Guidelines for the Conduct of Test for
Distinctiveness, Uniformity and Stability

On

Rice

(Oryza sativa L.)

Protection of Plant Varieties and Farmers’ Rights Authority
(PPV & FRA)

Government of India
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Subject</td>
<td>1</td>
</tr>
<tr>
<td>II. Seed material required</td>
<td>1</td>
</tr>
<tr>
<td>III. Conduct of tests</td>
<td>1</td>
</tr>
<tr>
<td>IV. Methods and observations</td>
<td>2</td>
</tr>
<tr>
<td>V. Grouping of varieties</td>
<td>3</td>
</tr>
<tr>
<td>VI. Characteristics and symbols</td>
<td>3</td>
</tr>
<tr>
<td>VII. Table of characteristics</td>
<td>5</td>
</tr>
<tr>
<td>VIII. Explanation for the Table of characteristics</td>
<td>13</td>
</tr>
<tr>
<td>IX. Literature</td>
<td>24</td>
</tr>
<tr>
<td>X. Working Group details</td>
<td>25</td>
</tr>
<tr>
<td>CONTENTS</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>I. Subject</td>
<td>1</td>
</tr>
<tr>
<td>II. Seed material required</td>
<td>1</td>
</tr>
<tr>
<td>III. Conduct of tests</td>
<td>1</td>
</tr>
<tr>
<td>IV. Methods and observations</td>
<td>2</td>
</tr>
<tr>
<td>V. Grouping of varieties</td>
<td>3</td>
</tr>
<tr>
<td>VI. Characteristics and symbols</td>
<td>3</td>
</tr>
<tr>
<td>VII. Table of characteristics</td>
<td>5</td>
</tr>
<tr>
<td>VIII. Explanation for the Table of characteristics</td>
<td>13</td>
</tr>
<tr>
<td>IX. Literature</td>
<td>24</td>
</tr>
<tr>
<td>X. Working Group details</td>
<td>25</td>
</tr>
</tbody>
</table>
I. Subject

These test guidelines shall apply to all varieties, hybrids, transgenics and parental lines of Rice (Oryza sativa L.)

II. Seed material required

1. The Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA) shall decide when, where and in what quantity and quality of the seed material are required for testing a variety denomination applied for registration under the Protection of Plant Varieties and Farmers' Rights (PPV & FR) Act, 2001. Applicants submitting such seed material from a country other than India shall make sure that all customs and quarantine requirements stipulated under relevant national legislations and regulations are complied with. The minimum quantity of the seed to be provided by the applicant shall be 3000 grams in case of the candidate variety or hybrid and 1500 grams for each of the parental line of the hybrid. Each of these seed lots shall be packed, sealed and properly labeled with details, in ten equal weighing packets and submitted in one lot. Wherever, individual panicles are to be supplied, such panicles shall be individually packed and submitted along with the said seed lot, with proper labeling of the denomination, harvest year and such related details.

2. At least 100 panicles each representing the normal ear size and drawn from the main tiller of the candidate variety shall be submitted.

3. The seed and ears submitted shall have at least 80% germination, 98% physical purity, highest genetic purity, uniformity, sanitary and phyto-sanitary standards. In addition the moisture content of the seed shall not exceed 11-12% to meet the safe storage requirement. The applicant shall also submit along with the seed a certified data on germination test made not more than one month prior to the date of submission.

4. The seed material submitted shall not have been subjected to any chemical or bio-physical treatment.

III. Conduct of tests

1. The minimum duration of DUS tests shall normally be at least two independent similar growing seasons.

2. The tests shall normally be conducted at two test locations. If any essential characteristics of the candidate variety are not expressed for visual observation at these locations, the variety shall be considered for further examination at another appropriate test site or under special test protocol on expressed request of the applicant.

3. The field test shall be carried out under conditions favouring normal growth and expression of all test characteristics. The size of the plots shall be such that parts of plants could be removed for measurement and observation without prejudicing the observations on the standing plants until the end of the growing period. Each test shall include about 2500 plants, in the plot size and planting space specified below across three replications. Separate plots for observation and
for measurement can only be used if they have been subjected to similar environmental conditions. All the replications shall be sharing similar environmental conditions of the test location.

4. **Test plot design**

   - Number of rows : 30
   - Row length : 6 m
   - Row to row distance : 30 cm
   - Plant to plant distance : 20 cm
   - Expected plants / replications : 900
   - Number of replications : 3 for irrigated and shallow lowland tests
   - : 5 for upland, saline-alkaline, semi-deep water and deep water tests.

5. Observations shall not be recorded on plants in border rows.

6. Additional test protocol for special purpose shall be established by the PPV & FR Authority.

**IV. Methods and observations**

1. The characteristics described in the Table of characteristics (see section VII) shall be used for the testing of varieties, inbred lines and hybrids for their DUS.

2. For the assessment of Distinctiveness and Stability observations shall be made on 30 plants or parts of 30 plants, which shall be equally divided among 3 replications (10 plants per replication).

3. For the assessment of Uniformity of characteristics on the plot as a whole (visual assessment by a single observation of a group of plants or parts of plants), a population standard of 0.1% with an acceptance probability of at least 95% shall be applied. In the case of a sample size of 1500 plants the number of off-types shall not exceed 4.

4. For the assessment of Uniformity of characteristics on single panicle-rows, plants or parts of plants (visual assessment by observations of a number of individual panicle-rows, plants or parts of plants) the number of aberrant panicle-rows, plants or parts of plants shall not exceed 2 in 50.

5. For the assessment of all colour characteristics, the latest Royal Horticultural Society (RHS) colour chart shall be used.

6. Unless otherwise indicated, all observations on the leaf shall be made on the penultimate leaf.
V. **Grouping of varieties**

1. The candidate varieties for DUS testing shall be divided into groups to facilitate the assessment of Distinctiveness. Characteristics, which are known from experience not to vary, or to vary only slightly within a variety and which in their various states are fairly evenly distributed across all varieties in the collection are suitable for grouping purpose.

2. The following characteristics are proposed to be used for grouping rice varieties:
   
   a) Basal leaf: Sheath colour (Characteristic 2)
   
   b) Time of heading (50% of plants with panicles) (Characteristic 20)
   
   c) Stem: Length (excluding panicle; excluding floating rice) (Characteristic 29)
   
   d) Decorticated grain: Length (Characteristic 54)
   
   e) Decorticated grain: Shape (in lateral view) (Characteristic 56)
   
   f) Decorticated grain: Colour (Characteristic 57)
   
   g) Endosperm: Content of amylose (Characteristic 59)
   
   h) Decorticated grain: Aroma (Characteristic 62)

VI. **Characteristics and symbols**

1. To assess Distinctiveness, Uniformity and Stability, the characteristics and their states as given in the Table of characteristics (Section VII) shall be used.

2. Note (1 to 9) shall be used to describe the state of each character for the purpose of digital data processing.

3. Legend:

   (*) Characteristics that shall be observed during every growing season on all varieties and shall always be included in the description of the variety, except when the state of expression of any of these characters is rendered impossible by a preceding phenological characteristic or by the environmental conditions of the testing region. Under such exceptional situation, adequate explanation shall be provided.

   (+) See Explanation on the Table of characteristics in Section VIII. It is to be noted that for certain characteristics, the plant parts on which observations to be taken are given in the explanation or figure(s) for clarity and not the colour variation.

4. A decimal code number in the sixth column of Table of characteristics indicates the optimum stage for the observation of each characteristic during the growth and development of plant. The relevant growth stages corresponding to these decimal code numbers are described below:
**Decimal Code for the Growth Stage**

<table>
<thead>
<tr>
<th>Code</th>
<th>Growth stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>After germination, emergence of first leaf through coleoptile / second leaf visible (less than 1 cm)</td>
</tr>
<tr>
<td>40</td>
<td>Booting: the increase in the size of the young panicle and its inward extension inside the upper leaf sheaths detectable as a bulge in the rapidly elongating culm</td>
</tr>
<tr>
<td>50</td>
<td>1st spikelet of inflorescence just visible</td>
</tr>
<tr>
<td>55</td>
<td>½ of inflorescence emerged</td>
</tr>
<tr>
<td>60</td>
<td>Beginning of anthesis: it begins with the protrusion of the first dehiscing anthers in the terminal spikelets on the panicle branches</td>
</tr>
<tr>
<td>65</td>
<td>Anthesis half way</td>
</tr>
<tr>
<td>70</td>
<td>Milk development stage: formation of white milky sap within the spikelets</td>
</tr>
<tr>
<td>80</td>
<td>Dough development (spikelets become hard)</td>
</tr>
<tr>
<td>90</td>
<td>Ripening (terminal spikelets ripened)</td>
</tr>
<tr>
<td>92</td>
<td>Caryopsis hard (can be no longer be dented by thumb nail and over 90% spikelets ripened)</td>
</tr>
</tbody>
</table>

5. Type of assessment of characteristics indicated in column seven of Table of characteristics is as follows.

- **MG**: Measurement by a single observation of a group of plants or parts of plants
- **MS**: Measurement of a number of individual plants or parts of plants
- **VG**: Visual assessment by a single observation of a group of plants or parts of plants
- **VS**: Visual assessment by observation of individual plant or parts of plants
### VII. Table of characteristics

<table>
<thead>
<tr>
<th>S.No</th>
<th>Characteristics</th>
<th>States</th>
<th>Note</th>
<th>Example variety/line</th>
<th>Stage of observation</th>
<th>Type of assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (+)</td>
<td>Coleoptile: Colour</td>
<td>Colourless</td>
<td>1</td>
<td>Krishna Hamsa, Prasad</td>
<td>10</td>
<td>VS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Green</td>
<td>2</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Purple</td>
<td>3</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. (*)</td>
<td>Basal leaf: Sheath colour</td>
<td>Green</td>
<td>1</td>
<td>Rasi, Heera, Annada, Bhogali</td>
<td>40</td>
<td>VS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Light purple</td>
<td>2</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Purple lines</td>
<td>3</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uniform purple</td>
<td>4</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Leaf: Intensity of green colour</td>
<td>Light</td>
<td>1</td>
<td>Rasi, Vandana, Heera, Sugandha</td>
<td>40</td>
<td>VG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium</td>
<td>4</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dark</td>
<td>5</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Leaf: Anthocyanin colouration</td>
<td>Absent</td>
<td>1</td>
<td>Sugandha</td>
<td>40</td>
<td>VG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Present</td>
<td>2</td>
<td>Shyamala</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Leaf: Distribution of anthocyanin colouration</td>
<td>On tips only</td>
<td>1</td>
<td>Vivek Dhan 62, CSR 10</td>
<td>40</td>
<td>VG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>On margins only</td>
<td>2</td>
<td>Aruna, IR 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>In blotches only</td>
<td>3</td>
<td>Aruna, IR 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uniform</td>
<td>4</td>
<td>Shyamala</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. (+)</td>
<td>Leaf Sheath: anthocyanin colouration</td>
<td>Absent</td>
<td>1</td>
<td>Prasad, Govind</td>
<td>40</td>
<td>VG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Present</td>
<td>2</td>
<td>Aruna, IR 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Leaf sheath: Intensity of anthocyanin colouration</td>
<td>Very weak</td>
<td>1</td>
<td>---</td>
<td>40</td>
<td>VG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weak</td>
<td>3</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium</td>
<td>5</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strong</td>
<td>7</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very strong</td>
<td>9</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. (*)</td>
<td>Leaf: Pubescence of blade surface</td>
<td>Absent</td>
<td>1</td>
<td>Sneha, Sugandha, Nagajana, Vibhava</td>
<td>40</td>
<td>VS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weak</td>
<td>3</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium</td>
<td>5</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strong</td>
<td>7</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very strong</td>
<td>9</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. (*)</td>
<td>Leaf: Auricles</td>
<td>Absent</td>
<td>1</td>
<td>Vikramarya</td>
<td>40</td>
<td>VS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Present</td>
<td>2</td>
<td>Jaya, Bas. 370</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. (*)</td>
<td>Leaf: Anthocyanin colouration of auricles</td>
<td>Colourless</td>
<td>1</td>
<td>IR 24</td>
<td>40</td>
<td>VS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Light purple</td>
<td>2</td>
<td>Aruna, Amulya Hemavathi, Janaki</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Purple</td>
<td>3</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. (+)</td>
<td>Leaf: Collar</td>
<td>Absent</td>
<td>Present</td>
<td>1</td>
<td>9</td>
<td>Rasi, IR 24</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>--------</td>
<td>---------</td>
<td>---</td>
<td>---</td>
<td>-------------</td>
</tr>
<tr>
<td>12. (+)</td>
<td>Leaf: Anthocyanin colouration of collar</td>
<td>Absent</td>
<td>Present</td>
<td>1</td>
<td>9</td>
<td>Rasi, IR 24</td>
</tr>
<tr>
<td>13. (+)</td>
<td>Leaf: Ligule</td>
<td>Absent</td>
<td>Present</td>
<td>1</td>
<td>9</td>
<td>---</td>
</tr>
<tr>
<td>14. (*) (+)</td>
<td>Leaf: Shape of ligule</td>
<td>Truncate</td>
<td>Acute</td>
<td>Split</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>15. (*)</td>
<td>Leaf: Colour of ligule</td>
<td>White</td>
<td>Light purple</td>
<td>Purple</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>16.</td>
<td>Leaf: Length of blade</td>
<td>Short (&lt;30 cm)</td>
<td>Medium (30-45 cm)</td>
<td>Long (&gt;45 cm)</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>17.</td>
<td>Leaf: Width of blade</td>
<td>Narrow (&lt;1 cm)</td>
<td>Medium (1-2 cm)</td>
<td>Broad (&gt;2 cm)</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>18.</td>
<td>Culm: Attitude (for floating rice only)</td>
<td>Non procumbent</td>
<td>Procumbent</td>
<td>1</td>
<td>---</td>
<td>40</td>
</tr>
<tr>
<td>19. (+)</td>
<td>Culm: attitude</td>
<td>Erect</td>
<td>Semi-erect</td>
<td>Open</td>
<td>Spreading</td>
<td>1</td>
</tr>
<tr>
<td>20. (*)</td>
<td>Time of heading (50% of plants with panicles)</td>
<td>Very early (&lt;71 days)</td>
<td>Early (71-90 days)</td>
<td>Medium (91-110 days)</td>
<td>Late (111-130 days)</td>
<td>Very late (&gt; 131 days)</td>
</tr>
<tr>
<td>21. (*) (+)</td>
<td>Flag leaf: Attitude of blade (early observation)</td>
<td>Erect</td>
<td>Semi-erect</td>
<td>Horizontal</td>
<td>Drooping</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Spikelet: Density of pubescence of lemma</td>
<td>Absent Weak Medium Strong Very strong</td>
<td>1 3 5 7 9</td>
<td>--- Krishna Hamsa Ra  NDR 359 Vaumati, Vandana K 429</td>
<td>60-80</td>
<td>VS</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------</td>
<td>--------------------------------------</td>
<td>----------</td>
<td>-------------------------------------------</td>
<td>--------</td>
<td>----</td>
</tr>
<tr>
<td></td>
<td>Male sterility</td>
<td>Absent Present 1 IR 24 IR 580 25A</td>
<td></td>
<td></td>
<td>65</td>
<td>VG</td>
</tr>
<tr>
<td>24. (+)</td>
<td>Lemma: Anthocyanin colouration of keel</td>
<td>Absent or very weak Weak Medium Strong Very strong</td>
<td>1 3 5 7 9</td>
<td>IR 24, Swarnadhan Bhadra, Remya Aruna Makom, Janaki Malaviyadhan</td>
<td>65</td>
<td>VS</td>
</tr>
<tr>
<td>25. (+)</td>
<td>Lemma: Anthocyanin colouration of area below apex</td>
<td>Absent Weak Medium Strong Very strong</td>
<td>1 3 5 7 9</td>
<td>IR 24 VL Dhan 81 Remya, Mandyia Vijaya Bhadra, Aruna Bhogali, Makom Janaki, Malaviyadhan</td>
<td>65</td>
<td>VS</td>
</tr>
<tr>
<td>26. (+)</td>
<td>Lemma: Anthocyanin colouration of apex</td>
<td>Absent Weak Medium Strong Very strong</td>
<td>1 3 5 7 9</td>
<td>Phalguna Mandyia Vijaya, Jalpriya Anjali, Shyamala Rasi Janaki</td>
<td>65</td>
<td>VS</td>
</tr>
<tr>
<td>27. (+)</td>
<td>Spikelet: Colour of stigma</td>
<td>White Light green Yellow Light purple Purple</td>
<td>1 2 3 4 5</td>
<td>Jaya, Bas. 370 --- Mahi Sugandha IR 24, Poornima Rasi Mahamaya</td>
<td>65</td>
<td>VS</td>
</tr>
<tr>
<td>28.</td>
<td>Stem: Thickness</td>
<td>Thin (&lt;0.40 cm) Medium (0.40-0.55 cm) Thick (&gt;0.55 cm)</td>
<td>3 5 7</td>
<td>Sneha, K 429 Lachit, Govind NDR 359, Janaki</td>
<td>70</td>
<td>MS</td>
</tr>
<tr>
<td>29. (*)</td>
<td>Stem: Length (excluding panicle; excluding floating rice)</td>
<td>Very short (&lt;91 cm) Short (91-110 cm) Medium (111-130 cm) Long (131-150 cm) Very long (&gt;150 cm)</td>
<td>1 3 5 7 9</td>
<td>H eera PR 106, Vajram Sabita Niraja ---</td>
<td>70</td>
<td>MS</td>
</tr>
<tr>
<td>30. (*)</td>
<td>Stem: Anthocyanin colouration of nodes</td>
<td>Absent Present</td>
<td>1 9</td>
<td>Chaitanya, IR 24 Amulya, Hemavathi</td>
<td>70</td>
<td>VS</td>
</tr>
<tr>
<td>No.</td>
<td>Category</td>
<td>Description</td>
<td>Code</td>
<td>Maturity</td>
<td>Rating</td>
<td></td>
</tr>
<tr>
<td>-----</td>
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<td>------</td>
<td>----------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Stem: Intensity of anthocyanin coloration of nodes</td>
<td>Weak, Medium, Strong</td>
<td>3</td>
<td>5</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CSR 27, RCM 5, Shaymala, Rongilee, Amulya, Saraswati</td>
<td></td>
<td></td>
<td>VS</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Stem: Anthocyanin colouration of internodes</td>
<td>Absent, Present</td>
<td>1</td>
<td>9</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IR 24, Krishnaveni, Prasanna, Janaki</td>
<td></td>
<td></td>
<td>VS</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Panicle: Length of main axis</td>
<td>Very short (&lt;16 cm), Short (16-20 cm), Medium (21-25 cm), Long (26-30 cm), Very long (&gt;30 cm)</td>
<td>1</td>
<td>9</td>
<td>70-90</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>K 429, Sneha, VL Dhan 221, Poornima, NDR 359, Shyamala Bas 370, Rongilee</td>
<td></td>
<td></td>
<td>MS</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Flag leaf: Attitude of blade</td>
<td>Erect, Semi-erect, Horizontal, Deflexed</td>
<td>1</td>
<td>3</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(late observation)</td>
<td>IR 24, Prasanna, VL Dhan 81, VL Dhan 206</td>
<td></td>
<td></td>
<td>VG</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Panicle: Curvature of main axis</td>
<td>Straight, Semi-straight, Deflexed, Dropping</td>
<td>1</td>
<td>3</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>---, Barh-avarodhi, Lachit, Govind, ADT 37, Poornima Bas 386</td>
<td></td>
<td></td>
<td>VG</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Panicle: Number per plant</td>
<td>Few (&lt;11), Medium (11-20), Many (&gt;20)</td>
<td>3</td>
<td>5</td>
<td>80-90</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kranti, Heera, Tulasi, Krishna Hamsa, Bas 386</td>
<td></td>
<td></td>
<td>MS</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Spikelet: Colour of tip of lemma</td>
<td>White, Yellowish, Brown, Red, Purple, Black</td>
<td>1</td>
<td>2</td>
<td>80-90</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aditya, Pantdhan 6, Prasanna, Pantdhan 12, Madya Vijaya, Bas 385</td>
<td></td>
<td></td>
<td>VS</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Lemma and Palea: Colour</td>
<td>Straw, Gold and gold furrows on straw background, Brown spots on straw</td>
<td>1</td>
<td>2</td>
<td>80-90</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aditya, Chattany, Vibhava, Pant Dhan 11, CTH 3</td>
<td></td>
<td></td>
<td>VG</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Characteristics</td>
<td>Value 1</td>
<td>Value 2</td>
<td>Value 3</td>
<td>Value 4</td>
<td>Value 5</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>39</td>
<td>Panicle: Awns</td>
<td>Absent</td>
<td>Present</td>
<td>Jaya, Krishnaveni</td>
<td>Pusa Bas 1</td>
<td>90</td>
</tr>
<tr>
<td>40</td>
<td>Panicle: Colour of awns (late observation)</td>
<td>Yellowish White</td>
<td>Yellowsh Brown</td>
<td>Brown</td>
<td>Reddish brown</td>
<td>Light red</td>
</tr>
<tr>
<td>41</td>
<td>Panicle: Length of longest awn</td>
<td>Very short</td>
<td>Short</td>
<td>Medium</td>
<td>Long</td>
<td>Very long</td>
</tr>
<tr>
<td>42</td>
<td>Panicle: Distribution of awns</td>
<td>Tip only</td>
<td>Upper half only</td>
<td>Whole length</td>
<td>Jawahar, Pantdhan 11</td>
<td>Bas 370, ASD 20</td>
</tr>
<tr>
<td>43</td>
<td>Panicle: Presence of secondary branching</td>
<td>Absent</td>
<td>Present</td>
<td>Rasi, Bas 370</td>
<td>90</td>
<td>VG</td>
</tr>
<tr>
<td>44</td>
<td>Panicle: Secondary branching</td>
<td>Weak</td>
<td>Strong</td>
<td>Clustered</td>
<td>Pantdhan 10, Bas 386</td>
<td>Annada, Pantdhan 11</td>
</tr>
<tr>
<td>45</td>
<td>Panicle: Attitude of branches</td>
<td>Erect</td>
<td>Erect to semi-Erect</td>
<td>Semi-erect to spreading</td>
<td>Sasyasree</td>
<td>Mangal Pantdhan 10</td>
</tr>
</tbody>
</table>
46. Panicle: Exertion
- (*) Mostly exerted
- (+) Well exerted

47. Time maturity (days)
- Very early (<100)
- Early (101-120)
- Medium (121-140)
- Late (141-160)
- Very late (>160)

48. Leaf: Senescence
- Early
- Medium
- Late

49. Sterile lemma: Colour
- (*) Gold
- (+) Red
- Purple

50. Grain: Weight of 1000 fully developed grains
- Very low (<15 g)
- Low (15-20 g)
- Medium (21-25 g)
- High (26-30 g)
- Very high (>30 g)

51. Grain: Length
- Very short (<6.0 mm)
- Short (6.1-8.5 mm)
- Medium (8.6-10.5 mm)
- Long (10.6-12.5 mm)
- Very long (>12.5 mm)

52. Grain: Width
- Very narrow (<2.0 mm)
- Narrow (2.1-2.5 mm)
- Medium (2.6-3.0 mm)
- Broad (3.1-3.5 mm)
- Very broad (>3.5 mm)
<table>
<thead>
<tr>
<th></th>
<th>Grain: Phenol reaction of lemma</th>
<th>Absent Present</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>53. (+) Grain: Phenol reaction of lemma</td>
<td>Absent Present</td>
<td>1</td>
<td>9</td>
<td>---</td>
<td>92</td>
</tr>
<tr>
<td>54. (+) Decorticated grain: Length</td>
<td>Short Medium Long Long* (Long for Basmati type) Extra long</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>55. (+) Decorticated grain: Width</td>
<td>Narrow (&lt;2.0 mm) Medium (2.0-2.5 mm) Broad (&gt;2.5 mm)</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>---</td>
</tr>
<tr>
<td>56. (+) Decorticated grain: Shape (in lateral view)</td>
<td>Short slender Short bold Medium slender Long bold Long slender Long slender* (For Basmati type) Extra long slender</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>57. (+) Decorticated grain: Colour</td>
<td>White Light brown Variegated brown Dark brown Light red Red Variegated purple Purple Dark purple</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>58. (+) Endosperm: Presence of amylose</td>
<td>Absent Present</td>
<td>1</td>
<td>9</td>
<td>---</td>
<td>Vasumati</td>
</tr>
<tr>
<td>59. (+) Endosperm: Content of amylose</td>
<td>Very low (&lt;10%) Low (10-19%) Medium (20-25%) High (26-30%) Very high (&gt;30%)</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Varieties with endosperm of amylose absent only Polished grain: Expression of white core</td>
<td>Absent or very small Small Medium Large Fully chalky</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>60. (+)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61. (+)</td>
<td>Gelatinization temperature through alkali spreading value</td>
<td>Low Medium High medium High</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pusa Basmati 1 Taroari Basmati Kasturi</td>
<td>92</td>
<td>MG</td>
</tr>
<tr>
<td>62. (*) (+)</td>
<td>Decorticated grain: Aroma Present</td>
<td>Absent Present</td>
<td>1</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Jaya Bas 370</td>
<td>92</td>
<td>MG</td>
</tr>
</tbody>
</table>
VIII. Explanation for the Table of characteristics:
Characteristic 6. Leaf Sheath: Anthocyanin colouration
Characteristic 9. Leaf: Auricle
Characteristic 11. Leaf: Collar
Characteristic 13. Leaf: Ligule
Characteristic 24. Lemma: Anthocyanin colouration of keel
Characteristic 25. Lemma: Anthocyanin colouration of area below apex
Characteristic 26. Lemma: Anthocyanin colouration of apex
Characteristic 27. Spikelet: Colour of stigma
Characteristic 38. Lemma and Palea: Colour
Characteristic 39. Panicle: Awns
Characteristic 49. Sterile lemma: Colour
Characteristic 14. Leaf: Shape of ligule

- Truncate
- Acute
- Split

Characteristic 19. Culm: attitude

- Erect
- Semi-erect
- Open
- Spreading
Characteristic 33. Panicle: Length of main axis

- Pedicel
- Spikelet
- Secondary branch
- Panicle axis
- Primary branch
- Flag leaf
- Panicle base
- Uppermost Internode

Part of Panicle
Characteristic 21 and 34. Flag leaf: attitude of blade (early observation (21), late observation (34))

---

Characteristic 35. Panicle: Curvature of main axis
Characteristic 43. Panicle: Presence of secondary branching

Characteristic 44. Panicle: Secondary branching
Characteristic 45. Panicle: Attitude of branches

- Erect
- Erect to Semi-erect
- Semi-erect
- Semi-erect to spreading
- Spreading
Characteristic 53: Grain: phenol reaction of lemma

Grains are soaked in 1.5 percent aqueous phenol solution for 24 hours, drained and air-dried. Hull color is then recorded unstained and stained (Chang, T.T. and E.A. Bardenas, 1965).

Characteristic 54: Decorticated grain: Length (mm)

Please see the diagram "length and width measures of the grain".

Characteristic 55: Decorticated grain: Width (mm)

Please see the diagram "length and width measures of the grain".

Characteristic 56: Decorticated grain: Shape (in lateral view)

After dehusking (brown rice) or after milling (polished rice) the length and breadth of the grains are measured for computing the shape and size. Select minimum 10 full grains per replication with both the ends intact.
and measure the length and breadth by using Grain Shape Tester or Dial Micrometer. Average of length and breadth measurements are taken in millimeters and length/breadth ratio is calculated. Ramaiah, 1969, classification is used to assign the grain shape based on length and length/breadth ratio.


<table>
<thead>
<tr>
<th>State</th>
<th>Kernel length (mm)</th>
<th>Length/breadth ratio</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Slender</td>
<td>&lt; 6.0</td>
<td>&gt; 3.0</td>
<td>1</td>
</tr>
<tr>
<td>Short Bold</td>
<td>&lt; 6.0</td>
<td>&lt; 2.5</td>
<td>2</td>
</tr>
<tr>
<td>Medium Slender</td>
<td>&lt; 6.0</td>
<td>2.5-3.0</td>
<td>3</td>
</tr>
<tr>
<td>Long Slender</td>
<td>&gt; 6.0</td>
<td>&gt; 3.0</td>
<td>4</td>
</tr>
<tr>
<td>Long Bold</td>
<td>&gt; 6.0</td>
<td>&lt; 3.0</td>
<td>5</td>
</tr>
<tr>
<td>Basmati type</td>
<td>&gt; 6.61</td>
<td>&gt; 3.0</td>
<td>5</td>
</tr>
<tr>
<td>Extra Long Slender</td>
<td>&gt; 7.5</td>
<td>&gt; 3.0</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: The classification of extra long slender grain is done according to SES, IRRI 1996; for Basmati type long slender grain length shall be more than 6.61 mm as per the proceedings of Annual Rice Workshop, 1998.

**Characteristic 58: Endosperm: Presence of amylose**

By observation glutinous rice has waxy grains and non-glutinous rice has non-waxy to transparent with various grades according to the amylose content of the endosperm. When it is necessary glutinous rice and rice with various grades of amylose content, chemical analysis is needed.

**Characteristic 59: Endosperm: Content of amylose**

The simplified procedure of Juliano (1971) is used for the amylose content analysis. Twenty whole-grain milled rice is ground in a UDY cyclone mill (sieve mesh size 60). 100 mg of rice powder is put into a 100 ml volumetric flask and 1 ml of 95% ethanol and 9 ml of 1N Sodium hydroxide are added. The contents are heated on a boiling water bath to gelatinize the starch. After cooling for one hour, distilled water is added and contents are mixed well. For each set of samples run, low, intermediate and high amylose standard varieties are included to serve as checks. Five ml of the starch solution is put in a 100 ml volumetric flask with a pipette. One ml of 1 N acetic acid, 2 ml of iodine solution (0.2 g iodine and 2.0 g potassium iodide in 100 ml of aqueous solution) is added and volume is made up with distilled water. Contents are shaken well and let stand for 20 minutes. Absorbance of the solution is measured at 620 nm with a spectrophotometer of standard make. Amylose content is determined by using a conversion factor and the results are expressed on a dry weight basis. The moisture content of the sample is essentially constant and need not be determined if the relative humidity and temperature of the laboratory is controlled.

<table>
<thead>
<tr>
<th>State</th>
<th>Content of amylose</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low</td>
<td>3-9%</td>
<td>1</td>
</tr>
<tr>
<td>Low</td>
<td>10-19%</td>
<td>3</td>
</tr>
<tr>
<td>Medium</td>
<td>20-25%</td>
<td>5</td>
</tr>
<tr>
<td>High</td>
<td>26-30%</td>
<td>7</td>
</tr>
<tr>
<td>Very high</td>
<td>&gt; 30%</td>
<td>9</td>
</tr>
</tbody>
</table>
**Characteristic 60: Polished grain: Expression of white core (Varieties with endosperm of amylose absent only)**

Degree of chalkiness describes the milled sample rice with respect to (a) white core (b) white belly and (c) white back. Chalky white spots often appear in the starchy endosperm. A white chalky region extending to the edge of the ventral side and towards the centre of the endosperm is called a white core. Soft textured, white spots occurring in the middle part on the ventral side (side on which the embryo lies) are called abdominal white or white belly. A long white streak on the dorsal side is called the white back.

<table>
<thead>
<tr>
<th>State</th>
<th>Kernel (%)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent or very small</td>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td>Small</td>
<td>&lt;25%</td>
<td>3</td>
</tr>
<tr>
<td>Medium</td>
<td>26-50%</td>
<td>5</td>
</tr>
<tr>
<td>Large</td>
<td>51-75%</td>
<td>7</td>
</tr>
<tr>
<td>Fully chalky</td>
<td>&gt;75%</td>
<td>9</td>
</tr>
</tbody>
</table>

**Characteristic 61: Gelatinization temperature**

**Gelatinization temperature through alkali spreading and clearing test (Little et. al., 1958)**

Duplicate sets of six whole milled grains are spaced evenly in transparent plastic boxes (50 mm x 42 mm x 22 mm) containing 10 ml of 1.7% Potassium Hydroxide. The dishes are kept at 27-30°C for 23 hours undisturbed in an incubator. Standard varieties must be used as checks for high, intermediate and low gelatinization temperature. The spreading of kernels noted on a 7 point scale is expressed as average of six values. Scoring is done as follows:

**Alkali spreading Value / Scale**

1. Kernel not affected
2. Kernel swollen
3. Kernel swollen, collar incomplete and narrow
4. Kernel swollen, collar complete and wide
5. Kernel split or segmented, collar complete
6. Kernel dispersed, merging with collar
7. All kernel dispersed and intermingled

<table>
<thead>
<tr>
<th>Alkali spreading Value / Scale</th>
<th>Classification</th>
<th>Gelatinization Temperature</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-7</td>
<td>High</td>
<td>Low</td>
<td>1</td>
</tr>
<tr>
<td>4-5</td>
<td>Medium</td>
<td>Medium</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Low, Medium</td>
<td>High, Medium</td>
<td>5</td>
</tr>
<tr>
<td>1-2</td>
<td>Low</td>
<td>High</td>
<td>7</td>
</tr>
</tbody>
</table>
Characteristic 62: Decorticated grain: Aroma

The method consists of adding about 15 ml of water to 5g of rice sample in a test tube (200 mm x 35 mm), soak for 10 minutes. Cook the sample in the water bath for 15 minutes. Transfer the cooked rice in to a petri dish. After cooling keep it in the refrigerator for 20 minutes. Then the petri plates are opened and the contents are smelled. The samples possessing the scent, as one could easily feel, produce a sharp and readily recognizable aroma. (D.R.R. unpublished).

SS : Strongly Scented
MS : Mild Scented
NS : Non Scented

IX. Literature

   Vol.1 Morphology (1993)


X. Working Group details:

The Test Guideline developed by the National Core Committee in consultation with the Project co-ordinator (Rice), the Nodal Officer, DUSTesting, DR R, Hyderabad and the Task Force (1/2005) constituted by the PPV&FR Authority.

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