Watermelon (*Citrullus lanatus* (Thunb.) Mansf.)

I. Subject

These test guidelines apply to all varieties, hybrids and parental lines of watermelon (*Citrullus lanatus* (Thunb.) Mansf.).

II. Seed Material Required

1. The Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA) shall decide when, where and in what quantity and quality of the seed material required for testing the variety is to be delivered. Applicants submitting material from a country other than India must make sure that all customs and formalities are complied with.
2. The minimum quantity of seed of varieties, hybrids and parental lines to be supplied by the applicant should be:
    - For open field cultivation: 150 g seeds (in one submission only).
3. The seed should meet the minimum requirement for germination capacity (80%), moisture content (<8%) and physical purity (98%) prescribed for certified seed in India. Especially for storage, which requires a higher standard, the applicant should state the actual germination capacity, which should be as high as possible. The seed supplied should be visibly healthy, not lacking in vigour or affected by any important pest or disease.
4. The seed material must not have undergone any treatment 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

1. The minimum duration of test should normally be two independent but similar growing seasons (summer) with reference to the eco-system of the variety submitted for DUS test.
2. The test should normally be conducted at two different locations. If any essential characteristic of the variety can not be observed at these places, the variety may be tested at an additional place.
3. The test should be carried out under conditions ensuring normal growth. The size of the plot should be such that plants or parts of plant may be removed for measuring and counting without prejudice to the observations which must be made upto the end of the growing period. Each test shall include 105 plants for open field cultivation, which should be divided among 3 replications. Separate plots for observations and for measuring can only be used if they have been subjected to similar environmental conditions.
4. Test plot design

    Number of rows : 5

Row length	:	5.6 m
Row to row distance	:	3.0 m
Plant to plant distance	:	0.8 m
Number of replications	:	3

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

IV. Methods and Observations

1. The characteristics described in the Table of Characteristics (Section VII) should be used for the testing of varieties for DUS.
2. For the assessment of Distinctiveness and Stability, observations should be made on 30 plants or parts of plants selected randomly, which should be divided among 3 replications (10 plants in each replication).
3. For the assessment of Uniformity of characteristics in the plot as a whole (visual assessment by a single observation of a group of plants or parts of plants), a population standard of 0.5% with an acceptance probability of at least 95% should be applied. In case of a sample size of 105 plants, the number of off-types should not exceed 2.
4. Observations on the cotyledon should be made just before the development of the first true leaf.
5. All observations on the leaf should be made on fully developed but not old leaves, preferably between the 5^{th} and 8^{th} node when the plant has at least one fruit set.
6. All observations on the ovary shall be recorded on the day of anthesis.
7. All observations on width shall be recorded at the maximum point of width of the part concerned.
8. All observations on the fruit should be made on 1^{st} or 2^{nd} well developed mature fruits. The maturity shall be judged based on dull hollow sound on thumping and fruit peduncle tendril dried.
9. All observations on the seeds should be made on fully developed, matured and dry seeds, after washing and drying.
10. Stage of recording of different observations will be as follows:

	Description	**Code**
a.	Cotyledons completely unfolded	10
b.	Active vegetative growth	20
c.	Flowering stage: appearance of first pistillate/ perfect flower in 50% plants from date of sowing	30

d.	Commercial maturity stage (harvest maturity)	40

V. Grouping of Varieties

1. The collection of varieties to be grown in the trial should be divided into groups to facilitate the assessment of Distinctiveness. Characteristics, which are suitable for grouping purposes, are those, which are known from experience not to vary, or to vary only to lesser extent, within a variety. Their various states of expression should be fairly evenly distributed throughout the collection.
2. It is recommended that the competent authorities use the following characteristics for grouping of watermelon varieties:

a.	Leaf blade: degree of primary lobing	Characteristic 6
b.	Fruit: shape in longitudinal section	Characteristic 16
c.	Fruit: colour of rind	Characteristic 17
d.	Fruit: stripes	Characteristic 19
e.	Fruit: size	Characteristic 22
f.	Fruit: colour of flesh	Characteristic 23
g.	Seediness: number of seeds/fruit	Characteristic 24
h.	Seed: colour of coat	Characteristic 27

VI. Characteristics and Symbols

1. To assess Distinctiveness, Uniformity and Stability, the characteristics and their states as given in the Table of Characteristics should be used.
2. Notes (1-9) should be used for the purposes of recording and electronic processing of data. Each state of expression is allotted a corresponding numerical note (1-9) for the different characteristics.
3. Legend

   (*) Characteristics that should be used in every growing season on all varieties and shall always be included in the description of the variety, except when the states of expression of any of these characters is rendered impossible by a preceding 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.

4. Type of assessment of characteristics indicated in Section VII 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

S. No.	Characteristics	States	Note	Example Varieties	Stage of observation	Type of assessment
1	2	3	4	5	6	7
1. (+)	Cotyledon: shape	Narrow elliptic	1	Sugar Baby, Charleston Grey	10	VG
		Medium elliptic	2	Arka Manik		
		Broad elliptic	3	Asahi Yamato, Thar Manak		
2.	Plant: length of internodes (cm)	Short (<7)	3	-	20	MS
		Medium (7-8.5)	5	Durgapura Lal, Sugar Baby		
		Long (>8.5)	7	Arka Manik, Charleston Grey		
3.	Leaf blade: length (cm)	Short (<10)	3	Durgapura Lal, Thar Manak	20	MS
		Medium (10-14)	5	Asahi Yamato		
		Long (>14)	7	Charleston Grey		
4.	Leaf blade: width (cm)	Narrow (<9)	3	Durgapura Lal	20	MS
		Medium (9-12)	5	-		
		Broad (>12)	7	Charleston Grey,		

				Durgapura Kesar		
5.	Leaf blade: colour	Light green	1	-	20	VG
		Green	3	Asahi Yamato		
		Dark green	5	-		
6. (*) (+)	Leaf blade: degree of primary lobing	Weak	3	Durgapura Lal	20	VG
		Medium	5	Sugar Baby		
		Strong	7	Arka Manik, Durgapura Kesar		
7. (+)	Leaf blade: degree of secondary lobing	Weak	3	Durgapura Lal	20	VG
		Medium	5	Sugar Baby		
		Strong	7	Thar Manak		
8.	Petiole: length (cm)	Short (<7)	3	Durgapura Lal	20	MS
		Medium (7-9)	5	Arka Manik, Asahi Yamato		
		Long (>9)	7	Charleston Grey		
9.	Appearance of first pistillate/ perfect flower in 50% plants from date of sowing (days)	Early (<45)	3	Sugar Baby	30	MG
		Medium (45-50)	5	Durgapura Kesar		
		Late (>50)	7	Arka Manik, Durgapura Lal		
10.	Sex expression (at full flowering)	Monoecious	1	Arka Manik, Durgapura Lal	30	VG
		Andro-monoecious	3	AHW-65		
11.	Male sterility	Absent	1	Sugar Baby, Durgapura Lal, Arka Manik	30	VG
		Present	9	-		
12.	Ovary: length (cm)	Short (<1)	3	Arka Manik	30	MS
		Medium (1-2)	5	Durgapura Lal, Thar Manak		
		Long (>2)	7	Charleston		

				Grey		
13.	Ovary: width (cm)	Narrow (upto 0.8)	3	Asahi Yamato, Sugar Baby	30	MS
		Broad (>0.8)	5	Durgapura Kesar		
14.	Ovary: pubescence	Sparse	1	Durgapura Lal	30	VG
		Dense	2	Arka Manik, Durgapura Kesar		
15.	Ovary: colour	Yellow	3	Kashi Pitamber	30	VG
		Green	5	Sugar Baby, Arka Manik		
		Dark Green	7	-		
16. (*) (+)	Fruit: shape in longitudinal section	Round	1	-	40	VG
		Flat globe	2	Sugar Baby		
		Oval	3	-		
		Cylindrical (Oblong)	4	Charleston Grey		
		Elongated globe	5	Asahi Yamato, Arka Manik		
17. (*)	Fruit: colour of rind	Yellow	3	Kashi Pitamber	40	VG
		Light Green	5	Asahi Yamato, Charleston Grey		
		Medium green	7	Durgapura Kesar		
		Dark Green	9	Sugar Baby		
18.	Fruit: grooves	Absent	1	Sugar Baby, Asahi Yamato,	40	VG
		Present	9	Thar Manak		
19. (*)	Fruit: stripes	Absent	1	-	40	VG
		Weak	3	Asahi Yamato, Charleston Grey, Sugar Baby		

		Diffused	5	Arka Manik		
		Clearly defined	7	Thar Manak		
20.	Fruit: length (cm)	Short (<20)	3	Sugar Baby	40	MS
		Medium (20-30)	5	Arka Manik, Durgapura Lal		
		Long (>30)	7	Charleston Grey		
21.	Fruit: diameter (cm)	Narrow (<15)	3	Charleston Grey	40	MS
		Medium (15-25)	5	Durgapura Lal		
		Broad (>25)	7	Arka Manik		
22 (*)	Fruit: size (kg)	Small (<3)	3	Sugar Baby	40	MS
		Medium (3-6)	5	Arka Manik, Durgapura Lal		
		Large (>6)	7	-		
23. (*)	Fruit: colour of Flesh	White	1	-	40	VG
		Yellow	2	Durgapura Kesar		
		Orange	3	-		
		Reddish Pink	5	-		
		Light red	7	-		
		Dark Red	9	Sugar Baby, Asahi Yamato		
24. (*)	Seediness: number of seeds/ fruit	Absent or rudimentary (<20)	1	-	40	MS
		Low (<150)	2	-		
		Medium (150-350)	3	Charleston Grey, Sugar Baby		
		High (>350)	4	Durgapura Kesar		
25.	Seed: length (cm)	Short (<0.6)	3	Arka Manik	40	MS
		Medium (0.6-1)	5	Sugar Baby		

		Long (>1)	7	Charleston Grey		
26.	Seed: width (cm)	Narrow (<0.4)	3	Asahi Yamato	40	MS
		Medium (0.4-0.7)	5	Sugar Baby		
		Broad (>0.7)	7	Charleston Grey		
27. (*)	Seed: colour of coat	White	1	Durgapura Kesar	40	VG
		Grey	2	AHW-65, Asahi Yamato		
		Red	3	-		
		Brown	5	Durgapur Lal		
		Black	7	Sugar Baby		
		Others	9	-		

VIII. Explanation on the Table of Characteristics

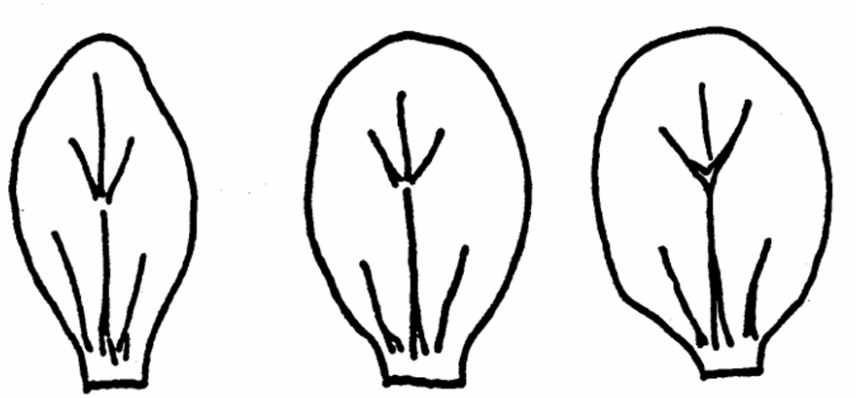
1. Explanation covering several characteristics

Characteristics containing the following key in the second column of the Table of Characteristics should be examined as indicated below:

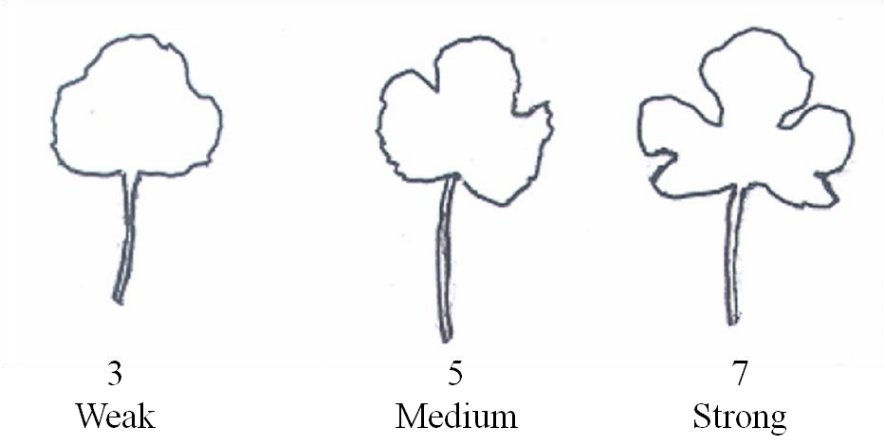
a.	Seedling	All observations on the seedling should be made just before the development of the first true leaf.
b.	Leaf blade	All observations on the leaf blade should be made on fully developed but not old leaves, preferably between the 5^{th} and 8^{th} node when the plant has at least one fruit set.
c.	Fruit	The flesh colour should be measured on the day of harvest.
d	Seed	All observations on the seed should be made on fully developed, matured and dry seeds, after washing and drying in the shade.

2. Explanation for individual characteristic

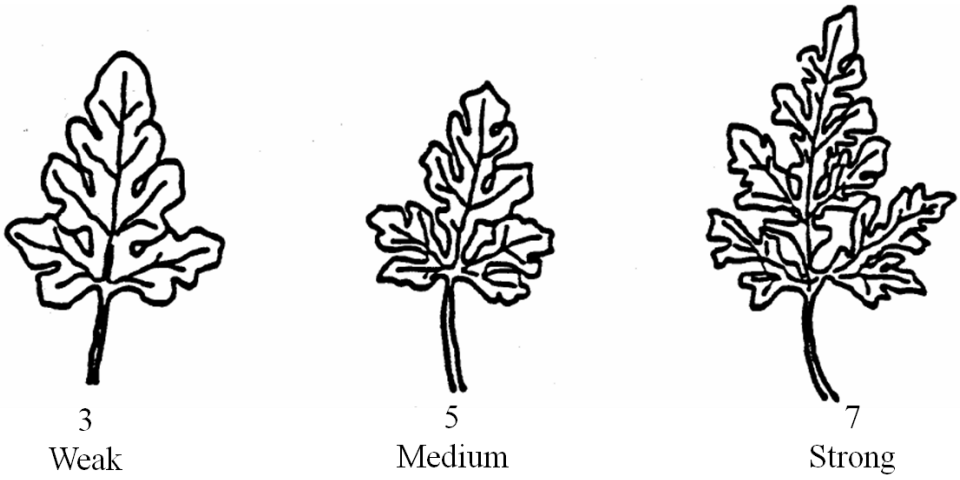
Characteristic 1. Cotyledon: shape



Characteristic 6. Leaf blade: degree of primary lobing

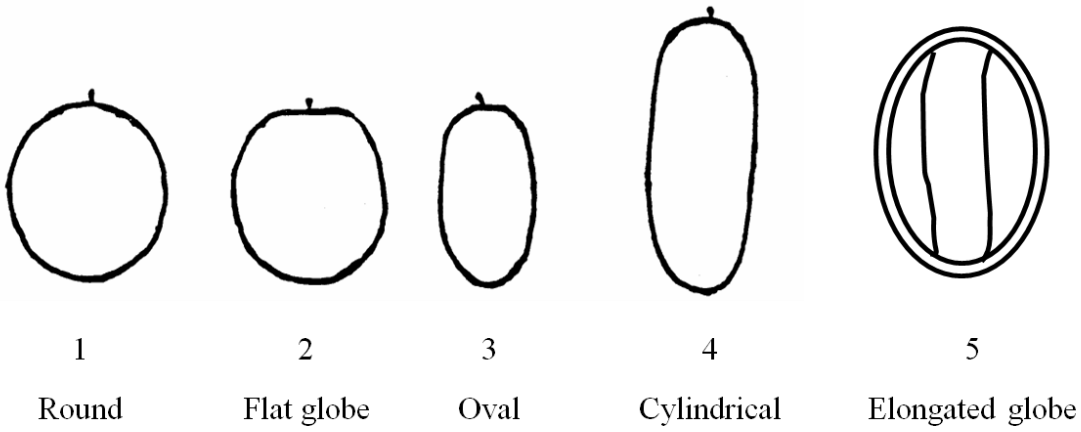


Characteristic 7. Leaf blade: degree of secondary lobing



3 Weak | 5 Medium | 7 Strong

Characteristic 16. Fruit: shape in longitudinal section



1 Round | 2 Flat globe | 3 Oval | 4 Cylindrical | 5 Elongated globe

IX. Working Group Details

The Test guidelines were developed by the Task Force (12/2011) constituted by the PPV&FR Authority, New Delhi in consultation with the Director, Indian Institute of Vegetable Research (IIVR), Varanasi, Project Coordinator (Vegetable Crops), Nodal Officer and Co-Nodal Officers of DUS testing centres.

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IX. DUS Testing Centres

Nodal Centre	**Other Centre**
Central Institute for Arid Horticulture, Sri Ganganagar Highway, Beechwal, Industrial Area P.O., Bikaner-334006 (Rajasthan).	Indian Institute of Horticultural Research, Hessarghatta, Lake Post, Bengaluru-560089 (Karnataka).