

**Guidelines for the conduct of tests
for Distinctiveness, Uniformity and Stability**

Kodo millet (*Paspalum scrobiculatum* L.)



**Protection of Plant varieties and Farmer's Rights Authority
Government of India**

Kodo millet (*Paspalum scorbiculatum* L.)

I Subject:

These test guidelines apply to all the varieties, hybrids and parental lines of Kodo millet (*Paspalum scorbiculatum* L.)

II Material required:

1. The Protection Plant Varieties and Farmers' Right Authority (PPV & FRA) shall decide when, where and in what quantity and quality of the seed material is required for testing a varietal denomination applied for registration, under The 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 material to be supplied by the applicant shall be 500 grams. The seed shall be packed and sealed in ten equal weighing packets of 50 grams each and submitted in one lot. In addition, 10 panicles need to be submitted, if required.
2. The seeds submitted shall have the following standards of seed germination:
 - a. Germination : 80% (Minimum)
 - b. Moisture content : 12% (Maximum)
 - c. Physical purity : 97% (Minimum)
 - d. Inert matter : 3% (Maximum)
3. 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. It also shall possess the highest genetic purity, uniformity, sanitary and phyto- sanitary standards as per national requirement.

4. The seeds/planting material shall not have been subjected to any chemical and bio-physical treatment.

III Conduct of tests:

1. The minimum duration of the DUS test shall normally be at least two independent similar growing seasons for new varieties and one season in case of farmers' varieties and varieties of common knowledge (VCK) under extant category.
2. The test shall normally be conducted at least at two test locations.
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 plants or its parts could be removed for measurement and observation without prejudicing the other observations on the plants until the end of growing period. Each test shall include about 360 plants across three replications. Separate plots for observation on pest/ disease resistance for those varieties claiming resistance shall be laid out in two replications.
4. Test plot design:
 - Number of rows: 04
 - Row length: 3.0 m
 - Row to row distance: 30cm
 - Plant to plant distance: 10 cm
 - No. of replication: 3
5. Observations shall not be recorded on plants in border rows.
6. Additional tests for special purpose shall be established by the PPV & FR Authority.

IV Methods and observation:

1. The characteristics described in the table of characteristics (Section VII) shall be used for the testing of varieties, parental lines and hybrids for their DUS.
2. For the assessment of Distinctness and Stability, observations shall be recorded on 30 plants or parts of 30 plants, which shall be divided among 3 replications (10 plants in each 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), the number of off types (including plant parts) should not exceed 2 in 100.
4. For the assessment of all colour characteristics, the latest Royal Horticultural Society (RHS) color chart shall be used.

V Grouping of varieties:

1. The candidate varieties for DUS testing shall be divided into groups to facilitate assessment of Distinctness. Characteristics which are suitable for grouping purpose are those which do not vary or vary slightly, within a variety. Their various states of expression should be fairly evenly distributed throughout the collection.
2. The following characteristics are to be used for grouping Kodo millet varieties
 1. Leaf juncture pigmentation (Characteristic 6)
 2. Panicle appearance (Characteristic 12)
 3. Spikelet arrangement on rachis (Characteristic 14)
 4. Spikelet irregular rows: Intensity (Characteristic 15)
 5. Glume: Nerves on glumes (Characteristic 24)

VI Characteristics & symbol

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. Notes (1-9) shall be given for each state of expression for different characteristics for the purpose of electronic 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.

Decimal code for the growth stage

| Stage code | General Description |
|------------|---------------------|
| 15 | 2-4 Leaf stage |
| 26 | Vegetative |
| 51 | 50 % Flowering |
| 59 | Complete flowering |
| 67 | Dough stage |

| | |
|----|---------------|
| 77 | Seed filling |
| 83 | Maturity |
| 95 | After harvest |

5. Type of assessment:

MG: Single measurement 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 plant parts.

VS: Visual assessment by observation of individual plant or parts of plants.

VII Table of Characteristics

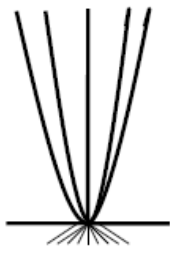
| Sl no | Characteristics | States | Score/ Notes | Example Varieties | Stage of observations | Type of assessment |
|----------------|-----------------------------|--------------------|--------------|-------------------|-----------------------|--------------------|
| 1 (+) | Plant: Growth habit | Erect | 3 | JK 155 | 15 | VG |
| | | Decumbent | 5 | JK 439 | | |
| | | Prostrate | 7 | GPLM 302 | | |
| 2 | Basal tillers: Number | Very low (<10) | 2 | GPLM 16 | 26 | MS |
| | | Low (10-20) | 3 | RK 390-25 | | |
| | | Medium (20.1-30.0) | 5 | GPLM 12 | | |
| | | High (>30) | 7 | GPLM 5 | | |
| 3 (* (+) | Leaf : Attitude | Erect | 3 | JK 48 | 26 | VG |
| | | Droopy | 5 | JK 155 | | |
| 4 (* (+) | Days to 50% flowering | Early(<65) | 3 | GPLM 8 | 51 | MG |
| | | Medium (65-75) | 5 | JK 65 | | |
| | | Late(75-85) | 7 | TNAU 86 | | |
| | | Very late(>85) | 9 | GPLM 328 | | |
| 5 (* | Leaf Sheath: Pigmentation | Absent | 1 | JK 48 | 59 | VS |
| | | Present | 9 | JK 155 | | |
| 6 (* | Leaf juncture: Pigmentation | Absent | 1 | RK 390-25 | 59 | VS |
| | | Present | 9 | JK 48 | | |
| 7 (* | Internode: Pigmentation | Absent | 1 | GPLM 23 | 59 | VS |
| | | Present | 9 | JK 155 | | |
| 8 | Leaf blade: Pigmentation | Absent | 1 | DPS 9-1 | 59 | VG |
| | | Present | 9 | - | | |

| | | | | | | |
|-----------------|---------------------------------------|--|---|---------------|----|----|
| 9 (+) | Flag leaf blade: Length (cm) | Short(<20.0) | 3 | RK 390-25 | 59 | MS |
| | | Medium (20.0-30.0) | 5 | DPS 9-1 | | |
| | | Long(>30.0) | 7 | - | | |
| 10 (+) | Flag leaf blade: width(cm) | Narrow(<0.5) | 3 | - | 59 | MS |
| | | Medium (0.5-1.0) | 5 | JK 98 | | |
| | | Wide(>1.0) | 7 | JK 48 | | |
| 11 (+) | Peduncle: Length (cm) | Short(<5.0) | 3 | - | 59 | MS |
| | | Medium (5.0-10.0) | 5 | JK 48 | | |
| | | Long(> 10.0) | 7 | RK 390-25 | | |
| 12 (* (+) | Panicle: Appearance | Compact | 3 | RK 390-25 | 67 | VG |
| | | Semi compact | 5 | JK 155 | | |
| | | Open | 7 | Indira kodo 1 | | |
| 13 (+) | Panicle: Exertion | Partial | 1 | RK 390-25 | 67 | VS |
| | | Complete | 9 | JK 13 | | |
| 14 (* (+) | Spikelet: Arrangement on rachis | Regular | 2 | TNAU 86 | 67 | VG |
| | | Irregular | 8 | RK 390-25 | | |
| 15 (+) | Spikelet: irregular rows number | Two-three | 3 | JK 48 | 67 | VG |
| | | Two -four | 5 | - | | |
| | | Lower half (regular at upper half) | 7 | RK 390-25 | | |
| 16 (+) | Spike: Branching | Absent | 1 | DPS 9-1 | 67 | VG |
| | | Present | 9 | RK 390-25 | | |
| 17 (+) | Spike: Curvature | Straight | 2 | TNAU 86 | 67 | VG |
| | | Curved | 4 | RK 390-25 | | |
| 18 | Spikelet: Density | Lax | 4 | JK 48 | 67 | VG |
| | | Dense | 6 | RK 390-25 | | |
| 19 (+) | Culm: Branching | Low (<3) | 3 | GPLM 37 | 67 | MG |
| | | Medium(3-7) | 5 | JK 48 | | |
| | | High (>7) | 7 | TNAU 86 | | |
| 20 (+) | Panicle: Length (cm) | Short (<6.0) | 3 | GPLM 610 | 77 | MS |
| | | Medium (6.0-9.0) | 5 | JK 13 | | |
| | | Long (>9.0) | 7 | JK 48 | | |
| 21 (+) | Thumb raceme: Length (cm) | Short (< 5) | 3 | - | 77 | MS |
| | | Medium (5-7) | 5 | JK 62 | | |

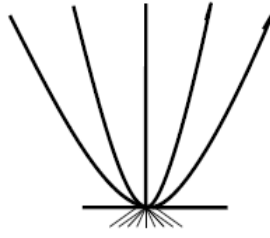
| | | | | | | |
|-----------------|---|----------------------------|---|-----------|----|----|
| | | Long (>7) | 7 | JK 48 | | |
| 22 (+) | Raceme: Length (cm) | Short(< 5.0) | 3 | GPLM 6 | 77 | MS |
| | | Medium (5.0-10.0) | 5 | JK 48 | | |
| | | Long (10.1-15.0) | 7 | GPLM 54 | | |
| | | Very long (>15.0) | 9 | - | | |
| 23 (* (+) | Raceme: Number (Above thumb) | Low (<2) | 3 | GPLM 101 | 77 | MS |
| | | Medium (2-4) | 5 | GPLM 1 | | |
| | | High (4-6) | 7 | DPS 9-1 | | |
| | | Very high (>6.0) | 9 | - | | |
| 24 (* (+) | Glume: Space between Nerves | Narrow (7 nerves) | 3 | JK 48 | 83 | VG |
| | | Broad (5 nerves) | 5 | DPS 9-1 | | |
| 25 (* (+) | Plant: Height (cm) | Dwarf (<30.0) | 3 | GPLM 196 | 83 | MS |
| | | Semi dwarf (30.0-50.0) | 5 | GPLM 193 | | |
| | | Tall (50.1-70.0) | 7 | JK 13 | | |
| | | Very Tall (>70.0) | 9 | JK 65 | | |
| 26 | Lodging | Absent | 1 | TNAU 86 | 83 | VG |
| | | Present | 9 | DPS 9-12 | | |
| 27 | Seed: Shattering | Absent | 1 | GPLM 2 | 83 | VG |
| | | Present | 9 | TNAU 86 | | |
| 28 (* (+) | Grain: Colour | Light brown RHS NO 177D | 3 | - | 83 | VG |
| | | Brown RHS NO177C | 4 | GPLM 68 | | |
| | | Dark brown RHS NO 177B | 5 | JK 155 | | |
| 29 | Grain: Shape | Elliptical | 2 | JK 439 | 95 | VG |
| | | Oval | 4 | RK 390-25 | | |
| 30 (* (+) | 1000- grain weight (g) at 12% moisture content | Low (<5.0) | 3 | GPLM 129 | 95 | MG |
| | | Medium (5.0-6.0) | 5 | RK 390-25 | | |
| | | High (>6.0) | 7 | GPLM 54 | | |

II Explanations for Table of Characteristics

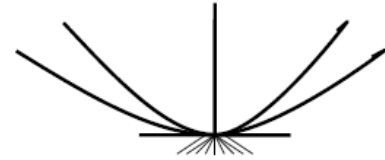
Characteristic 1 Plant: Growth habit



1
Erect

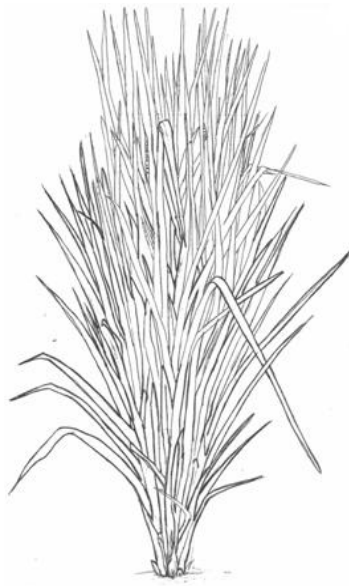


5
Decumbent



7
Prostrate

Characteristic 3 Leaf: Attitude



3
Erect



5
Droopy

Characteristic 4 Days to 50 % flowering

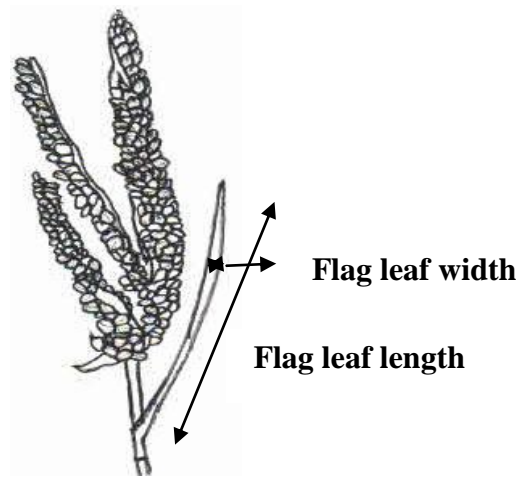
Days to 50% flowering is from sowing to the stage when ears have emerged from main tiller in 50 percent population.

Characteristic 9 Flag leaf blade: Length (cm)

Flag leaf blade length is measured from ligule to flag leaf blade tip.

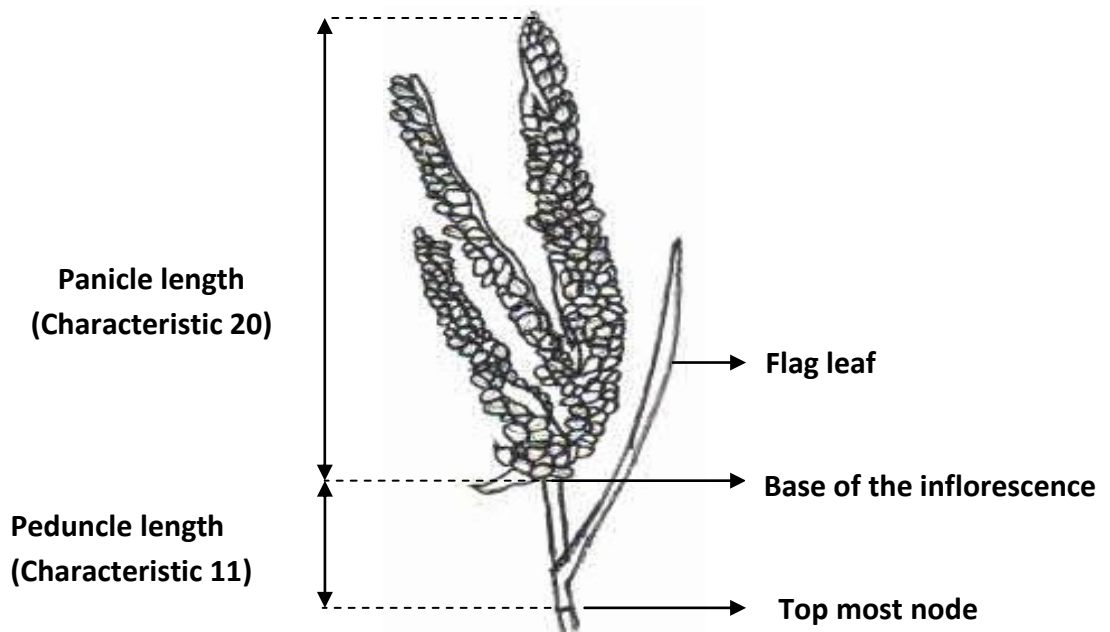
Characteristic 10 Flag leaf blade: Width (cm)

Flag leaf blade width is measured at the widest point of the flag leaf

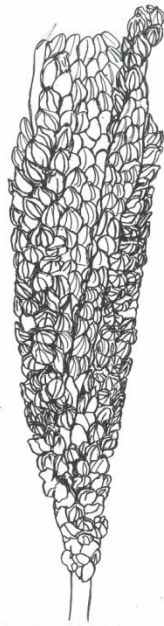


Characteristic 11 Peduncle: Length (cm)

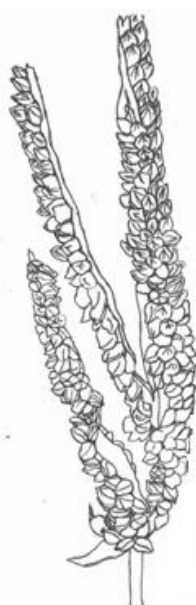
Peduncle length is measured from earhead base to the top most node on main tiller.



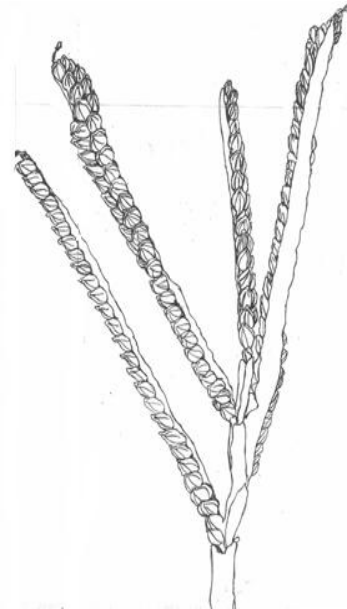
Characteristic 12 Panicle: Appearance



3
Compact

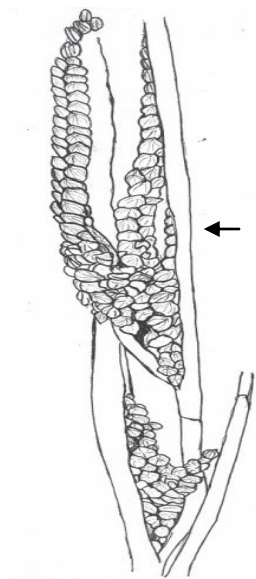


5
Semi-compact



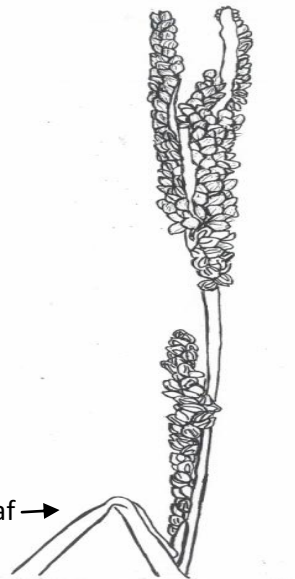
7
Open

Characteristic 13 Panicle: Exertion



1
Partial

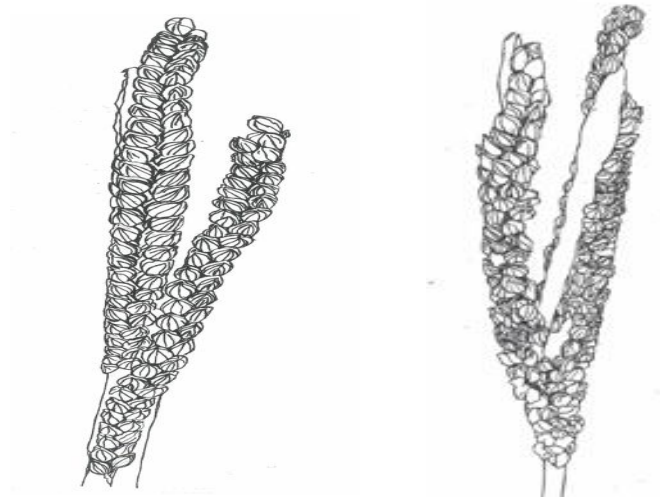
← Flag leaf



7
Complete

Flag leaf →

Characteristic 14 Spikelet: Arrangement on rachis



2
Regular

8
Irregular

Characteristic 15 Spikelet: Irregular rows number



3
Two-three

5
Two-Four

7
Lower half

Characteristic 16 Spike: Branching

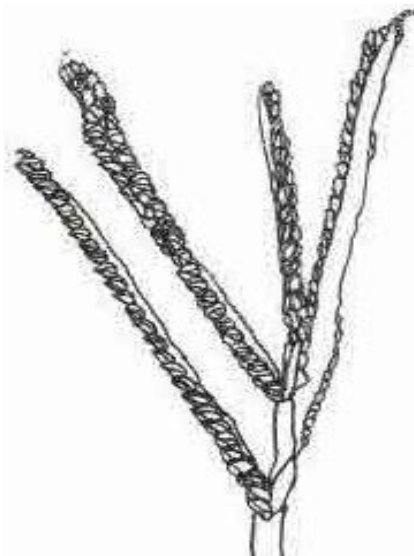


1
Absent

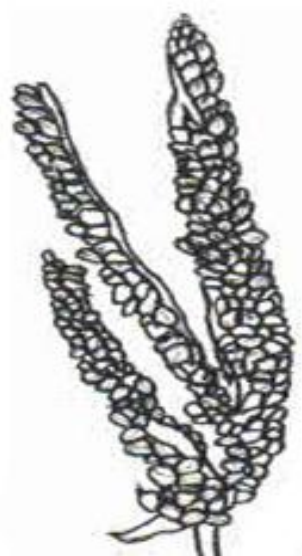


9
Present

Characteristic 17 Spike: Curvature



2
Straight



4
Curved

Characteristic 19 Culm: Branching

- Low - Upper nodes rarely produce branches
- Medium -Upper 2 – 4 nodes produce branches
- High- Most nodes produce branches

Characteristic 20 Panicle: Length (cm)

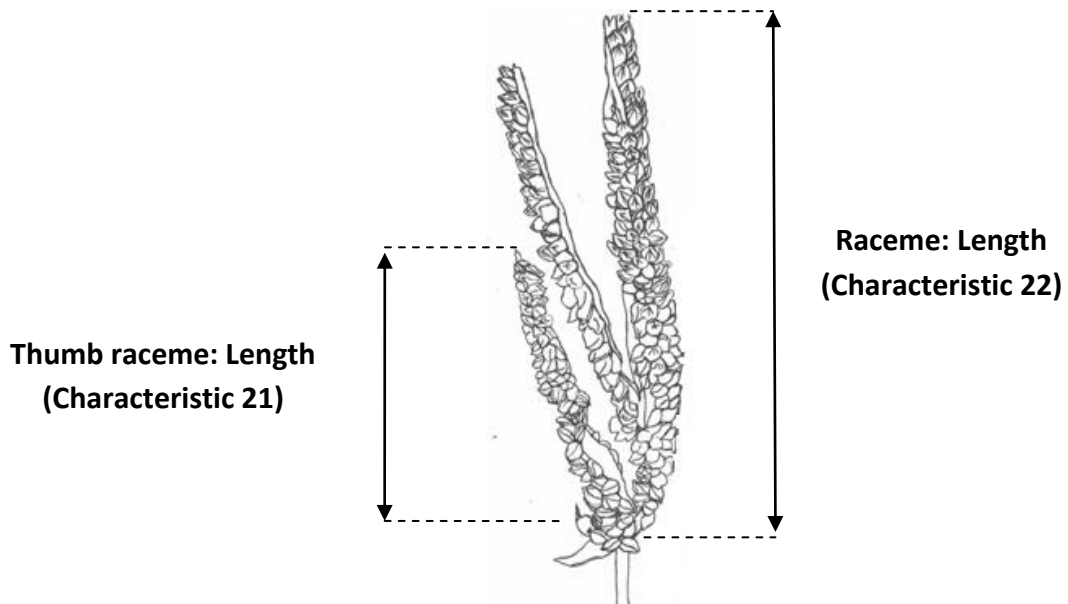
Panicle length is measured from base of the panicle to the tip of the panicle.

Characteristic 21 Thumb raceme: Length (cm)

Thumb raceme length is measured from base to the tip of the thumb raceme

Characteristic 22 Raceme: Length (cm)

Raceme length is measured from base of the longest raceme in the inflorescence to the tip of the raceme.



Characteristic 24 Glume : Space between nerves



3
Narrow

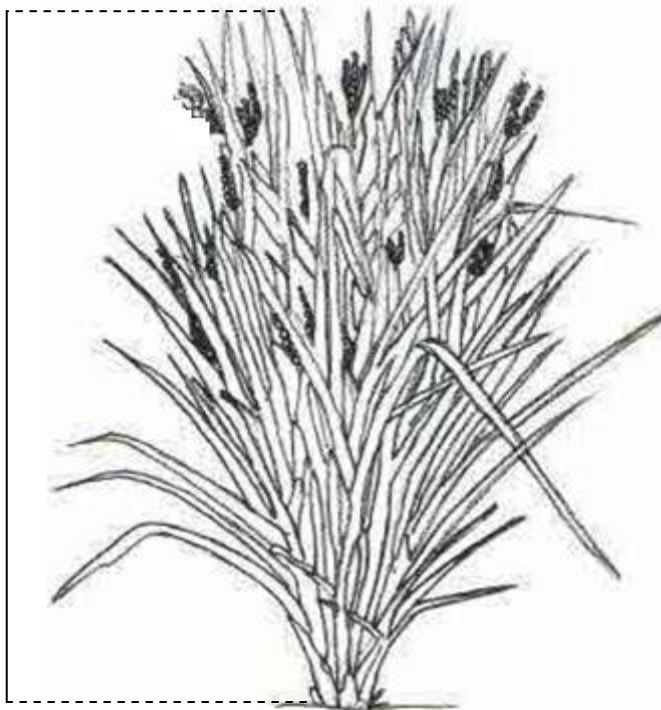


5
Broad

Characteristic 25 Plant: Height (cm)

Plant height is measured from ground level to the tip of the earhead on main tiller.

Plant height



IX. Working Group Details:

These Test guidelines have been developed by the National Core Committee in Consultation with the Project Coordinator, All India Coordinated Small Millets Improvement Project at UAS, GKVK, Bangalore-560 065 and the Nodal Officer, DUS Test Centre and Task Force constituted by the Authority.

The members of the Task Force

| | |
|---|-------------------|
| Dr. K. Narayana Gowda, Former VC UAS, Bengaluru | - Chairman |
| Dr. A. Seetharam, Former PC(AICPMIP), UAS, Bengaluru | - Member |
| Prof. B.T. Shankare Gowda, Former Prof. UAS, Bengaluru | - Member |
| Dr. T.G. Nagehwara Rao, PC(Small millets), UAS, Bengaluru | - Member |
| Dr. K.T. Krishne Gowda, Former PC(AICSMIP), UAS Bengaluru | -Special Invitee |
| Sh. Dipal Roy Choudhury, PPV&FRA, New Delhi | -Member Secretary |

Nodal Person(s) for development of the DUS Guideline

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Dr. Pratibha Das, Breeder, AICRP on Millets, Dindori

X. DUS Test Centers

| DUS centre (1) | Test Centre(2) |
|---|--|
| AICRP on Small Millets, Zonal Agril. Research Station, Jagdalpur-494005, Chhattisgarh | All India Coordinated Research Project on Small millets, College of Agriculture, REWA-486001, Jabalpur, Madhya Pradesh |