

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

**Elephant Foot Yam
(*Amorphophallus Paeonifolius*)**



**Protection of Plant varieties and Farmer's Rights Authority
(PPV & FRA)
Government of India**

Contents

- I. Subject
- II. Planting Material Required
- III. Conduct of tests
- IV. Methods and Observations
- V. Grouping of Varieties
- VI. Characteristics with rank of measurement
- VII. Table of Characteristics
- VIII. Explanation for the Table of characteristics
- IX. Working Group Details
- X. DUS testing centers

Elephant Foot Yam (*Amorphophallus Paeoniifolius*)

I. Subject

These test guidelines shall apply to all varieties, hybrids and parental lines of elephant foot yam (*Amorphophallus paeoniifolius*).

II. Planting material required

1. The Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA) shall decide when and in what quantity and quality the seed material is required for testing the variety denomination applied for registration under the Protection of Plant Varieties and Farmers' Rights (PPV & FR) Act, 2001. Applicants submitting such 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.
2. The minimum quantity of plant material, to be supplied by the applicant, should be 36 tubers 200-400g each immediately after harvest (not later than 20days).
3. The plant material supplied should be visibly healthy, not lacking in vigor, nor affected by any important pest or disease.
4. The plant material should not have undergone any chemical or bio-physical treatment which would affect the expression of the characteristics 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.
5. Storage of tubers: Tuber can be stored in thatched house in single layer for 4-5 months.

III. Conduct of tests

1. The minimum duration of DUS tests shall normally be at least two independent similar growing seasons with two consecutive plantings, the second being a replanting with same plant material or with reference to the agro climatic conditions of candidate variety.
2. The test shall normally be conducted at least at two test locations. If any essential characteristics of the candidate variety are not expressed for visual observation at these for which additional quantity of planting material shall be required.
3. The field tests shall be carried out under conditions favoring normal growth and expression of all test characteristics. The size of plot shall be such that plants or parts of plants could be removed for measurement and observation without prejudicing the other observations on the standing plants until the end of the growing period. Each test shall include about 36 plants in the plot size of (4.5x 4.5m) with planting space of (75 x 75cm) as specified schematically in figure of field layout. Separate plots for observation and for measurement can only be used, if they have been subjected to similar environmental conditions. 2-3 replications may be designed. All the replications shall be sharing similar environmental conditions of the test location.

4. Test plot design

Bed size	: 4.5m x 4.5m
Number of rows	: 6
Row to row distance	: 75 cm
Plant to plant distance	: 75 cm
Number of replications	: 3
Expected number of plants	: 36

5. Observations shall not be recorded on plants in border rows.
6. Additional test for special purpose shall be established by the PPV & FR Authority.

IV. Methods and observations

1. The characteristics described in the Table of characters (see section VII) shall be used for the testing of varieties for their DUS test.
2. For the assessment of Distinctiveness and Stability, observations shall be made on at least 36 plants or parts of 36 plants, which shall be equally divided among three replications (12 plants per replication) and any other observations made on all plants in the test, disregarding any off-type plants.
3. For the assessment of Uniformity, of characteristics on the plot as a whole (visual assessment by a single observation on group of plants or parts of plants), a population standard of 1% and an acceptance probability of at least 95 % shall be applied.
4. For the assessment of all colour characteristics, the latest Royal Horticultural Society (RHS) colour chart shall be used.
5. Unless otherwise indicated, all observation on the plant, observations on leaf and the pseudostem should be made before the end of the growing phase, during the full expression time preferably at about 120-150 days after planting or 30 days before harvest in early maturing cultivars. Unless otherwise indicated, all observations on the shoot should be made at least for 10 plants per replication/replications.
6. Stem and leaf characters should be recorded as the average expression of the character observed in a group of 10 plants during maximum growing phase (120-150 days).
7. All observations on the tubers /corm should be made at the time of harvest (180-220days after planting).

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 the varieties in the collection are suitable for grouping purposes.
2. The following characteristics shall be used for grouping of elephant foot yam varieties:
 - a) **Plant growth habit** (Height, Plant type) [characteristics 1 & 2]
 - b) **Leaf type** (Total number of leaves/rachis, Leaflet shape, Leaflet color, Leaflet vein colour, Leaf waxiness) [characteristics 4,5,7,8 & 9]
 - c) **Petiole/Culm type** (Size of speckles, Distribution of speckles, Rachis colour, Rachis pattern) [characteristics 12,15,18 & 20]
 - d) **Corm characteristics** (Shape, No.of corm wrinkle, Epidermal colour, flesh color, Skin texture, No. Of Cormlet, Cormlet shape, Bract colour of main bud) [characteristics 21,22,23,24,25, 27,28 & 31]

VI. Characteristics with rank of measurement

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 (1-5) shall be used to describe the state of each character for the purpose of digital data processing and these shall be given against the states of each characteristic. In the case of qualitative and pseudo-qualitative characteristics, all relevant states of expression are presented in the characteristic.
3. Legend / Expression of characters
 - Expression of characters is the most important aspects of whole guidelines. Following points need to be adhered carefully for permanent records.
 - 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 Explanations on the Table of characteristics in sections 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) and sketches for clarity and also for the colour variation.
4. The optimum stage of plant growth for assessment of each characteristic is given in the 6th column of the Table of characteristics as explained below.

Growth stages for observation	Code	Code No.
a. Leafing (25-45 days after planting)	25-45	(a)
b. Full foliage growth (120-150 days after planting)	120-150	(b)
c. Foliage (150-200 days after planting)	150-200	(c)
d. Harvest maturity (180-220 days after planting)	180-220	(d)
e. Budding (225-260 days after harvest)	225-260	(e)

5. Type of assessment of characteristics indicated in column 7th 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 observations of individual plants or parts of plants .

6. Type of assessment for post harvest palatability, softness etc.

To assess post harvest palatability, softness, mealiness etc. organoleptic evaluation shall be used.

VII. Table of characteristics

Sl. No.	Character	Characters with expression rank or measurement unit (State)	Note	Example of varieties	Stage of observation	Type of Assessment
1	2	3	4	5	6	7
1. (* (+)	Plant height	Short (<50cm)	1	BCA-5, NDA-4	(b)	MS
		Medium (50-100 cm)	3	BCA-1, BCA-3, BCA-4, IGAM-1, Sree Padma, NDA-5		
		Tall (>100)	5	BCA-2, Kovvur, NDA-9		
2. (* (+)	Plant type	Upright	1	Sree Padma, BCA-5	(b)	VG
		Semi upright	3	BCA-3, IGAM-2		
		Horizontal	5	Gajendra, Kovvur		
3.	Number of leaflet branch/ rachis	Low (10-15)	1	BCA-2	(b)	MS
		Medium (15-20)	3	BCA-3, BCA-4, IGAM-1, Sree Padma, NDA-5, BCA-5, NDA-4		
		High (>20)	5	NDA-9, Kovvur		
4. (* (+)	Total number of leaves per rachis	Lower (100-200)	1	BCA-3, BCA-5	(b)	MS
		Medium (200-250)	3	BCA-2, BCA-4, Kovvur, NDA-5, NDA-4		
		Higher (>250)	5	Sree Padma, NDA-9		
5. (* (+)	Leaflet shape	Round	1	Gajendra, Sree Padma	(b)	VS
		Intermediate	3	BCA-4, Sree athira		
		Long	5	BCA-3		
6.	Leaflet size	Small (<30 cm)	1	NDA-5	(b)	MS
		Intermediate (30-50 cm)	3	Appakudal, IGAM-1, BCA-2		
		Large (>50 cm)	5	Bidhan kusum, Kovvur		
7. (* (+)	Leaflet colour	Yellowish green	1	Gajendra, IGAM-1, NDA-5	(b)	VS
		Light green	2	(None)		
		Green	3	(None)		
		Dark green	4	(None)		
8. (* (+)	Leaflet vein colour	Yellowish	1	IGAM-1, BCA-2	(b)	VG
		Pale green	3	Kovvur, NDA-4, BCA-4		
		Light green	5	Sree Padma, NDA-5, BCA-5, BCA-3, BCA-1		
		Deep green	4	NDA-9		
9. (* (+)	Leaf waxiness	Low	1	IGAM-2, BCA-5, NDA-9	(b)	VG
		Medium	3	Gajendra, NDA-4, BCA-3		
10.	Leaflet blade petiole ratio	low (0.6-0.7)	1	BCA-4, NDA-5	(b)	MG
		Medium (0.8-0.9)	3	Bidhan kusum, NDA-9		
		High (0.96 and more)	5	Appakudal, AC-28		

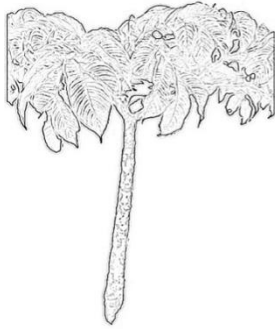
11.	Ground color of petiole	Light green	1	BCA-2, NDA-9	(b)	VG
		Light pink	3	Bidhan kusum, AC-28,		
		Pink	5	Gajendra, Kovvur		
12. (* (+)	Size of petiole speckles (Patches)	Small	1	BCA-3, BCA-5	(b)	MS
		Intermediate	3	Appakudal, TRC BADMA, AC-14		
		Large	5	IGAM-1		
13.	Color of petiole speckles	Light	1	Bidhan kusum, BCA-2, NDA-5, IGAM-2	(b)	VS
		Intermediate	3	Appakudal, AC-28		
		Dark	5	Sree Padma, BCA-4		
14.	White speckles (Patches) on petiole	Absent	1	(None)	(b)	VG
		Few	2	BCA-3, Sree Athira Sree Padma, Gajendra,		
		Intermediate	3	BCA-4, IGAM-2, NDA-4		
		Many	4	BCA-2, TRC BADMA		
15. (* (+)	Distribution of speckles	Absent	1	(None)	(b)	VG
		Spotty	3	BCA-3, BCA-5, AC-14		
		Contiguous	5	(None)		
16.	Petiole Texture	Lightly Rough	1	Kovvur, IGAM-1, BCA-5, BCA-3	(b)	VG
		Moderately Rough	2	NDA-5, NDA-4, BCA-5		
		Rough	3	NDA-9, Sree Padma		
		Smooth	4	Gajendra, BCA-1, BCA-2		
17.	Petiole colour	Dark green with white patches	1	IGAM-2	(b)	VG
		Green with white patches	5	NDA-9, BCA-1		
18. (*	Rachis colour	Green with white patches and purple spots	1	NDA-5	(b)	VG
		Green with white patches	5	Gajendra, BCA-2		
19.	Rachis /Leaflet branch junction colour	With white spot	1	BCA-1, BCA-2, BCA-4, BCA-5, NDA-4, Sree Padma	(b)	VG
		Without white spot	2	NDA-9, IGAM-1, Kovvur		
		With violet stripe	3	BCA-3		
		With purple spot	4	NDA-5		
20. (* (+)	Rachis Pattern	V-type	1	Kovvur, Sree Padma	(b)	VG
		Y-type	3	NDA-5, IGAM-1		

21. (* (+)	Corm shape	Round	1	Gajendra, NDA-9, BCA-2, IGAM-1, NDA-4	(d)	VG
		Round to Elliptical	3	NDA-5, NDA-9, Sree Padma, BCA-1		
		Oval	5	BCA-4		
22. (* (+)	No. of corm wrinkle	Few (1-2)	1	Gajendra, BCA-5	(d)	MS
		Intermediate (2-5)	3	IGAM-1		
		Many (>5)	5	(None)		
23. (* (+)	Epidermal colour of corm	Light brown	1	Gajendra, BCA-5, Sree athira	(d)	VS
		Brown	3	NDA-9, AC-14		
		Dark brown	5	BCA-3, AC-28		
24. (* (+)	Corm flesh colour	Pinkish yellow	1	Gajendra, NDA-9, Sree Padma, BCA-2	(d)	VG
		Yellow	2	NDA-5, NDA-9, BCA-1		
		Deep yellow	3	IGAM-1		
		Saffron	4	BCA-4, NDA-5, Kovvur		
		Orange	5	BCA-3		
25. (* (+)	Skin texture	Rough	1	IGAM-1, BCA-2, BCA-3, BCA-4, NDA-4, BCA-1	(d)	VG
		Smooth	3	Gajendra, Kovvur, BCA-5		
26.	Skin thickness	Very thick	1	BCA-2, NDA-4	(d)	VG
		Thick	3	NDA-9, BCA-3, BCA-4, NDA-5, Sree Padma, BCA-1		
		Medium	5	Kovvur, IGAM-1, BCA-5		
27. (* (+)	No. of Cormlets	Absent to few	1	Gajendra, Kovvur	(d)	MG
		More	3	AC-28, OL-5/80		
28. (* (*	Cormlet shape	Globular	1	BCA-3, IGAM-1, Gajendra	(d)	MS
		Clubbed	5	IGAM-2		
29.	No. of cormlet wrinkle	Few	1	BCA-3, Gajendra, TRC BADMA	(d)	MS
		Intermediate	5	Bidhan kusum, BCA-4		
30.	Epidermal color of cormlet	Light brown	1	IGAM-1	(d)	VS
		Brown	2	NDA-9, AC-14		
		Dark brown	3	AC-28, BCA-5		
31. (* (+)	Bract color of main bud	Light pink	1	BCA-3, Bidhan kusum, AC-28	(e)	VS
		Pink	3	Gajendra, Appakudal, TRC BADMA, NDA-4		
		Purplish pink	5	Sree Athira		
32.	Abscission layer in cormlet	Absent	1	IGAM-2	(d)	VG
		Present	5	NDA-5, BCA-5, Sree Padma		

33.	Leafing date	Within 30 days	1	BCA-3, Sree Padma	(a)	VG
		More than 30 days	5	Gajendra, Bidhan kusum, AC14, NDA-4		
34.	Maturing date	Early (150-160 days)	1	TRC BADMA, Gajendra	(c)	MG
		Medium (170-180 days)	3	BCA-3, Sree athira		
		Late (More than 180 days)	5	BCA-5, AC-14		
35.	Date of emergence	Early (within 30 days after planting)	1	Appakudal, IGAM-2	(a)	MG
		Late (more than 30 days)	5	Gajendra, Bidhan kusum, NDA-9, AC-14		
36.	Corm weight	Low (500-750 gm)	1	BCA-5, IGAM-1, Appakudal	(d)	MS
		Medium (750gm -1 kg)	3	NDA-4, NDA-5, Kovvur, BCA-4, BCA-3, BCA-2,		
		High (>1 kg)	5	Gajendra, Sree padma, NDA-9		
37.	Softiness	Very soft	1	Gajendra, BCA-2, NDA-4	(d)	Organoleptic
		Soft	2	BCA-1, NDA-5, NDA-9, IGAM-1		
		Medium soft	3	BCA-4, BCA-5		
		Hard	4	Kovvur, BCA-3		
		Very hard	5	Sree Padma		
38.	Palatability	Highly palatable	1	Gajendra, BCA-1, BCA-2, NDA-4, NDA-5, NDA-9	(d)	Organoleptic
		Moderately palatable	5	BCA-3, BCA-4, BCA-5, Sree Padma, Kovvur, IGAM-1		
39.	Mealiness	Highly coarse	1	Sree Padma	(d)	Organoleptic
		Medium coarse	2	BCA-4, BCA-5		
		Low coarse	3	Gajendra, BCA-1, NDA-5, NDA-9,		
		Very low coarse	4	BCA-2, NDA-4		
40.	Taste	Sweet	1	BCA-1, BCA-2, NDA-4, NDA-9	(d)	Organoleptic
		Tasteless	5	Gajendra, BCA-3, BCA-5, NDA-5, IGAM-1, Kovvur, Sree Padma		
41.	Acridity	Very low	1	BCA-1, BCA-2, NDA-9, IGAM-1	(d)	Organoleptic
		Low	3	BCA-3, BCA-4, BCA-5, NDA-4, Sree Padma, Kovvur		
		No acidity	5	Gajendra		

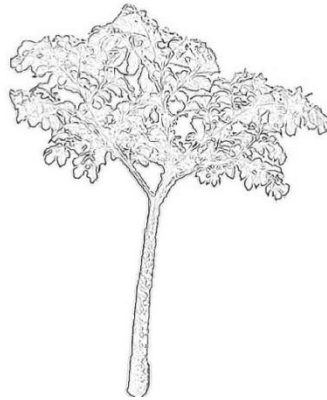
VIII. Explanation for the Table of characteristics

Characteristic 1: Plant height (cm)



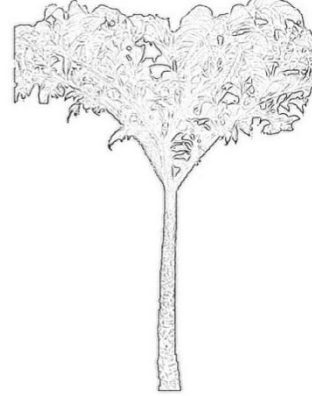
1

Short (<50cm)



3

Medium (50-100 cm)



5

Tall (>100 cm)



1

Short (<50cm)



3

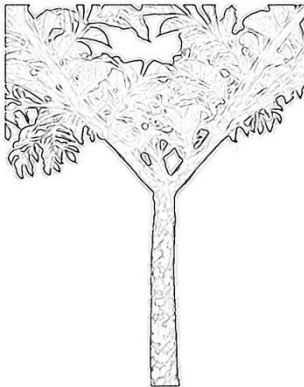
Medium (50-100 cm)



5

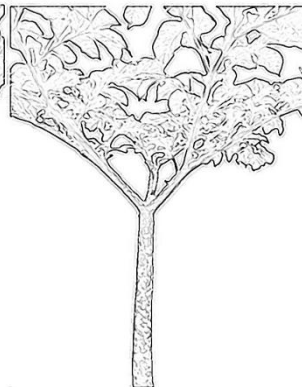
Tall (>100 cm)

Characteristic 2: Plant Type



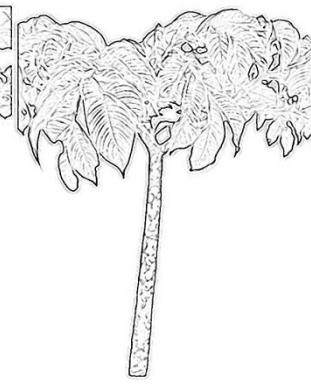
1

Upright



3

Semi upright



5

Horizontal



1

Upright

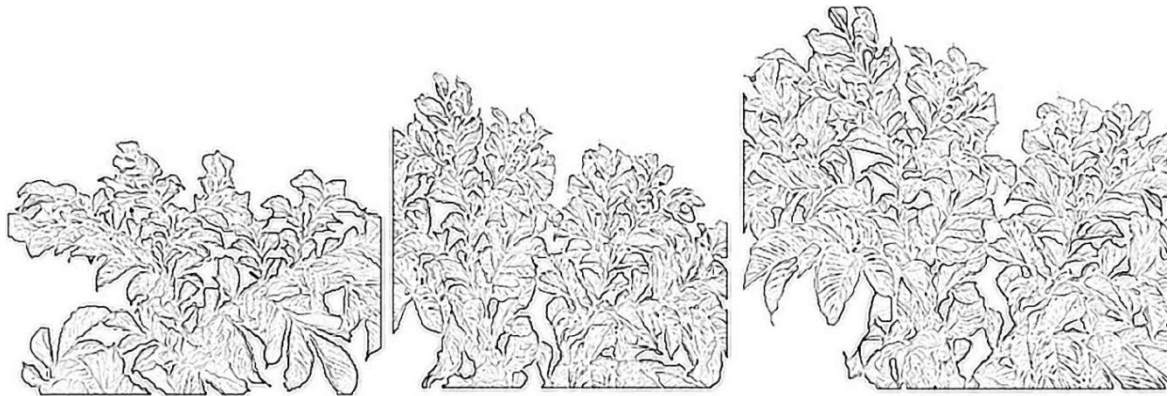
3

Semi upright

5

Horizontal

Characteristic 4: Total Number of Leaves Per Rachis



1

Lower (100-200)

3

Medium (200-250)

5

Higher (>250)



1

Lower (100-200)

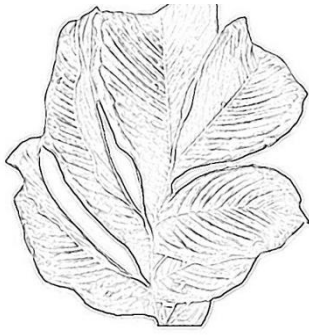
3

Medium (200-250)

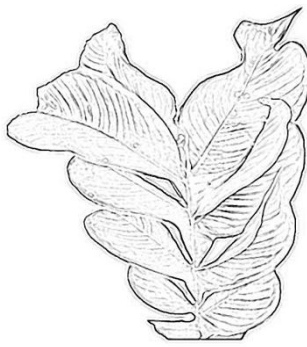
5

Higher (>250)

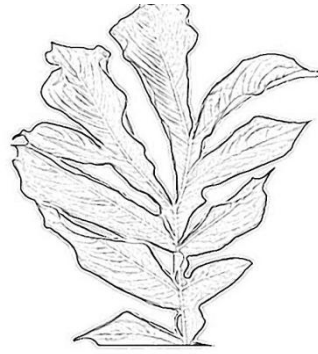
Characteristic 5: Leaflet shape



1
Round



3
Intermediate



5
Long



1
Round



3
Intermediate



5
Long

Characteristic 7: Leaflet colour



1
Yellowish green



4
Dark green

Characteristic 8: Leaflet vein colour



1

Yellowish



3

Pale green



5

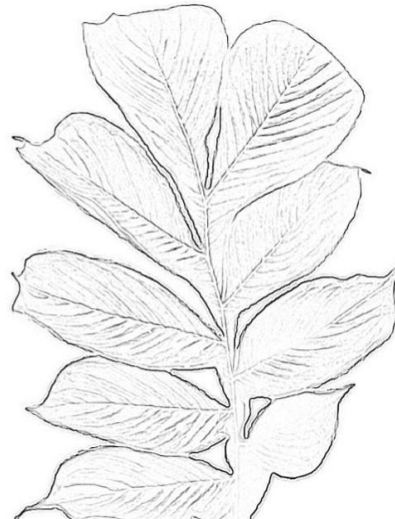
Light green

Characteristic 9: Leaf waxiness



1

Low



3

Medium



1

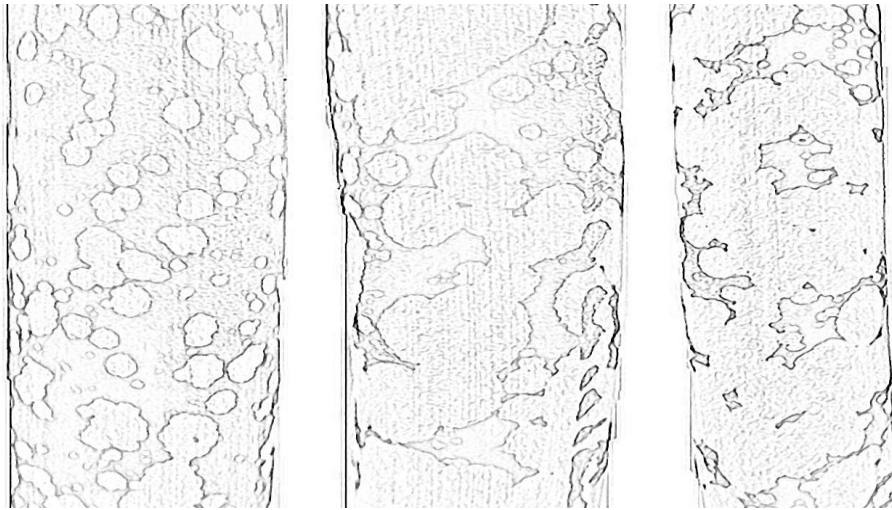
Low



3

Medium

Characteristic 12: Size of petiole speckles (Patches)



1
Small

3
Intermediate

5
Large

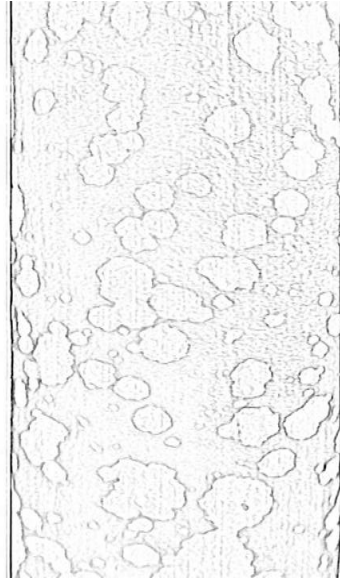


1
Small

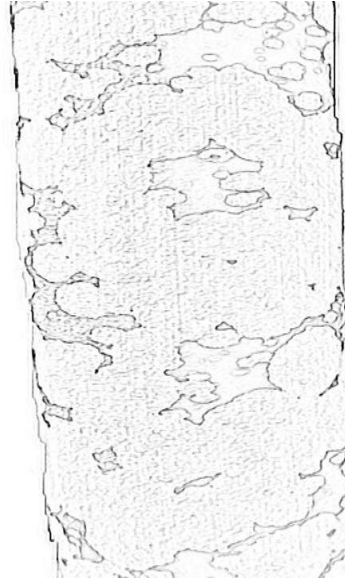
3
Intermediate

5
Large

Characteristic 15: Distribution of speckles



3
Spotty



5
Contiguous

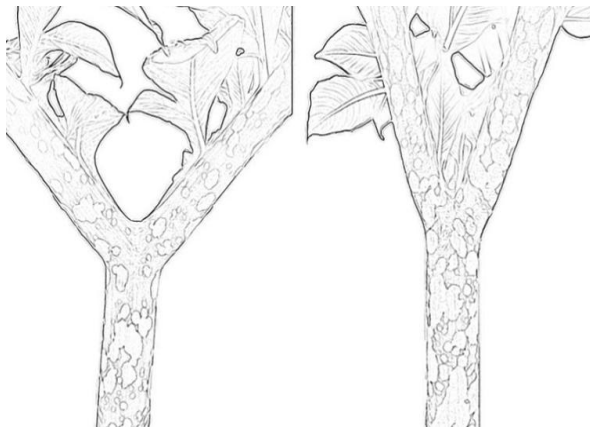


1
Spotty



5
Contiguous

Characteristic 20: Rachis pattern



1

V-type

3

Y-type



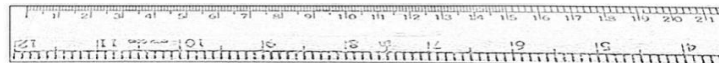
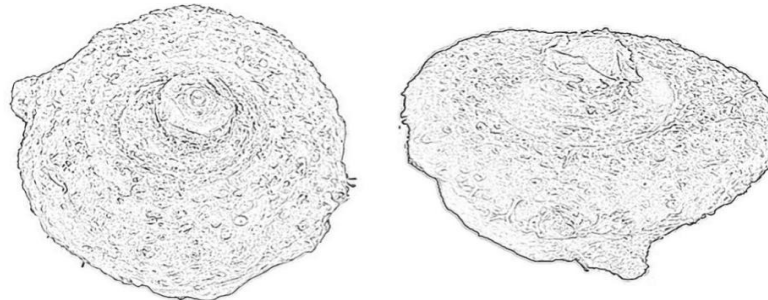
1

V-type

3

Y-type

Characteristic 21: Corn shape



1

Round

3

Round to elliptical



1

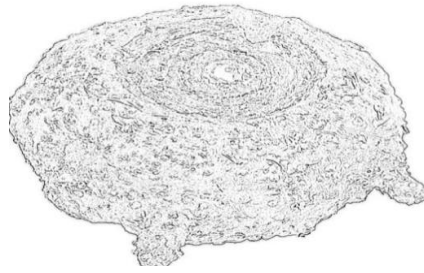
Round

3

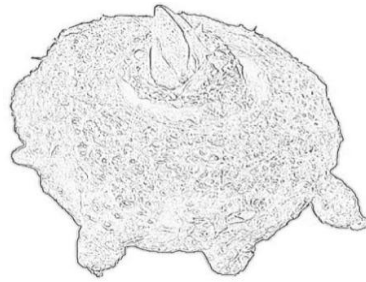
Round to elliptical



Characteristic 22: Corm wrinkle



**1
Few**



**3
Intermediate**



**1
Few**



**3
Intermediate**

Characteristic 23: Epidermal colour of corm



**1
Light brown**



**3
Brown**



**5
Dark brown**



Characteristic 24: Corm flesh colour

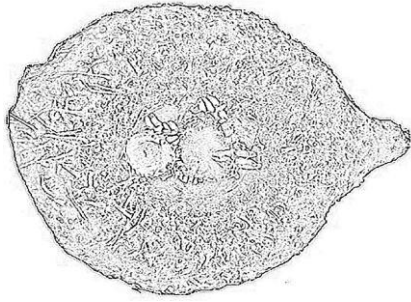


**1
Pinkish Yellow**

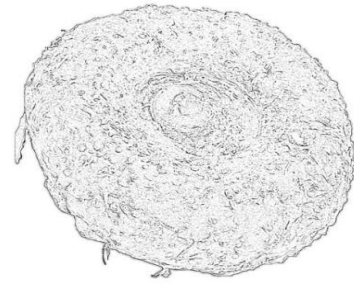


**5
Orange**

Characteristic 25: Skin texture



**1
Rough**



**3
Smooth**

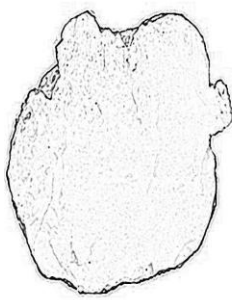


**1
Rough**

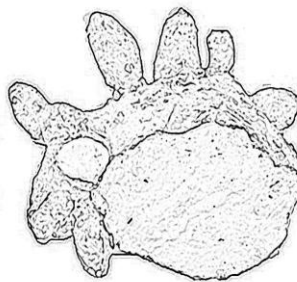
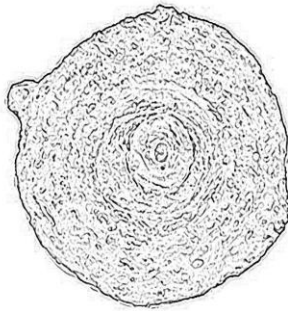


**3
Smooth**

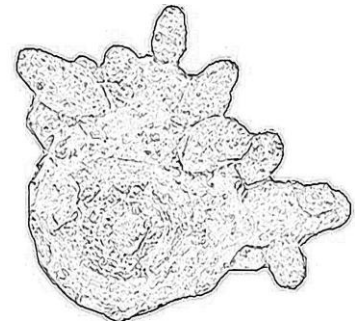
Characteristic 27: No. of Cormlet



**1
Few or absent**



**3
More**



**1
Few or absent**



**3
More**



Characteristic 31: Bract color of main bud



3
Pink



5
Purplish pink

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IX. Working group details

The test guidelines developed by the task force (**12/2014**) constituted by the PPV & FR Authority for **Elephant Foot Yam** with consultation by Nodal officer, ICAR-CTCRI & Co-Nodal officer BCKV, Kalyani. Technical inputs also provided by the PPV & FR Authority.

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X. DUS testing centers

Nodal DUS test centre	Co nodal DUS Test Center
Central Tuber Crops Research Institute Regional Centre, ICAR, Dumduma Housing Board, Bhubaneswar, Odisha- 751019	Directorate of Research, AICRP on Tuber Crops, Bidhan Chandra Krishi (BCKV),Kalyani, West Bengal – 741235