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

on
Turmeric
(*Curcuma longa* L.)

PROTECTION OF PLANT VARIETIES AND FARMERS' RIGHTS AUTHORITY
(PPV&FRA)
Government of India

CONTENTS

I. Subject

These test guidelines shall apply to all varieties of Turmeric (*Curcuma longa* L.).

II. Planting material required

1. The Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA) decide when where 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. The minimum quantity of planting material to be supplied by the applicant in one or several samples should be: 6 kg (clean and whole sum fresh rhizome with 35-40% moisture content).The rhizomes shall be packed in cotton cloth bag with proper labeling.

2. The planting material supplied should be healthy, with sprouts, not lacking in vigour or affected by any pests or diseases.

3. The planting material shall not have undergone any chemical or bio-physical treatment, unless the competent authority allow or request such treatment. If it has been treated, full details of the treatment must be given.

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.

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 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 tests shall be carried out under conditions favouring normal growth and expression of all test characteristics. Each test shall include about 40 plants in the plot size (3 m x 1 m) 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

Bed size	: 3 m^2 (3 m x 1 m)
Spacing	: 30 x 25 cm
Plants/ replication	: 40
Number of replications	: 3

5. Additional test protocols for special tests 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 for their DUS test.
2. For the assessment of Distinctiveness and Stability, observations shall be made on at least 30 plants or parts of 30 plants, which shall be equally divided among three replications (10 plants per replication).
3. For the assessment of Uniformity, 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, the leaf and the stem should be made before the end of the growing phase, during the full expression time. Unless otherwise indicated, all observations on the shoot (pseudostem) should be made on the main shoot (the tallest).
6. All observations on the rhizome should be made at the time of harvest.

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 purposes.

2. The following characteristics shall be used for grouping of turmeric varieties:

i) Plant: Height (Characteristic 2)
ii) Leaf: Lamina length (Characteristic 7)
iii) Leaf: Lamina width (Characteristic 8)
iv) Coma bract: Colour (Characteristic 14)
v) Rhizome: Habit (Characteristic 16)
vi) Rhizome: Shape (Characteristic 17)
vii) Rhizome: Number of mother rhizomes (Characteristic 19)

viii) Duration: Number of days (Characteristic 23)
ix) Dry recovery % (Characteristic 24)

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 to 9) shall be used to describe the state of each character for the purpose of digital data processing and these notes shall be given against the states of each characteristic.

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 explanations 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 for the colour variation.

4. The optimum stage of plant growth for assessment of each characteristic is given in the sixth column of the Table of characteristics.

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 observations of individual plants or parts of plants

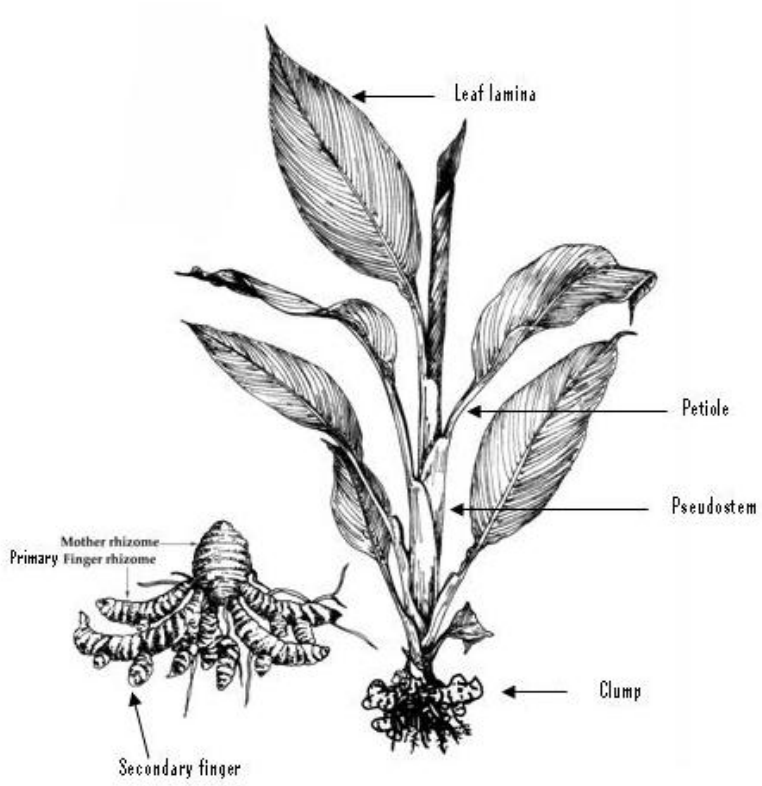
VII. Table of characteristics

Sl. No.	Characters	States	Note	Example Varieties	Stage of observation	Type of assessment
1	2	3	4	5	6	7
1 (+)	Plant: Pseudo stem habit	Compact	1	RH - 5	150 days of sowing	VG
		Open	9	GL puram		
2 (*) (+)	Plant: Height (cm)	Short (<85)	3	Sudarsana	150 days of sowing	MS
		Medium (85-100)	5	Pratibha		
		Tall (>100)	7	Aleppey Supreme		
3 (+)	Plant: Number of shoots	Few (<3)	1	Pratibha	150 days of sowing	MG
		Medium (3-5)	3	RH - 5		
		Many (>5)	5	GL Puram		
4 (+)	Plant: Number of leaves on main shoot	Few (<5)	3	Dundigam, GL Puram	150 days of sowing	MG
		Inter mediate (5-10)	5	Secundarabad local		
		Many (>10)	7	Aleppey Supreme		
5 (+)	Plant: Leaf disposition	Erect (<45^{o})	3	KPUA 656, UAKP 660	150 days of sowing	VG
		Semi-erect (45-85^{o})	5	Sudarsana, RH - 5		
		Horizontal (>85^{o})	7	-		
6 (+)	Leaf: Petiole length (cm)	Short (<15)	3	Amalapuram	150 days of sowing	MS
		Inter mediate (15-25)	5	OP Secundarabad local		
		Long (>25)	7	SB 10723, SB-10843		
7 (*) (+)	Leaf: Lamina length (cm)	Short (<30)	3	SB-10735	150 days of sowing	MS
		Medium (30-40)	5	Co 1		
		Long (>40)	7	UAKP 660		
8 (*) (+)	Leaf: Lamina width (cm)	Narrow (<10)	3	Armoor	150 days of sowing	MS
		Medium (10-15)	5	Alleppey		
		Broad (>15)	7	KPUA 656		
9	Leaf: Colour on dorsal side	Light green	3	Kuchipudi	150 days of sowing	VG
		Green	5	Amalapuram		
		Dark green	7	Tekkurpata		

10	Leaf: Colour on ventral side	Green	5	Cooch Behar	150 days of sowing	VG
		Dark green	7	OP 38		
11 **(+)**	Leaf: Venation pattern	Close	3	Rajendranagar local	150 days of sowing	VG
		Distant	5	Armoor		
12 (+)	leaf : Margin	Even	3	-	150 days of sowing	VG
		Wavy	5	Secundarabad local		
13	Pseudostem: Anthocyanin colouration	Absent	1	SB-10715	150 days of sowing	VG
		Present	9	Jalpaiguri Local		
14 **(*)**	Coma bract: Colour	White	1	Rajapuri, Arunachal local	After the full emergence of the spike	VS
		Coloured	9	SB - 10746		
15	Bract tip: Colour	White	1	Jalpaiguri, Rajapuri, Arunachal local	After full emergence of the spike	VS
		Rose	3	SB - 10746		
		Purple	5	SB - 10757		
		Green	7	SB - 10810		
16 **(*)** (+)	Rhizome: Habit	Compact	3	Prabha	At harvest	VG
		Intermediate	5	Alleppey Supreme		
		Loose	7	Sudarsana, Rajendra Sonia		
17 **(*)** (+)	Rhizome: Shape	Straight	3	Salem	At harvest	VG
		Curved	5	Pratibha		
18 (+)	Rhizome: Length (Primary)	Short (< 5 cm)	3	Prabha	At harvest	MS
		Medium (5 – 10 cm)	5	Pratibha		
		Long (> 10 cm)	7	Salem, Suranjana, Narendra Haldi		
19 **(*)** (+)	Rhizome: Number of mother rhizomes	One	1	Amalapuram	At harvest	MG
		Two – Three	3	Pratibha		
		More than Three	5	Suvarna		
20 (+)	Rhizome: Internode pattern (cm)	Close (< 1)	3	Amalapuram, Prabha, Kedaram	At harvest	MS
		Distant (>1)	5	Suranjana, Narendar Haldi		
21 (+)	Rhizome: Status of tertiary rhizome	Absent	1	Sudarsana	At harvest	VG
		Present	9	Suguna, GL Puram		

22 (+)	Rhizome: Inner core colour	Orange	3	Sudarsana	At harvest	VS
		Lemon yellow	5	Salem		
		Reddish yellow	7	Prabha, Pratibha		
23 **(*)** (+)	Duration (Number of days)	Short (<180)	3	Sudarsana, Suvarna	After drying of the above ground parts	VG
		Medium (181 -200)	5	Alleppey		
		Long (>200)	7	Pratibha, Sugantham, Kuchipudi		
24 **(*)** (+)	Dry recovery (%)	Low (<15)	3	Sudarsana	After harvest and curing	MG
		Inter mediate (15-20)	5	Alleppey		
		High (> 20)	7	Prabha, Prathibha		

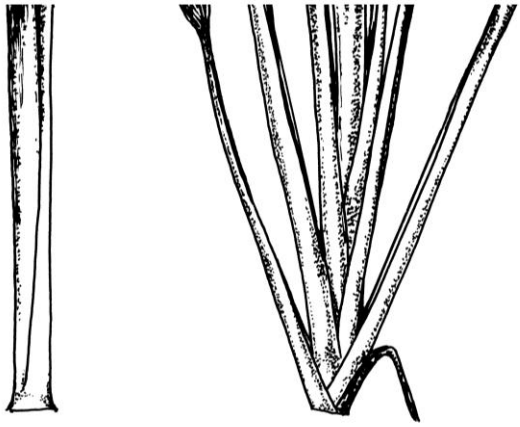
VIII. Explanation of Table of characteristics



Turmeric plant

Characteristic 1. Plant: Pseudostem habit

The extent of compactness of leaf sheath should be assessed visually.



1
Compact

9
Open

Characteristic 2. Plant: Height

It shall be measured from the soil level to the tip of the leaf of the main shoot. An average of 5 clumps should be taken from each replication.

Characteristic 3. Plant: Number of shoots

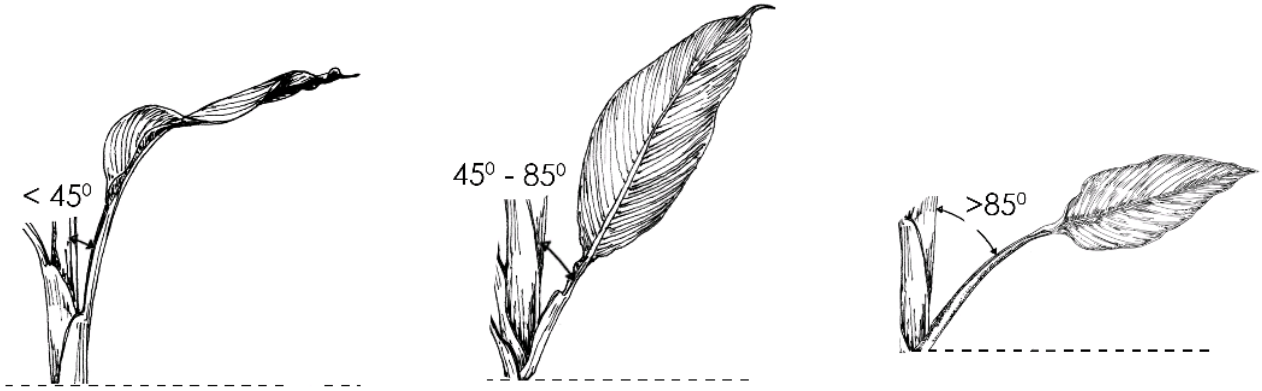
An average number of shoots of 5 clumps should be counted from each replication.

Characteristic 4. Plant: Number of leaves on main shoot

An average number of leaves of 5 clumps should be counted from each replication.

Characteristic 5. Plant: Leaf disposition

It is the angle of leaf plain with the shoot axis.



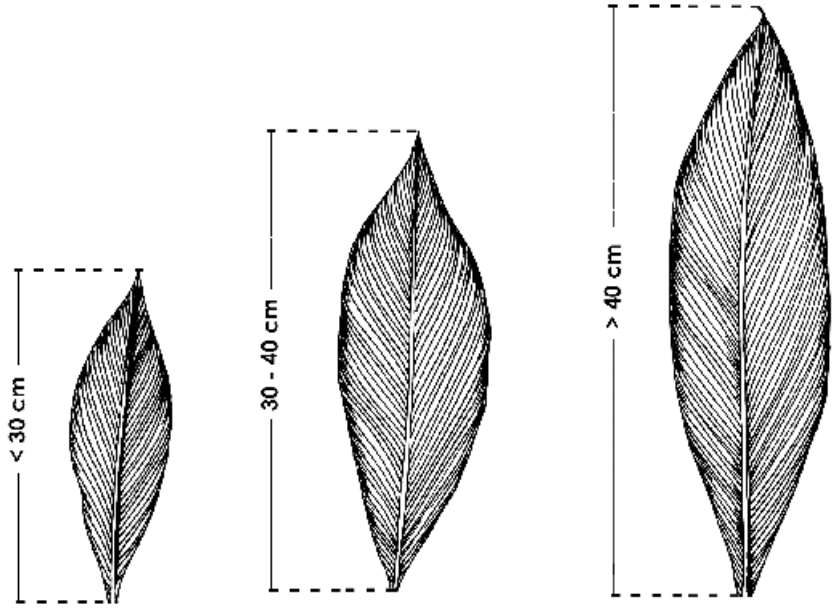
3	5	7
Erect	**Semi-erect**	**Horizontal**

Characteristic 6. Leaf: Petiole length

It shall be measured from the pseudostem to the base of the leaf blade from the middle three leaves of the main shoot. An average of 5 clumps from each replication should be taken.

Characteristic 7. Leaf: Lamina length

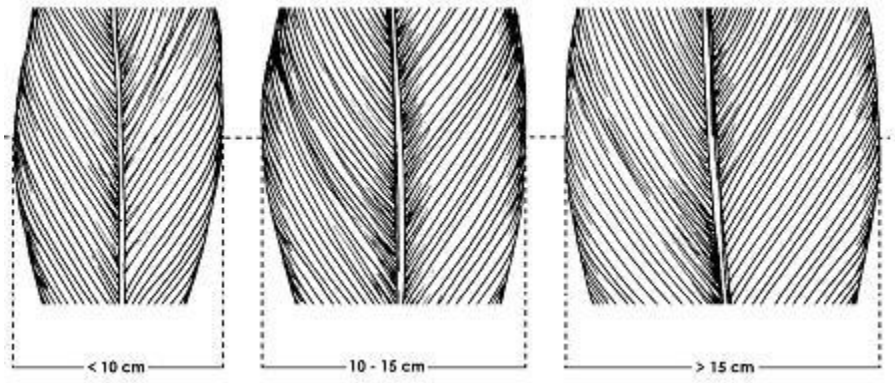
It shall be measured from the tip of the petiole to the leaf blade tip from the middle three leaves of the main shoot. An average of 5 clumps from each replication should be taken.



3	5	7
Short	**Medium**	**Long**

Characteristic 8. Leaf: Lamina width

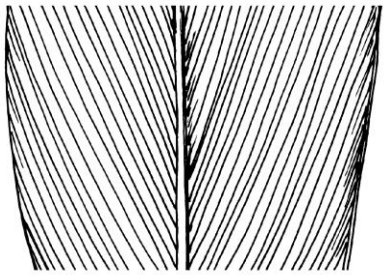
It shall be measured at the maximum width of middle three leaves of main shoot. An average of 5 clumps should be taken from each of the replication.



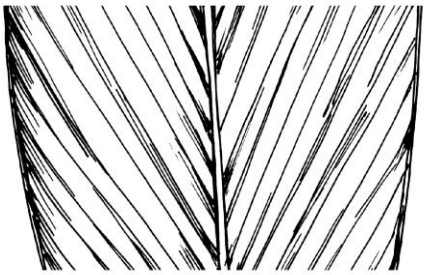
3	5	7
Narrow	**Medium**	**Broad**

Characteristic 11. Leaf: Venation pattern

The width of two adjacent parallel veins should be visually assessed to categorize the character.



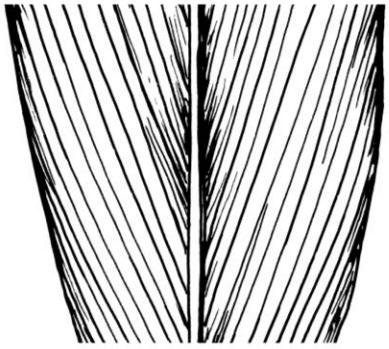
3
Close



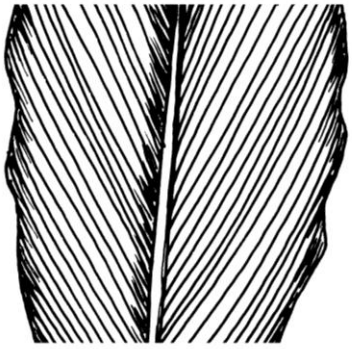
5
Distant

Characteristic 12. Leaf: Margin

Visual assessment by a single observation of a group of plants or parts of plants



3
Even



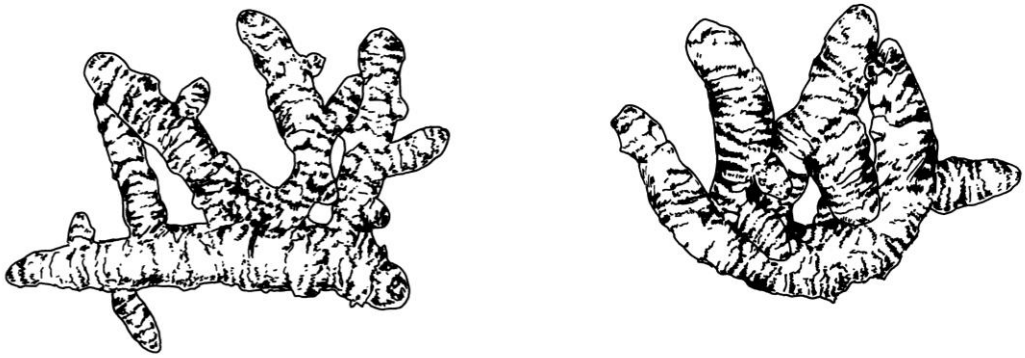
5
Wavy

Characteristic 16. Rhizome: Habit

3	5	7
Compact	**Intermediate**	**Loose**

Characteristic 17. Rhizome: Shape

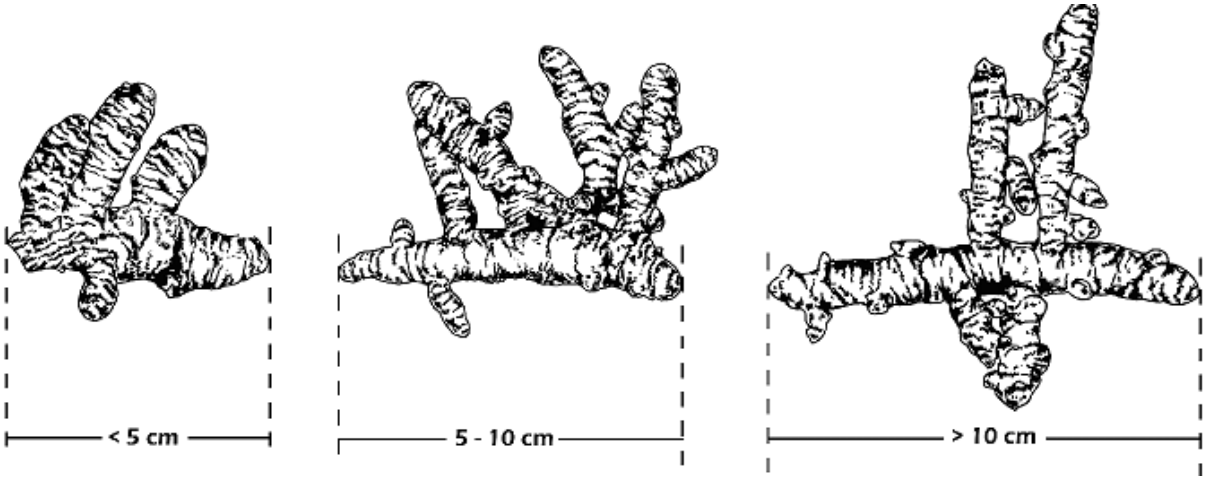
The curvature of the primary fingers should be visually assessed.



3	5
Straight	**Curved**

Characteristic 18. Rhizome: Length (Primary)

The physical nature (length) of the primary fingers should be measured from the attachment to mother rhizome to the tip.



3
Short

5
Medium

7
Long

Characteristic 19. Rhizome: Number of mother rhizomes

Number of mother rhizomes per clump should be counted. An average of 5 clumps should be recorded from each replication.

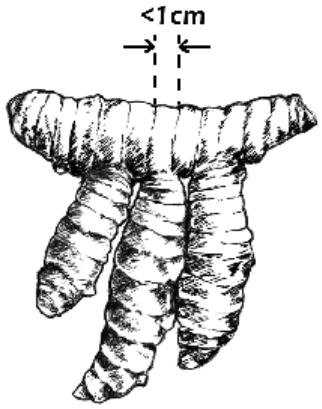
1
One

3
Two – three

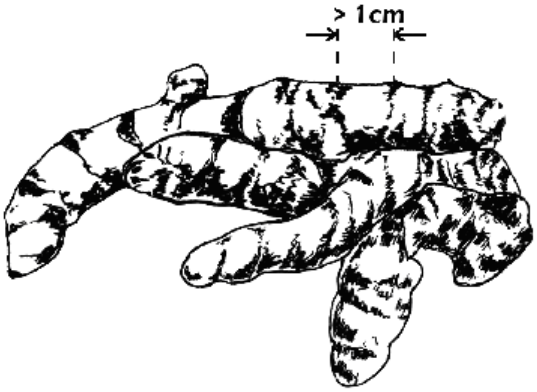
5
More than three

Characteristic 20. Rhizome: Internode pattern

The distance between two adjacent internodes should be measured and categorization accordingly.



3
Close



5
Distant

Characteristic 21. Rhizome: Status of tertiary rhizome

1
Absent

9
Present

Characteristic 23. Duration

The number of days of absolute wilting of above ground parts should be taken.

Characteristic 24. Dry recovery

Dry recovery shall be recorded from the boiled and sun dried rhizome (moisture 11 – 12 %) from five kilogram of fresh rhizome.

IX. Literature

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Velayudhan, K.C., Muralidharan, V.K., Amalraj, V.A., Gautam, P.L., Mandal, S. and Dinesh Kumar. (1999). *Curcuma* Genetic Resources. Scientific Monograph No. 4. National Bureau of Plant Genetic Resources. New Delhi. pp. 149.

X. Working group details

The test Guidelines developed by Indian Institute of Spices Research, Calicut was finalized by the Task Force (7/2007) constituted by PPV & FR Authority.

The members of the Task Force (7/2007)

Dr. K. V. Ahamed Bavappa (Chairman)

Prof. K.V. Peter

Dr. J. Thomas

Dr. S. Edison

Dr. Y. R. Sarma

Dr. V. A. Parthasarathy

Nodal Officer

Dr. D. Prasath
Scientist (Sr. Scale)
Indian Institute of Spices Research (ICAR)
Marikunnu. P.O.Calicut-673128

Co-Nodal Officer (NEH)
(to be informed later)

XI. DUS testing centres

Nodal centre	Other centre
Indian Institute of Spices Research (ICAR) Marikunnu P.O. Calicut-673 012, Kerala	ICAR Research Complex for NEH Region Umroi Road, Umiam, Meghalaya 793 103