

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

**On**

***Jatropha (Jatropha curcas L.)***



**Protection of Plant Varieties and Farmer's Rights Authority  
(PPV & FRA), Govt. of India**



## **Contents**

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



# **Jatropha (*Jatropha curcas* L.)**

## **I. Subject**

These test guidelines shall apply to all clonally propagated varieties of Jatropha (*Jatropha curcas* L.)

## **II. Materials required**

1. The Protection of Plant Varieties and Farmers Rights Authority (PPV & FRA) shall decide on the quantity and quality of the plant material required for testing the variety and when and where it is to be delivered for registration under the Protection of Plant Varieties and Farmers Rights (PPV & FRA) Act, 2001.
2. Applicants submitting such plant 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.
3. Clonally propagated plant materials of 60 cm height from collar to the apical tip are required for DUS testing. The plants must have fully developed root system.
4. The minimum number of planting material to be supplied by the applicant or his nominee during June-July shall be 60 rooted plants.
5. The age of the plants shall be 6 months while submitting for testing.
6. The plant material should be visibly healthy, not lacking in vigour or affected by any important pests or diseases.
7. The plant material should not have undergone any 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.

## **III. Conduct of tests**

### ***Duration of test***

The minimum duration of DUS tests shall normally up to two independent flowering Season.

### ***Testing Place***

The tests shall normally be conducted at two 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 expression of interest of the applicant.

### ***Conditions for Conducting the Examination***

The tests should be carried out under conditions ensuring satisfactory growth for the expression of the relevant characteristics of the variety and for the conduct of the examination.

### ***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**

No. of rows : one

Row to row distance : 3 m

Plant to plant distance : 2 m

No. of plants per replication : 6

No. of replications : 3

The test plot will be surrounded by one guard row. Additional test protocol for special purpose shall be established by the PPV & FR Authority.

#### ***On-site DUS testing***

- a. On-site testing shall be conducted at the places specified by the applicant.
- b. The age of the trees at on-site shall be between 3 to 6 years.
- c. A trial with minimum of 18 trees in 1-2 blocks planted in uniform spacing shall be considered for on-site testing.
- d. The trees must be healthy and free from pest and disease and raised under standard management practices.
- e. The Expert Committee constituted by the PPV & FRA in consultation with the DUS Centre shall be authorized to inspect on-site testing and recording of the appropriate characters.

#### **IV. Methods and Observations**

- a. The characteristics described in the Table of characteristics shall be used for testing of varieties for their DUS (Section VII).
- b. The assessment of Distinctiveness and Stability of all observations shall be made on 6 plants or parts taken each of 6 plants, which will be equally divided among 3 replications (2 plants per replication).
- c. The assessment of Uniformity of characteristics shall be made in 6 plants per replication, with an acceptance probability of at least 95%. The maximum number of off-type allowed would be 1 in 18 plants.
- d. All observations of leaf shall be made in mature leaves at middle of the crown in the middle third of the youngest shoots not showing signs of active growth. A sample of 10 leaves per plant (representing all four directions of the plant) shall be taken for morphometric characterization.
- e. The branchlet and fruit characteristics should be evaluated from 10 samples each collected from nine plants. Samples should be collected from the longest primary branch in the mid portion of the crown.
- f. Observations on mature fruit should be recorded when the fruit is ready for harvesting.
- g. Observations on seeds should be made on 10 typical seeds taken from a minimum sample size of 50 fully developed seeds.
- h. For the assessment of all colour characteristics, the latest Royal Horticultural Society (RHS) colour chart will be used.

#### **V. Grouping of clones**

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 purpose.

2. The following characteristics shall be used for grouping of *Jatropha* clones:

- a. Growth habit (Characteristics 1.2)
- b. Young shoot colour (Characteristics 2.2)

- c. Petiole colour (Characteristics 3.5)
- d. Juvenile leaf colour (Characteristics 3.6)
- e. Fruit shape (Characteristics 4.3)
- f. Fruit: Prominence of ridges (Characteristics 4.4)
- g. Seed: shape (Characteristics 5.3)
- h. Seed carnicle (Characteristics 5.4)

## 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 given for each state of expression for different characteristics for the purpose of electronic data processing.
3. Legend:
  - i. (\*) 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 the environmental conditions of the testing region. Under such exceptional situation, adequate explanation shall be provided.
  - ii. (+) 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 in the sixth column of Table of characteristics indicates the stage for the observation of each characteristic during the growth and development of the variety. The relevant growth stages corresponding to the decimal code number are described below.

Code	Examination of Characteristics	Stage of observation
1.	Plant character	a. Observations on the plant height were made on mature plants with a fully developed stem and crown. b. Observations on the growth habit were made on mature plants with a fully developed stem and crown with complete foliage of atleast 2 years of age. c. Observations on the stem bulginess/ young shoot colour were made on mature plants with a fully developed trunk and crown.
2.	Leaf character	a. All the observations on leaf were made on fully developed leaves from admist of vigorous current season shoots occupying the peripheral/ circumference of plant crown. b. All observations for length and width on the mature leaf and leaflets were made on the central part of leaf. c. All observations for length of petiole were made on the mature leaf. d. Observation on the petiole colour was made on matured leaf under natural day light condition. e. All observations on the juvenile leaf were made on actively growing spring flush.
3.	Fruit character	a. All fruits for observation were taken from periphery of the plant and fruit misformed as a result of clustering were not sampled. b. Observations on the fruits were made on 10 typical fruits taken from a minimum sample size of 50 fruits at the time of full maturity. c. Observations on the fruit shape were presented as they appear in nature; nevertheless shape is to be observed in direction from the base (stalk end) to the top. d. Observations on the fruit shoulder and fruit segment were made at full

		<p>maturity stage</p> <p>e. All observations for length and width on the mature fruit were made on the longest and broadest portion of the fruit respectively.</p> <p>f. Observation on Pod: Seed ratio was made on 50 fully matured fruit taken from a minimum sample size of 500 fully developed fruits at harvestable maturity stage.</p>
4.	Seed character	<p>a. All observations on the seeds were made on the fresh seed in pods at full maturity stage.</p> <p>b. Observations on the seed length/width were made on 10 typical seeds taken from a minimum sample size of 50 fully developed seeds.</p> <p>c. Observation on the seed shape and seed carnicle was made on fully mature seeds at harvestable maturity stage.</p> <p>d. Observation on Seed coat: Kernel ratio were made on 50 fully matured fruit taken from a minimum sample size of 500 fully matured pods at harvestable maturity stage.</p>

5. Type of assessment of characteristics indicated in column seven of Table 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 plants

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



### VII. Table of characteristics

S.No	Characteristics	States	Note	Example Source	Stage of observation	Type of assessment
<b>1</b>	<b>Plant character</b>					
1.1 ( <sup>+</sup> ) (PQL)	Plant height (cm)	Short (<130.0)	3	HC 8	1a	MG
		Medium (130.0 - 200.0)	5	HC 20		
		Tall (>200.0)	7	SRM		
1.2 (* ) (PQL)	Growth habit	Erect	1	HC 1	1b	VG
		Bushy	2	HC 13		
		Spreading	3	HC 19		
<b>2</b>	<b>Stem character</b>					
2.1 (* ) (QL)	Stem bulginess	Absent	1	MTP 5	1c	VG
		Present	9	MTP 4		
2.2 (* ) (PQL)	Young shoot colour	Green	1	MTP 1	1c	VS
		Pinkish red	2	HC 5		
<b>3</b>	<b>Leaf character</b>					
3.1 ( <sup>+</sup> ) (QN)	Leaf length (cm)	Short (<8.0)	3	HC 19	2b	MG
		Medium (8.0 - 15.0)	5	HC 13		
		Long (>15.0)	7	SRM		
3.2 ( <sup>+</sup> ) (QN)	Leaf width (cm)	Narrow (<7.0)	3	HC 19	2b	MG
		Medium (7.0 - 14.0)	5	HC 23		
		Broad (>14.0)	7	SRM		
3.3 ( <sup>+</sup> ) (QN)	Petiole length (cm)	Short (<10.0)	3	HC 19	2c	MG
		Medium (10.0 - 16.0)	5	HC 23		
		Long (>16.0)	7	SRM		
3.4 (* ) (PQL)	Leaf shape <b>(PQL)</b>	Cordate	1	HC 20	2a	VG
		Palmate	2	HC 10		
3.5 (* ) (QL)	Leaf texture	Smooth	1	HC 1	2a	VG
		Coarse	2	HC 4		
		Rough	3	HC 8		
		Leathery	4	HC 15		
3.6 (* ) (PQL)	Petiole colour	Greenish pink	1	HC 8	2d	VS
		Green	2	HC 11		
3.7 (* ) (PQL)	Juvenile leaf colour	Dark pink	1	HC 5	2e	VS
		Greenish pink	2	HC 15		
<b>4</b>	<b>Fruit character</b>					

4.1 (+) (QN)	Fruit length (cm)	Short (<2.5)	3	HC 19	3b	MG
		Medium (2.5 - 3.5)	5	SRM		
		Long (>3.5 cm)	7	HC 12		
4.2 (+) (QN)	Fruit width (cm)	Narrow (<2.1)	3	HC 19	3b	MG
		Medium (2.1 - 2.9)	5	HC 17		
		Broad (>2.9)	7	HC 12		
4.3 (* ) (PQL)	Fruit shape	Oval	1	HC 3	3c	VG
		Spherical	2	HC 4		
		Oblong	3	HC 21		
4.4 (* ) (QL)	Fruit: Prominence of ridges	Weak	3	HC 16	3d	VG
		Medium	5	HC 18		
		Strong	7	HC 25		
4.5 (* ) (QL)	Fruit: Presence of shoulder	Absent	1	HC 21	3d	VG
		Present	9	HC 4		
4.6 (* ) (QL)	Fruit: Presence of segment	Absent	1	HC 22	3d	VG
		Present	9	HC 25		
4.7 (* ) (PQL)	Fruit colour	Dark yellow	1	HC 10	3e	VS
		Yellowish orange	2	HC 19		
		Reddish orange	3	HC 25		
5	<b>Seed character</b>					
5.1 (+) (QN)	Seed length (cm)	Short (<1.5)	3	HC 19	4b	MG
		Medium (1.5 - 2.0)	5	HC 26		
		Long (>2.0)	7	HC 27		
5.2 (+) (QN)	Seed width (cm)	Narrow (<0.60)	3	HC 19	4b	MG
		Medium (0.60 - 1.10)	5	HC 9		
		Broad (>1.10)	7	HC 27		
5.3 (* ) (PQL)	Seed shape	Ellipsoid	1	HC 4	4c	VG
		Ovate	2	HC 15		
5.4 (+)	Seed carnicle	Big	1	HC 2	4c	VG
		Medium	2	HC 5		
		Small	3	HC 4		
5.5 (* )	Seed coat : Kernel ratio	High (> 65 %)	1	HC 6	4d	MG
		Medium (58 – 65 %)	3	HC 2		
		Low (< 58 %)	5	HC 1		

## VII. Explanations on the table of characteristics

### Characteristic 1.2: Growth habit



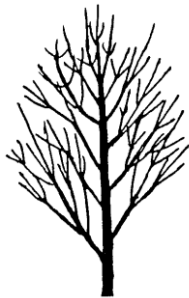
**Erect**



**Bushy**



**Spreading**



**(1)  
Erect**



**(2)  
Bushy**

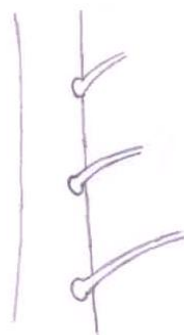


**(3)  
Spreading**

### Characteristic 2.1: Stem bulginess



**(1)  
Absent**



**(9)  
Present**



**Characteristic 2.2: Young shoot colour**



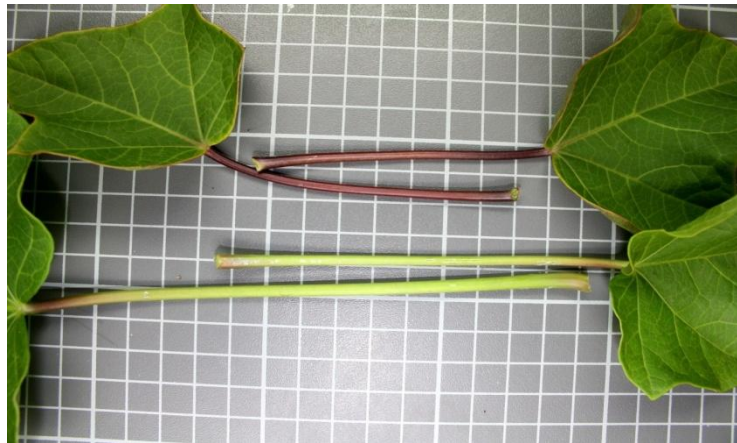
**Green (1)**

**Pinkish red (2)**

**Characteristic 3.6: Petiole colour**

**(1) Greenish pink**

**(2) Green**



**Characteristic 3.7: Juvenile leaf colour**



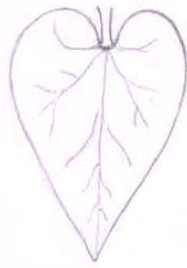
**(1)  
Dark pink**



**(2)  
Greenish pink**



**Characteristic 3.4: Leaf shape**



**(1)  
Cordate**



**(2)  
Palmate**

**Characteristic 4.3: Fruit shape**



**(1)  
Oval**



**(2)  
Spherical**



**(3)  
Oblong**



**(1)  
Oval**



**(2)  
Spherical**



**(3)  
Oblong**

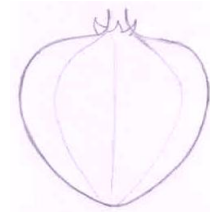
**Characteristic 4.5: Fruit: Presence of shoulder**



**(1)  
Absent**



**(9)  
Present**



**Characteristic 4.6: Fruit: Presence of segment**



**(1)  
Absent**



**(9)  
Present**



**Characteristic 5.3: Seed shape**



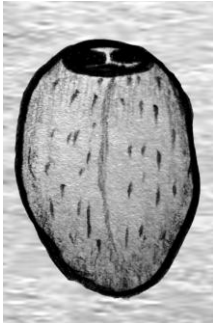
**(1)  
Ellipsoid**



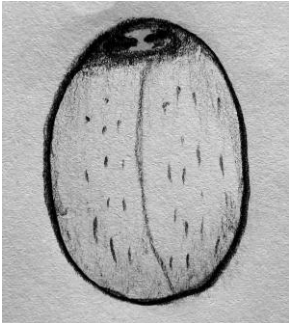
**(2)  
Ovate**



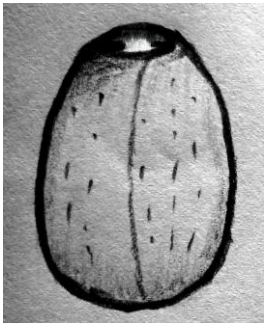
**Characteristic 5.4: Seed carnicle**



**Big  
(1)**



**Medium  
(2)**



**Small  
(2)**

## IX. Working group details

The test guidelines developed by the task force (03/2014) constituted by the PPV & FR Authority for **Jatropha**(*Jatropha curcas L.*) with consultation by FCRI, TNAU, Mettupalayam Technical inputs also provided by the PPV & FR Authority and nodal officer.

### The members of the Task Force

- 1. Dr. B. Gurudev Singh** **Chairman**  
Head, Genetics Tree Breeding  
IFGTB, Coimbatore-641002
- 2. Prof. Balakrishna Gowda** **Member**  
Professor,  
Department of Forestry & Environmental Science  
University of Agricultural Sciences, GKVK Campus,  
Bengaluru - 560 065
- 3. Dr. Kumaran K.** **Member**  
Professor of Forestry  
Forestry College, Periakulam, Theni-625601, Tamil Nadu
- 4. Dr. A. Balasubramanian, Ph. D.**  
Professor and Head (Forestry)  
Department of Forest Ecology and Environment  
FCRI, TNAU, Mettupalayam-641301
- 5. Dr. Ravi Prakash** **Member Secretary**  
Registrar, PPV & FRA, New Delhi

## X. DUS testing centers

<b>Nodal DUS test centre</b>	<b>Co nodal DUS Test Center</b>
Forest College and Research Institute, Mettupalayam, Coimbatore, Tamil Nadu.	