>
<tr>
<td>IET 18990</td>
<td>17</td>
<td>Normal</td>
<td>190</td>
<td>225</td>
<td>19.91</td>
<td>0.79</td>
<td>0.38</td>
<td>2.08</td>
<td>1.51</td>
<td>53</td>
<td>4.43</td>
</tr>
<tr>
<td>IET 19227</td>
<td>15</td>
<td>Faint</td>
<td>187</td>
<td>211</td>
<td>19.13</td>
<td>0.84</td>
<td>0.30</td>
<td>2.75</td>
<td>1.30</td>
<td>60</td>
<td>4.00</td>
</tr>
<tr>
<td>IET 19391</td>
<td>16</td>
<td>Strong</td>
<td>203</td>
<td>226</td>
<td>39.93</td>
<td>0.94</td>
<td>0.31</td>
<td>3.06</td>
<td>1.53</td>
<td>17</td>
<td>2.63</td>
</tr>
<tr>
<td>IET 19228</td>
<td>20</td>
<td>Faint</td>
<td>143</td>
<td>152</td>
<td>32.25</td>
<td>0.85</td>
<td>0.29</td>
<td>2.98</td>
<td>1.51</td>
<td>42</td>
<td>4.16</td>
</tr>
<tr>
<td>IET 19294</td>
<td>16</td>
<td>Normal</td>
<td>179</td>
<td>128</td>
<td>34.03</td>
<td>0.47</td>
<td>0.35</td>
<td>1.36</td>
<td>1.52</td>
<td>19</td>
<td>3.13</td>
</tr>
<tr>
<td>IET 19492</td>
<td>15</td>
<td>Normal</td>
<td>190</td>
<td>257</td>
<td>24.31</td>
<td>1.16</td>
<td>0.21</td>
<td>5.50</td>
<td>1.53</td>
<td>37</td>
<td>3.37</td>
</tr>
<tr>
<td>IET 18675</td>
<td>19</td>
<td>Normal</td>
<td>127</td>
<td>151</td>
<td>19.50</td>
<td>0.68</td>
<td>0.25</td>
<td>2.75</td>
<td>1.25</td>
<td>65</td>
<td>3.90</td>
</tr>
<tr>
<td>Pusa Basmati</td>
<td>16</td>
<td>Normal</td>
<td>185</td>
<td>222</td>
<td>18.02</td>
<td>1.18</td>
<td>0.34</td>
<td>3.46</td>
<td>1.28</td>
<td>61</td>
<td>3.43</td>
</tr>
</tbody>
</table>

F value * * * * * * * *
SEm + (0.05) 0.74 3.87 3.78 0.39 0.05 0.01 0.21 0.02 2.9 0.19
CD (0.05) 2.19 11.4 11.16 1.55 0.16 0.53 0.64 0.06 8.55 0.57

* Significant at 5% level

Pusa Basmati – control
Among aromatic rice varieties IET18675 had highest head rice recovery (81.85 percent) least being in IET18990 (65.11 percent). Varietal differences with respect to grain length, breadth, L/B ratio, grain width, 1000 kernel weight, bulk density and endosperm chalkiness is presented in Table 1.

Long grains are more accepted than short grains, whereas wider varieties are less acceptable. Lower the 1000 grain weight and bulk density, finer will be the grain. Chalkiness is an undesirable physical characteristic. Among aromatic rice varieties IET19391 and IET19492 had no chalky grains, IET 19491, IET 18973 and pusa basmati had less than 10 percent and other remaining varieties had 10 to 20 percent endosperm chalkiness.

Varietal difference with respect to cooking characteristics such as cooking time, aroma, percent increase in weight, percent increase in volume etc are presented in Table 3.

Cooking time ranged between 15 to 20 minute, percent increase in weight 127 to 210, per cent increase in volume 128 to 257, water uptake ratio 15.85 to 39.93, and kernel elongation ratio 1.25 to 1.53. Significant difference was observed between the varieties for cooking characteristics like cooking time, per cent increase in weight, per cent increase in volume, water uptake ratio, length, breadth, L / B ratio, kernel elongation ratio, percent curled grains, and dispersed solids. Similar study was conducted by Hirannaia et al (2001) and Chaubey et al (1988) who evaluated quality of rice on the basis of apparent water uptake ratio, L / B ratio and kernel elongation ratio.

Mean scores for selected sensory characteristics such as color, grain size, texture, taste and overall acceptability for raw and cooked rice samples of aromatic rice varieties are presented in Figure 2 & 3.

IET18973 and IET19294 had the highest sensory mean score for overall acceptability among raw aromatic rice varieties.

Table 3: Correlation coefficient of mean sensory scores with cooking characteristics.

<table>
<thead>
<tr>
<th>Cooking characteristics</th>
<th>Correlation coefficient (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking time (min.)</td>
<td>-0.62*</td>
</tr>
<tr>
<td>Percent increase in weight</td>
<td>0.74*</td>
</tr>
<tr>
<td>Percent increase in volume</td>
<td>0.52*</td>
</tr>
<tr>
<td>Water uptake ratio</td>
<td>0.28*</td>
</tr>
<tr>
<td>Length (cm)</td>
<td>0.21*</td>
</tr>
<tr>
<td>Breadth (cm)</td>
<td>0.12*</td>
</tr>
<tr>
<td>L / B</td>
<td>0.21*</td>
</tr>
<tr>
<td>Kernel elongation ratio</td>
<td>0.44*</td>
</tr>
<tr>
<td>Percent curled grains</td>
<td>-0.57*</td>
</tr>
<tr>
<td>Dispersed solids (%)</td>
<td>-0.42 NS</td>
</tr>
</tbody>
</table>

* Significant at 5 percent    NS – non significant.

Fig 2: Mean sensory scores of raw aromatic rice varieties

* I. ET 19491
  I. ET 18973
  I. ET 18990
  I. ET 19227
  I. ET 19391
  I. ET 19228
  I. ET 19294
  I. ET 19492
  I. ET 19294
  Pusa Basmati
aromatic rice varieties in row form, whereas in 
cooked form IET19391 and IET19492 had highest 
sensory mean score for overall acceptability.

Correlation between sensory mean score 
and cooking characteristics like percent increase in 
volume, water uptake ratio, length, L / B ratio, and 
kernel elongation ratio are presented in Table 3.

Sensory quality of the cooked rice was 
positively correlated with the cooking 
characteristics like percent increase in weight and 
volume, water uptake ratio, length, L / B ratio, 
and kernel elongation ratio whereas negatively 
correlated with cooking time and dispersed solids.

Similar study Conducted by Thayumanavan 
(1987) who assessed the cooking quality of forty 
rice varieties and found that cooking quality is 
correlated with the sensory quality.

CONCLUSION

Most of the aromatic rice varieties selected 
for the study was found to be good in both physical 
and cooking characteristics.

Awareness about the unique grain cooking 
and eating quality is increasing. Now, a large section 
of population prefers to eat aromatic rice thus, every 
year domestic as well as international demand for 
aromatic rice is on increase.

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