सुपारी

(*अरेका कटेचु* एल.)

पर

विशिष्टता, एकरूपता तथा स्थायित्व

परीक्षण के लिए दिशानिर्देशिका

Guidelines
for the Conduct of Test for
Distinctiveness, Uniformity and Stability
On
Arecanut
(*Areca catechu* L.)

पौधा किस्म और कृषक अधिकार संरक्षण प्राधिकरण

Protection of Plant Varieties and Farmers' Rights Authority

(PPV&FRA)

भारत सरकार

Government of India

Arecanut (*Areca catechu* L.)

I. Subject

These test guidelines shall apply to all varieties, hybrids and parental lines of hybrid varieties of arecanut (*Areca catechu* L.).

II. Planting material required

1. The Protection of Plant Varieties and Farmer's Rights Authority (PPV & FRA) shall decide when, where and in what quantity and quality the plant material are required for testing variety denomination applied for registration under the Protection of Plant Varieties and Farmers' Rights. Applicants submitting planting 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 number of planting materials to be supplied by the applicants or his nominee in one or several samples shall be: 10 numbers of one year-old seedlings.
2. The planting materials supplied shall be healthy, not lacking in vigor or nutrient deficiency as well as free from pests or diseases. The age of the seedlings shall be 12 months from the date of sowing in the polythene bags (15 cm × 25 cm size) with soil mixture (2:1:1 soil, compost and sand).
3. The planting material should not have undergone any treatment which would affect the expression of the characteristic of the variety. Unless the competent authorities allow or request such treatment. If it has been treated, full details of the treatment must be given.
4. In addition, taking into consideration the long duration of the crop, the applicant shall additionally submit about 6 inflorescences and 6 fruit bunches, harvested from the parental palms in the presence of the concerned authorities.
5. The juvenile growth characters shall be recorded on the seedlings supplied at the DUS centre. The Expert Committee constituted by the PPV&FRA in consultation with the DUS centre shall be authorized to inspect the mother palms of the candidate variety and record inflorescence and fruit characters from the mother palms of the candidate variety.

III. Conduct of tests

1. The minimum duration of DUS tests shall be two independent crop seasons (i.e. two consecutive years) from same plants.
2. The test shall normally be conducted at one place. If any essential characteristic of the candidate variety is/are not expressed for visual observation at this location; the variety shall be considered for further examinations at another appropriate test site or under special test protocol on expression of the applicant.
3. The field test shall be carried out under conditions favoring normal growth and expression of all test characteristics.

4. **Test design:**

The design of the tests should be such that plants or parts of plants may be removed for measurement or counting without prejudice to the observations which must be made up to the end of the growing cycle.

Test plot design:

i. As a minimum, each test shall include eight plants, planted in a compact block in the DUS testing centre, with a spacing of 2.7 × 2.7 m.

ii. Adult palms and fruit characters will be assessed to include two similar harvest seasons/years.

iii. Mother palms of a candidate variety: - As a minimum, eight mother palms of the candidate variety, planted in compact blocks, should be available for inspection and examination for 'on site' DUS testing. The palms should be healthy and free of pests and diseases and raised under standard management practices. In the absence of prescribed number of parental palms of the candidate variety for 'on site' testing, the DUS test duration shall be enhanced to include at least two similar harvest seasons at the DUS testing centre.

On-site DUS testing

a. The applicant or his/her nominee on his/her behalf shall submit a request to the Authority for conducting a reliable trial according to Test Guidelines and the instructions from Authority before on-site examination of the candidate variety. It will be the responsibility of the applicant to conduct the trial of the candidate variety(s) along with suitable reference variety. This may be relaxed in case of farmers' variety, as the case may be.

b. The applicant or his/her nominee shall submit a request to the Authority for on-site examination prior to the start of growing cycle as mentioned in Test Guidelines for site examination of the candidate variety.

c. On-site testing may be conducted at the places specified by the applicant. The minimum age of the trees at on-site shall be three years.

d. The Expert Committee constituted by the PPV & FRA in consultation with the DUS Centre will inspect on-site testing and recording of the expression of the characters.

e. Applicant or his/her nominee shall supply the Expert Committee with summary of distinct characteristics supported by photographs. The Expert Committee shall take notes and observations on distinctness and shall confirm preliminary data and/or summary of distinctness from applicant.

f. The Expert Committee shall submit report for monitoring of the trial to the Authority.

g. In the absence of prescribed number of plants of the candidate variety for 'on site' testing for farmers' variety, the DUS test duration shall be enhanced to include at least one more season.

h. The Authority may relax the criteria for no of plants, spacing and other requirements maximum for a period up to 3 years from the date of publication of the general guideline in the Plant Varieties Journal of India.

iv. Additional test protocols and guidelines for special characters 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 testing of candidate varieties and for their DUS.
2. For the assessment of Distinctiveness and Stability observation shall be made on 8 plants or parts of 8 plants.
3. For the assessment of uniformity, a population standard of 1% and an acceptance probability of at least 95 % shall be applied. In the case of a sample size of 20 palms, the maximum number of off-types allowed would be 1.
4. All the leaf characters shall be recorded on the oldest leaf of the palm.
5. For assessment of all color characteristics the latest Royal Horticultural Society (RHS) color chart shall be used.
6. For the assessment of distinctiveness and stability, observations shall be made on eight plants or parts of eight plants.

V. Grouping of the varieties

1. The candidate varieties for DUS shall be divided into groups for facilitating 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 evenly distributed across all varieties in the collection, are suitable for grouping purposes.
2. The following characteristics shall be used for grouping Arecanut varieties:
   a) Crown shape (characteristic 4)
   b) Plant height (characteristic 5)
   c) Leaf length (characteristic 8)
   d) Leaf breadth (characteristic 9)
   e) Color of ripe nuts (characteristic 17)
   f) Shape of nuts (characteristic 18)

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. Notes (1 – 9) shall be used to describe the state of each character for the purposes of electronic data processing and these notes shall be given against the states of each characteristic.

3. Type of assessment of characteristics indicated in column four of Table of characteristics are as follows:

   MG: Measurement by single observation of a group of plants or part of plants.

   MS: Measurement of a number of individual plants or part 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 part of plants.

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 the plant.

Decimal code for the growth and reproductive stages

Stage code	General description
10	At the time of planting
40	Maturity (4 years after planting)
50	Flowering stage
80	Fruiting stage (10 months after flowering)
95	Post-harvest

5. Legend:

   (*) Characteristics that shall be observed during in every growing season over which the examinations are made and always be included in the variety descriptions, except when the state of expression of a preceding characteristics or regional environmental conditions render this impossible.

   (+) See explanation on the Table of characteristics in Section VII. 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.

VII. Table of Characteristics

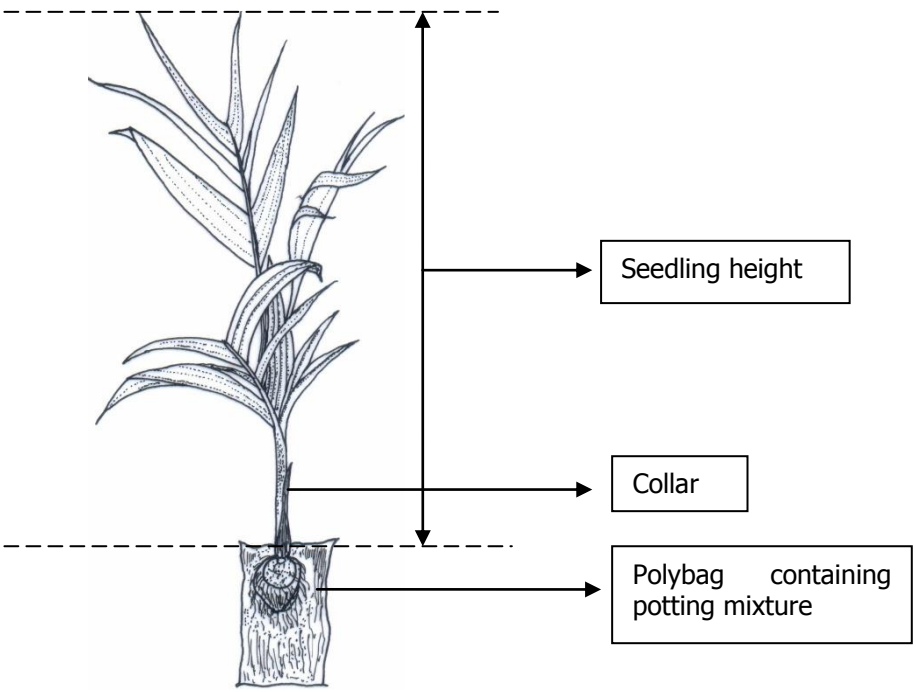
Sl. No.	Characteristics	States	Note	Example variety	Stage of observation	Type of assessment
1. (+)	Seedling girth (cm)	Low (< 2) Medium (2-4) High (> 4)	2 4 6	Mang, H. D. Sum, Sree Mohit	10	MS
2. (+)	Number of leaves/ seedling	Few (< 4) Medium (4-6) Many (> 6)	3 5 7	H. D. Mohit Mang, Sum	10	MS
3. (*) (+)	Seedling height (cm)	Short (< 50) Medium (50-110) Tall (> 110)	3 5 7	H. D. Mang Mohit	10	MS
4. (*) (+)	Crown shape	Drooping Intermediate Upright	4 6 8	Mang Mohit, Sum H. D.	40	VG
5. (*) (+)	Plant height (m)	Short (< 6) Medium (6-8) Tall (> 8)	3 5 7	H. D. Mang Mohit, Sum	40	MS
6. (*) (+)	Crown length (m)	Short (< 1.50) Medium (1.50-2.50) Long (> 2.50)	2 4 6	H. D. Mang Mohit, Sum, Sree	40	MS
7. (*) (+)	Internode length (cm)	Short (< 4) Medium (4-10) Long (> 10)	2 4 6	H. D. Mang Mohit	40	MS
8. (+)	Leaf length (cm)	Short (< 120) Medium (120-200) Long (> 200)	3 5 7	H. D. Mang Mohit, Sum	40	MS
9. (+)	Leaf breadth (cm)	Narrow (< 85) Medium (85-105) Broad (> 105)	3 5 7	H. D. Mang Mohit, Sum	40	MS
10. (*) (+)	Leaf sheath length (cm)	Short (< 50) Medium (50-90) Long (> 90)	2 4 6	H. D. Mang Mohit	40	MS
11. (*) (+)	Leaf sheath breadth (cm)	Narrow (< 25) Medium (25-40) Broad (> 40)	2 4 6	H. D. Mang Kahi	40	MS
12. (*) (+)	Initiation of flowering (months)	Early (< 30) Medium (30-45) Late (> 45)	2 5 8	Mang H. D. Mohit	50	VG

13. (+)	Spadix length (cm)	Short (< 50) Medium (50-70) Long (> 70)	3 5 7	H. D. Sum Mang, Mohit	50	MS
14. (+)	Spadix breadth (cm)	Narrow (< 12) Medium (12-18) Broad (> 18)	3 5 7	H. D. Sum Mang, Mohit	50	MS
15. (*) (+)	Number of female flowers per inflorescence	Few (< 120) Medium (120-180) Many (> 180)	2 4 6	H. D. SK Local Mang	50	MG
16. (+)	Orientation of the infructescence	Upright Horizontal Drooping	2 4 6	H.D. Mang Mohit	80	VG
17. (*) (+)	Colour of ripe nuts	6B (Pale yellow) 9A (Yellow) 13A (Deep yellow) 21B (Pale orange) 28B (Orange)	1 3 5 7 9	Sagar Mang H. D. Sree Kahi	80	VG
18. (*) (+)	Shape of nuts	Round Oval Oblong	2 4 6	Sree Sum Mang, Mohit	80	VG
19. (*) (+)	Fresh fruit weight (g)	Low (< 24) Medium (24-36) High (> 36)	3 5 7	H. D. Sum, Mang Sree, Mohit	80	MG
20. (+)	Fruit length (cm)	Short (< 4.50) Medium (4.50-5.50) Long (> 5.50)	2 4 6	H. D. Sum, Mang Sree	80	MG
21. (+)	Fruit breadth (cm)	Narrow (< 3.50) Medium (3.50-4.50) Broad (> 4.50)	2 4 6	H. D. Sum, Mang Sree	80	MG
22. (*) (+)	Dry fruit weight (g)	Low (< 9) Medium (9-13) High (> 13)	3 5 7	H. D. Sum Sree	95	MG
23. (*) (+)	Kernel length (mm)	Short (< 18) Medium (18-26) Long (> 26)	3 5 7	H. D. Sum Sree	95	MG
24. (+)	Kernel breadth (mm)	Narrow (< 16) Medium (16-24) Broad (> 24)	3 5 7	H. D. Mang Sree	95	MG

25. (+)	Dry kernel weight (g)	Low (< 6) Medium (6-12) High (> 12)	3 5 7	H. D. Mohit, Sum Sree	95	MG
26. (+)	Dry kernel weight/palm (kg)	Low (< 1) Medium (1-3) High (> 3)	3 5 7	H. D. Mang Kahi	95	MG
27. (*) (+)	Husk thickness (mm)	Thin (< 4) Medium (4-6) Thick (> 6)	2 4 6	H. D. Sum Mohit	95	MG
28. (+)	Dry husk weight (g)	Low (< 3) Medium (3-5) High (> 5)	3 5 7	H. D. Sum Mohit	95	MG
29. (*) (+)	Kernel recovery percentage (%)	Low (< 15) Medium (15-25) High (> 25)	3 5 7	Mang, Mohit H. D., Sum	95	MG
Special characters:						
30. (+)	Arecoline content (mg/g dry nut weight)	Low (< 0.32) Intermediate (0.32-0.40) High (> 0.40)	3 5 7	Madhu Mang Mohit	95	MG
31. (+)	Tannins (total polyphenols) (mg/g dry nut weight)	Low (< 160) Intermediate (160-180) High (> 180)	2 4 8	SK Local Sree Mang	95	MG

Mang-Mangala, Sum-Sumangala, Sree- Sreemangala, Mohit-Mohithnagar, Kahi-Kahikuchi, SK Local-South Kanara Local, Madhu-Madhuramangala, H. D. - Hirehalli Dwarf

VIII. Explanations on the Table of Characteristics



Characteristic 1: Seedling girth

The girth measured in cm at collar region of the seedling at the time of planting.

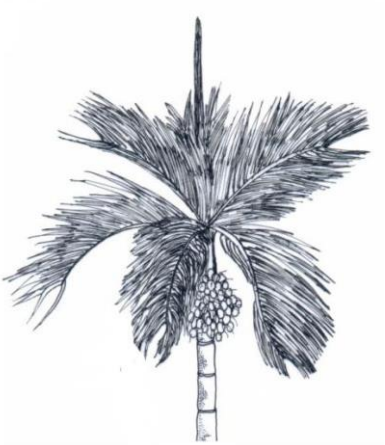
Characteristic 2: Number of leaves/ seedling

The number of leaves present in the seedling at the time of planting shall be recorded.

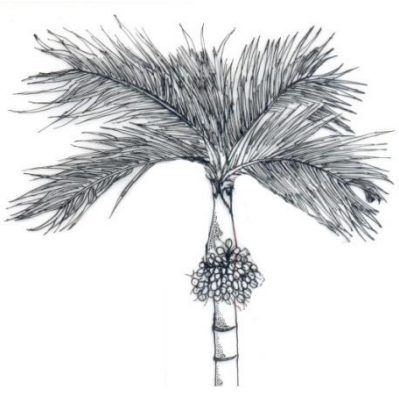
Characteristic 3: Seedling height

The height of the seedlings shall be measured in cm from base of the seedling to the tip of the oldest leaf at the time of planting.

Characteristic 4: Crown: Shape



4
Drooping

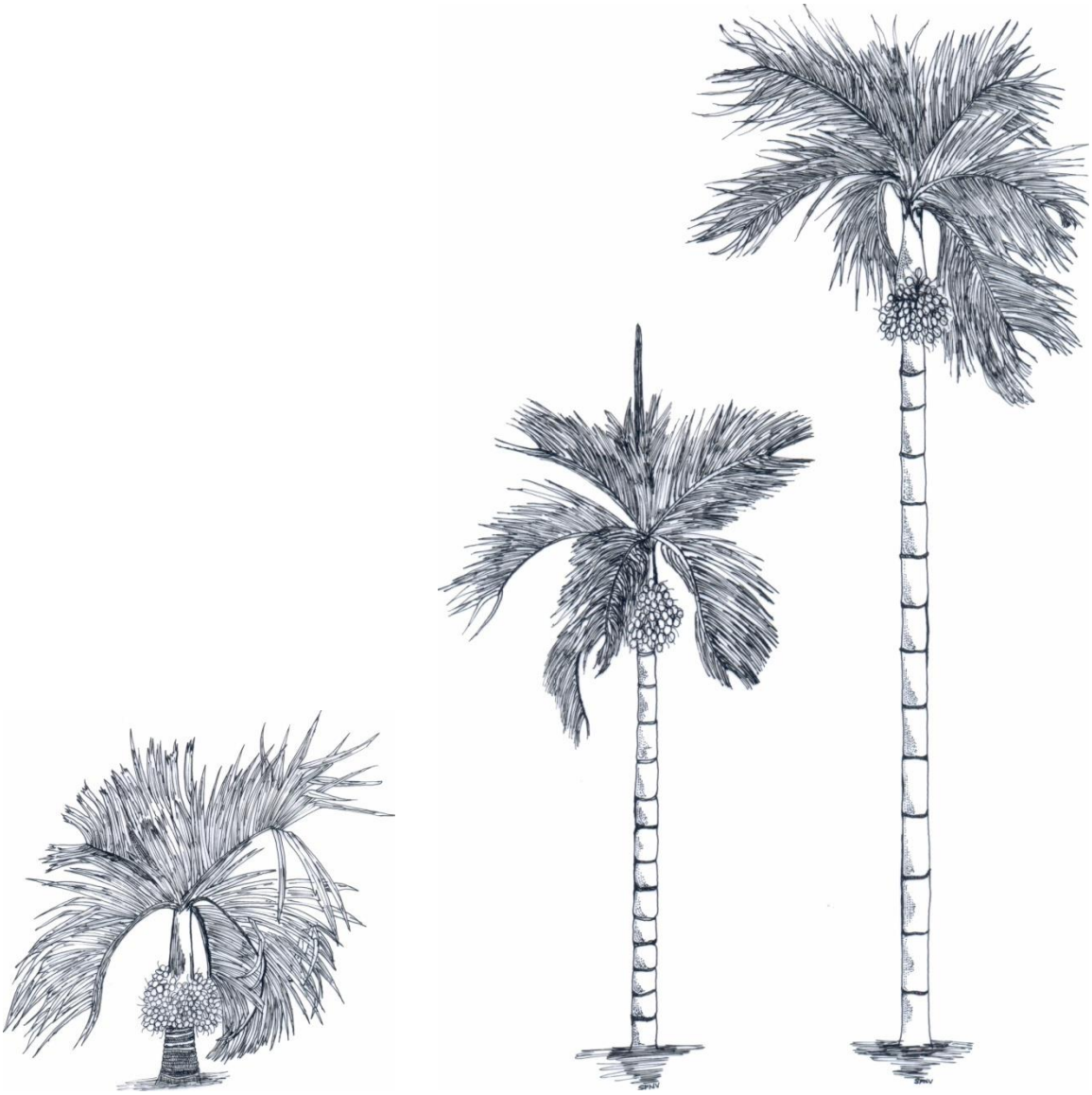


6
Intermediate

8
Upright

Characteristic 5: Plant height

The height of the plant shall be measured in m from base of the palm to the tip of crown.



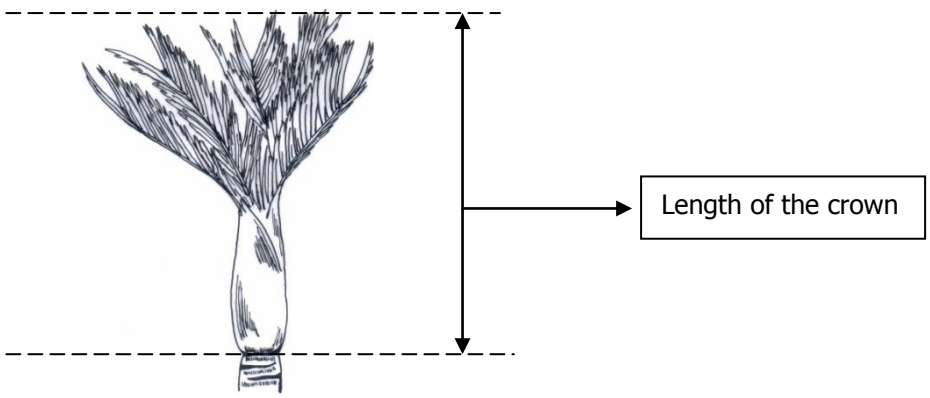
2
Dwarf

4
Semi tall

6
Tall

Characteristic 6: Crown length

The length of the crown shall be measured in m from the base of the crown to the tip of the crown.



Characteristic 7: Internode length

The length of the internode in cm at 0.5 m height shall be recorded.

Characteristic 8: Leaf length

The length of the oldest leaf from the base of the petiole to the tip of the leaf shall be measured in cm.

Characteristic 9: Leaf breadth

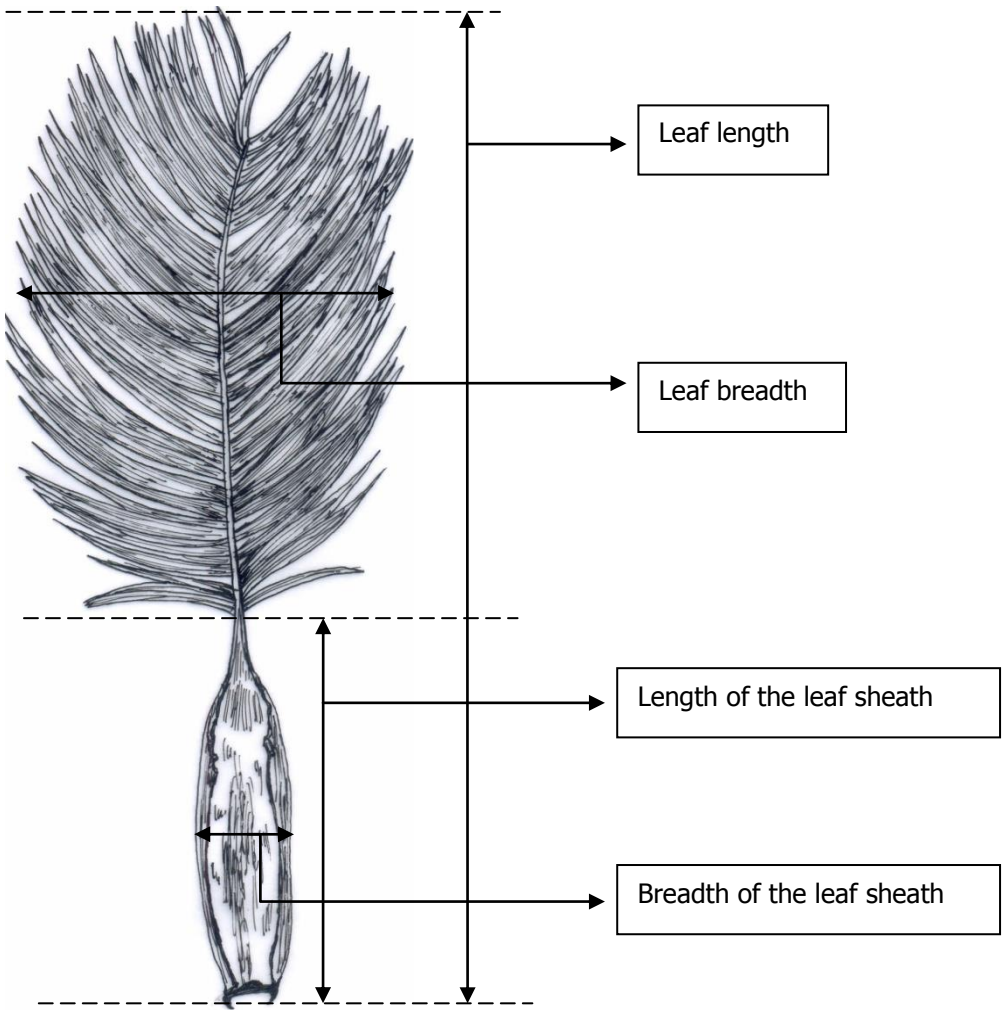
The breadth of the leaf shall be measured in cm from the tip of the left leaflet to the tip of the right leaflet in the middle portion of the oldest leaf.

Characteristic 10: Leaf sheath length

The length of the leaf sheath shall be measured in cm from its base to the point of attachment with the leaflets.

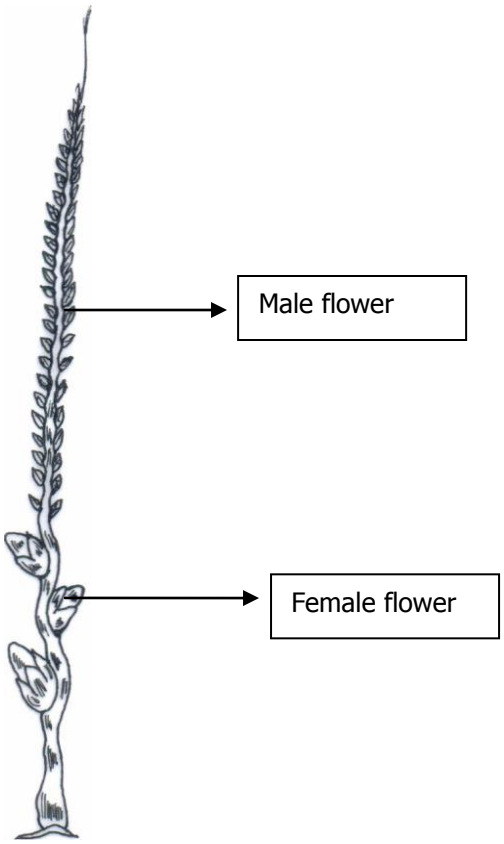
Characteristic 11: Leaf sheath breadth

The breadth of the leaf sheath shall be measured in cm at the broadest portion (middle) of the leaf sheath.



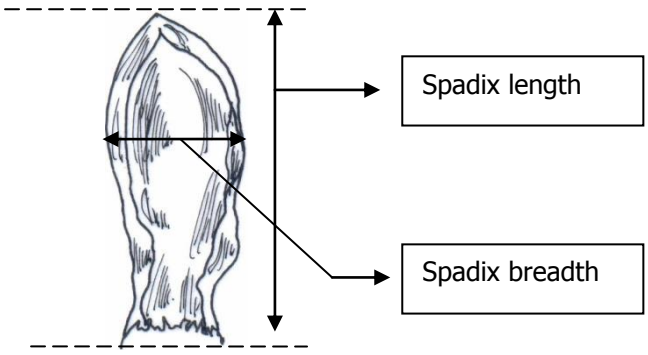
Characteristic 12: Initiation of flowering (months)

Initiation of flowering shall be recorded as the period in months from the time of planting one year old seedling to flowering (splitting of the spathe exposing the inflorescence).



Characteristic 13: Spadix length

The spadix length shall be measured in cm starting from the base of the inflorescence to the tip.



Characteristic 14: Spadix breadth

The spadix breadth shall be measured in cm at broadest portion (middle) of the spadix.

Characteristic 15: Number of female flowers per inflorescence

The number of female flowers produced per inflorescence shall be recorded.

Characteristic 16: Orientation of the infructescence

The position of the infructescence shall be recorded as

a. Upright
b. Horizontal
c. Drooping

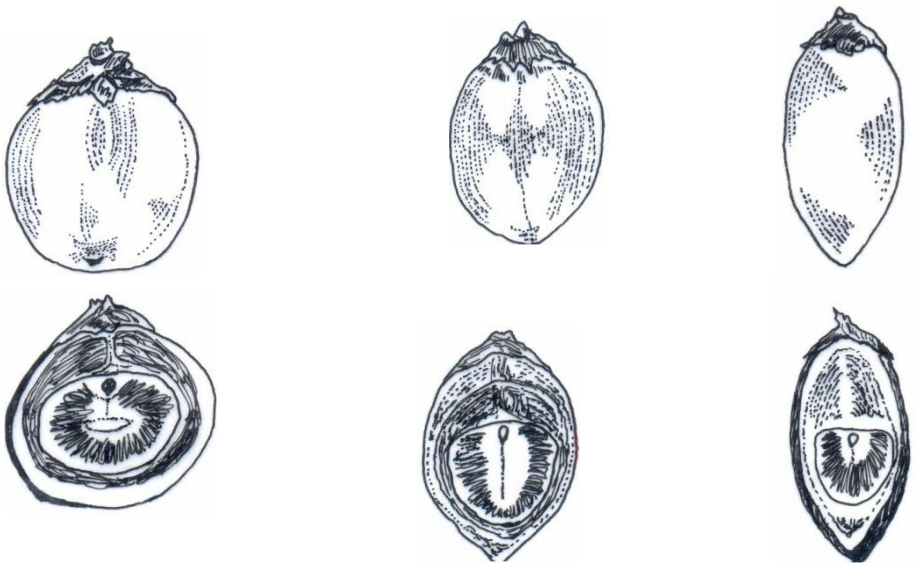
Characteristic 17: Color of ripe nuts

The color of the fruit shall be recorded as described in Royal Horticultural Society.

a. 6B (Pale yellow)
b. 9A (Yellow)
c. 13A (Deep yellow)
d. 21B (Pale orange)
e. 28B (Orange)
f. N30C (Deep orange)

Characteristic 18: Shape of nuts

The shape of the nuts shall be recorded as



2
Round

4
Oval

6
Oblong

Characteristic 19: Fresh fruit weight

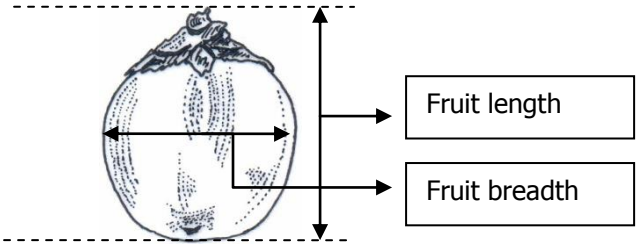
The fresh weight of the whole nut shall be measured in g immediately after the harvest.

Characteristic 20: Fruit length

The length measured of the fruit shall be measured in cm in polar zone of the nut.

Characteristic 21: Fruit breadth

The breadth measured of the fruit shall be measured in cm in equatorial zone of the nut.

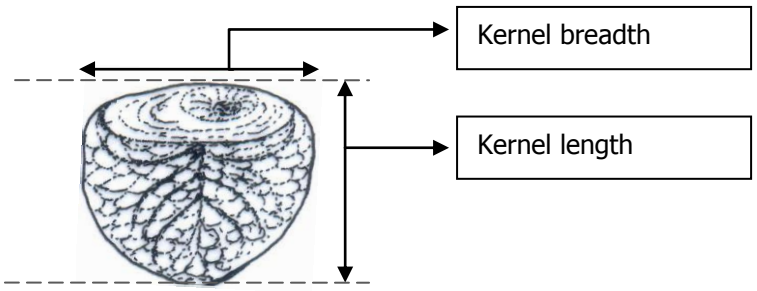


Characteristic 22: Dry fruit weight

The weight in g of whole nut after drying shall be recorded.

Characteristic 23: Kernel length

The length measured in mm at the polar zone of the kernel shall be recorded.



Characteristic 24: Kernel breadth

The breadth measured in mm at the equatorial zone of the kernel shall be recorded.

Characteristic 25: Dry kernel weight

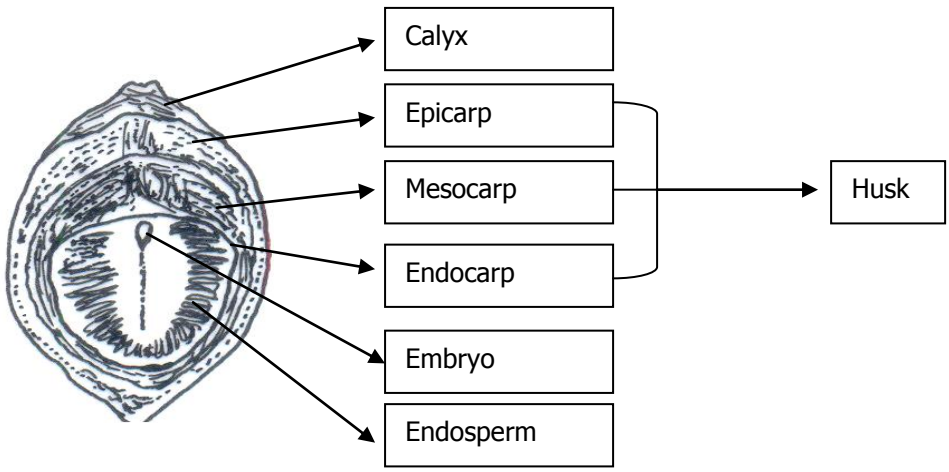
The weight of dried kernel in g after dehusking the nut shall be recorded.

Characteristic 26: Dry kernel weight/palm

The weight of dried kernel produced per palm per year in kg shall be recorded.

Characteristic 27: Husk thickness

The thickness of the husk measured in cm in split nut shall be recorded.



Characteristic 28: Dry husk weight

The weight of dried kernel in g after dehusking the nut shall be recorded.

Characteristic 29: Kernel recovery percentage

The kernel recovery percentage shall be recorded as ratio of the weight of the dried kernel to the weight of the fresh nut expressed in percentage.

Special character 30: Arecoline content

The amount of arecoline is determined using HPLC method using arecoline hydrobromide as standard (Aromdee *et. al*., 2003).

Special character 31: Tannins (total polyphenols)

Tannins (total polyphenols) are determined using vanillin-HCl assay (Chavan & Singhal, 2013) using catechin as standard.

IX. Literature:

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X. Working group details

The test guidelines developed by the task force **(01/2016)** constituted by the PPV & FR Authority for **Arecanut (*Areca catechu* L.)** with consultation by Nodal Officer, DUS Test Centre, ICAR-CPCRI, Regional Station, Vittal, Karnataka and Technical inputs also provided by the PPV & FR Authority.

Members of the Task force (01/2016):

1. **Dr. V. A. Parthasarathy** — Chairman
   Former Director & Emeritus Scientist,
   Indian Institute of Spices Research, Kozhikode,
   Res:-Narmada Nilayam, 32/482C, Bharathan Bazar,
   Chelavoor, Calicut – 673 571, Kerala.

2. **Dr. M. Anandaraj** — Member
   Former Director, Indian Institute of Spices Research, Kozhikode
   "Madhoovan" 33/3938A, Adjacent to KSHB colony,
   Malaparamba – 673 009, Kozhikode, Kerala.

3. **Dr. P. Chowdappa** — Member
   Director,
   ICAR – Central Plantation Crops Research Institute,
   P.O. Kudlu, Kasaragod – 671 124, Kerala.

4. **Dr. D. P. Waskar** — Member
   Director of Research
   Vasantrao Naik Marathwada Krishi Vidyapeeth
   Parbhani-431402, Maharashtra.

5. **Dr. K. S. Ananda** — Member
   Head and Principal Scientist (Genetics & Plant Breeding),
   ICAR – Central Plantation Crops Research Institute,
   Regional Station, Vittal, Bantwal Tk., DK, Karnataka-574243

6. **Dr. N. K. Krishna Kumar** — Special invitee
   Former DDG (Horticulture), ICAR,
   Presently Regional Director, **India – Bioversity International**,
   Sub-regional Office for South Asia, G-1, B-Block, NASC,
   DPS Marg, Pusa Campus, New Delhi – 110 012.

7. **Dr. Ravi Prakash** — Member Secretary
   Registrar (Farmers' Rights), PPV & FRA, New Delhi

Nodal Officer:

Dr. K. S. Ananda
Head and Principal Scientist (Genetics & Plant Breeding),
ICAR – Central Plantation Crops Research Institute,
Regional Station, Vittal, DK, Karnataka-574243.

XI. DUS Testing Centres

Nodal DUS test centre	**Co nodal DUS Test Centre**
ICAR – Central Plantation Crops Research Institute, Regional Station, Vittal, Karnataka – 574243.	ICAR – Central Plantation Crops Research Institute, Research Centre, Kahikuchi, Assam – 781017.