

**Guidelines for the Conduct of Test for
Distinctiveness, Uniformity and Stability
On
Strawberry
(*Fragaria x ananasa* Duch.)**



**Protection of Plant Varieties and Farmers' Rights Authority
(PPV & FRA)
MOA, Government of India, New Delhi**

I. Subject

These test guidelines shall apply to all varieties, hybrids and parental lines of Strawberry (*Fragaria x ananasan* Duch.)

II. Material required

1. The Protection of plant varieties and farmer's Rights Authority (PPV & FRA) shall decide the quantity and quality of 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 Right (PPV & FR) Act 2001. The applicants submitting such testing material from the country other than India, shall make sure that all customs and quarantine requirements stipulated under the relevant national legislation are complied with.
2. The testing material to be supplied in the form of runners, plant propagules or seedling plants
3. The minimum quantity of plant material to be supplied by the applicant should be 120 runners or plant propagules (tissue cultured plants hardened at 4-5 leaf stage)
4. Plant material supplied should be healthy, with good vigour and not affected by any pest or disease.
5. Plant material should not have undergone any treatment which would affect the expression of characteristics of the variety, unless the PPV & FRA, allow or request such treatment. If it has been treated, the full details of treatments must be given.

III. Conduct of tests

1. The minimum duration of test should be two independent fruiting seasons. Test shall be conducted at least at two locations.
2. The test should be carried out under conditions ensuring satisfactory growth for expression of relevant characteristics of varieties and for conduct of examination. In particular, it is essential that plant produce satisfactory crop of fruit in each of the two fruiting seasons.
3. Test plot 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. The additional test protocol for special purpose may be established by PPV & FRA

- | | | |
|---|---------------------|--|
| 1 | Locations | : Two (CITH, Srinagar and IIHR, Bangalore) |
| 2 | No. of replications | : Three |
| 3 | Treatment unit | : 20 plants per replication per location |
| 4 | Spacing | : 60 x 60 cm |

IV. Methods and Observations

The characteristics described in the Table of Characteristics (see section VII) shall be used for the testing of varieties/ hybrids for their DUS.

1. For the assessment of Distinctiveness and Stability, observations shall be made on 10 plants from the middle of the plot. Whereas plant parts should be taken from each plant in each replication. In the case of parts of plants, the number to be taken from each of the plant should be at least three.
2. Mature leaves in the middle of youngest shoot not showing sign of active shoot growth should be selected for observation of leaves.
3. Observation on the inflorescence should be made at a time of full bloom on terminal panicles of typical shoots from exposed regions of the plants.
4. The observation on stolon of plants should be made towards the end of growing season.
5. Observation on fruits should be made on secondary fruits (at maturity).
6. For assessment of uniformity, a population standard of 5% and a probability of at least 95% should be applied. In case same size of 20 plants, one off type is allowed.
7. Type of assessment of characteristics as indicated in column of section VII (Table of characteristics) is as follows.
 - a) **MG**: Measurement by a single observation of a group of plants or parts of plants
 - b) **MS**: Measurement by a single observation of individual plants or parts of plant
 - c) **VG**: Visual assessments by a single observation of a group of plants or parts of plants
 - d) **VS**: Visual assessments by a single observation of individual plants or parts of plant

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 purpose.
2. Grouping characteristics are those in which the documented state of expression even where produced different locations, can be used either individually or in combination with other such characteristics: to select varieties of common knowledge that can be excluded from the growing trial used for examination of distinctiveness and to organize growing trial so that similar varieties can be grouped together.

Following characteristics are to be used for grouping strawberry varieties

- a. Terminal leaflet: Margin -----(Characteristic 15)
- b. Flower- Relative position of petals ----(Characteristic 23)
- c. Fruit- Fruit shape -----(Characteristic 30)
- d. Fruit- Width of band without achenes-(Characteristic 36)
- e. Fruit- Position of achenes -----(Characteristic 37)
- f. Fruit- Attitude of calyx -----(Characteristic 39)

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
- (*) 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 phonological characteristics.
- (+) 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.
4. A code number in the sixth column of Table of characteristics for observation of each characteristics during growth and development of plants. The explanation of the type of characteristics is provided in general introduction.
 - (a) The observations on the plant growth habit and vigour, foliage density and leaf stipules should be made on plants shortly before flowering.
 - (b) The observations of the inflorescence (including the flower) should be made on plants during flowering. Unless otherwise indicated, observations on the flower should be made on the secondary flower. In the case of remontant varieties, the characteristics should be observed on the first flush of flowers.
 - (c) The observations on leaves should be made during fruiting on fully mature leaves.
 - (d) The Observations fruits and stolon should be made after the fruiting.

VII. Table of characteristics

S. No.	Characteristics	States	Notes	Varieties characterized	Stages of observation	Type of assessment
1	2	3	4	5	6	7
1. (+)	Plant: Growth habit	Upright	1	Tillamook, Douglas, Gorella	a	VG
		Semi-upright	2	Kimberley, Brighton, Festival		
		Spreading	3	Anthea, Katrain Sweet,		
2. (+)	Plant: Density of foliage	Sparse	3	Howard, Brighton	a	VG
		Medium	5	Kimberley, Blackmore, Cammarosa		
		Dense	7	Tillamook, Missionary, Bangalora,		
3.	Plant: Vigour	Weak	3	Regina	a	VG
		Medium	5	Festival, Kimberley, Blackmore		
		Strong	7	Tillamook, Missionary, Shasta		
4. (*)	Plant: Position of inflorescence in relation to foliage	Beneath	1	Brighton, Heera, Blackmore,	b	VG
		Same level	2	Tillamook, Kimberley, Missionary		
		Above	3	-		
5. (*)	Plant: Number of stolon	Few (< 5)	3	Sweet Charlie, Florida, Tioga	d	MG
		Medium (5-10)	5	Kimberley, Blackmore, Douglas		
		Dense (>10)	7	Tillamook, Missionary, Brighton		
6.	Stolon: Anthocyanin coloration	Absent	1	Kimberley, Missionary, Douglas	d	VG
		Weak	3	Tillamook, Bangalora, Phenomen		
		Medium	5	Howard, Brighton, Heera		
		Strong	7	Shasta, Larson, Katrain Sweet		
7. (+)	Leaf: Circumference (mm)	Small (<80)	3	Lucundi	c	MG
		Medium (80-120)	5	Tillamook, Red Coat		
		Large (>120)	7	Kimberley, Missionary, Brighton		
8.	Leaf: Colour of upper side	Light Green	3	Kimberley, Bangalora, Dil Pasand	c	VG
		Green	5	Douglas, Bangalora, Anthea		
		Dark green	7	Tillamook, Howard, Brighton		

9. (* (+)	Leaf: Blistering	Absent or weak	1	Banglora, Elista, Howard	c	VG
		Medium	2	Tillamook, Kimberley, Missionary,		
		Strong	3	Majestic, Phenomen		
10. (* (+)	Leaf: Glossiness	weak	3	Heera, Blackmore	c	VG
		Medium	5	Tillamook, Kimberley, Brighten		
		Strong	7	Banglora		
11. (* (+)	Terminal leaflet: Length width ratio	Shorter (<1)	1	Tillamook, Howard, Brighten	a	MS
		Equal (=1)	2	Heera, Blackmore, Majestic		
		larger (>1)	3	Camarosa, Missionary, Phenomen		
12. (* (+)	Terminal leaflet: Shape of base	Acute	1	Missionary, Blackmore, Tillamook	c	VG
		Obtuse	2	Shasta, Phenomen, Majestic		
		Rounded	3	Elista		
13. (+)	Terminal leaflet: Margin	Serrate	1	Tillamook. Shasta	c	VG
		Intermediate	2	Doughlas		
		Crenate	3	Kimberley, Missionary, Howard		
14. (+)	Terminal Leaflet: Shape in cross section	Concave	1	Tillamook, Kimberley, Phenomen,	c	VG
		Straight	2	Howard		
		Convex	3	Missionary, Majestic Brighton		
15.	Petiole: Length (cm)	Short (< 8)	3	Douglas, Fiana, Florida	c	MG
		Medium (8-12)	5	Kimberley, Missionary, Shasta		
		Long (> 12)	7	Tillamook, Howard, Phenomenon		
16. (+)	Petiole : Attitude of hair	Upwards	1	Blackmore, Kimberley, Heera	c	VG
		Horizantal	3	Brighton, Katrain Sweet-2, VL-1		
17.	Stipule: Anthocyanin coloration	Weak	3	Tillamook, Missionary, Douglas	a	VG
		medium	5	Howard, Heera, Blackmore		
		Strong	7	Shasta, Wild		
18.	Inflorescence: Number of flowers/ Inflorescence	Few (< 4)	3	Bangalora, Cammarosa	b	VS
		Medium (4-7)	5	Missionary, Blackmore, Shasta, Douglas		
		Many (>7)	7	Tillamook,		

				Kimberley, Majestic		
19.	Flower Diameter(mm)	Small (< 27)	3	Dana, Florida, Kimberley	b	MS
		Medium (27-32)	5	Brighton, Howard, Tillamook		
		Large (> 32)	7	Heera, Shasta, Douglas		
20. (* (+)	Flower: Relative arrangement of petals	Free	1	Brighton, Heera, Howard	b	VG
		Touching	2	Katrain Sweet, Dilpasand		
		Overlapping	3	Kimberley, Blackmore, Tillamook		
21. (* (+)	Flower: Size of calyx in relation to corolla	Smaller (<1)	1	Blackmore, Phenomen, Larson	b	MS
		Same size (=1)	2	Douglas, Heera		
		Larger (>1)	3	Brighton, Kimberley		
22.	Petal: Length width ratio	shorter (<1)	3	Cammarosa, Tillamook, Brighton	b	MG
		Equal (=1)	5	-		
		Larger (>1)	7	Katrain Sweet-1, Howard		
23. (*	Petal: Colour of upper side	Greenish White	1	Larson, Kimberley, Tillamook, Brighton,	b	VG
		White	2	Sweet Heart, Shimla Delicious, Julicot		
		Pink	3	-		
		Red	4	-		
24. (*	Fruit: Length width ratio	shorter (<1)	3	Tillamook, Heera, Elista,	d	MG
		Equal (=1)	5	Phenomen, Majestic		
		longer (>1)	7	Missionary, Howard, Brighton		
25. (*	Fruit: Size (weight in g)	Small (<6)	3	Blackmore, Catskill, Fair Fax	d	MG
		Medium (6-9)	5	Phenomen, Florida, Pajaro		
		Large (>9)	7	Brighton, Missionary, Howard		
26. (* (+)	Fruit: Shape	Reniform	1	Early Dawn		
		Obloid	2	Blackmore, Red Coat, Heera		
		Globose	3	Phenomen, Larson,		

				Elista		
		Conical	4	Brighton, Missionary, Jutogh Special	d	VS
		Rhomboid	5	Gorella, Rear Ground, Swiss-2		
		Ovoid	6	Catskill, Swiss		
		Cylindrical	7	Douglas		
		Wedged	8	-		
		Cordiform	9	-		
27. (*)	Fruit: Colour	Whitish yellow	1	-		
		Orange	2	Phenomen, Red Coat		
		Orange red	3	Majestic, Cavalier, Blackmore		
		Red	4	Catskill, , Florida	d	VS
		Dark red	5	Missionary, Bangalora, Rear Ground		
		Redish black	6	Jutogh Special, Douglas, Gorella		
28.	Fruit: Evenness of color	Even	1	Kimberley, Howard, Brighton		
		Slightly uneven	2	Phenomen, Catskill, Rear Ground	d	VS
		Uneven	3	Majestic, Jutogh Special, Fiana		
29.	Fruit: Glossiness	Weak	1	Robinson, Larson, Katrain Sweet-1		
		Medium	2	Missionary, Phenomen, Majestic	d	VS
		Strong	3	Brighton, Howard, Tillamook		
30.	Fruit: Evenness of surface	Even or very slightly uneven	1	Phenomen, Missionary, Camarosa		
		Slightly uneven	2	Swiss, Shasta, Majestic	d	VS
		Strongly uneven	3	Jutogh Special, Catskill, Anthea		
31. (+)	Fruit: Width of band without achenes	Narrow	3	Camarosa, Heera, Larson		
		Medium	5	Blackmore, Kimberley, Missionary	d	VS
		Broad	7	Gorella, , Swiss-2		
32. (*) (+)	Fruit: Position of achnes	Below surface	1	Phenomenon, Fiana, Douglas		
		Level with surface	2	Shasta, Majestic, Cavalier	d	VS
		Above surface	3	Tillamook, Kimberley, Howard		
33. (*) (+)	Fruit: Position of calyx attachment	Inserted	1	Elista, Bangalora		
		Level with ground	2	Tillamook, Kimberley,	d	VS

				Missionary		
		Exserted	3	Majestic, Fair Fax, Addie		
34. (* (+)	Fruit: attitude of sepals	Upward	1	Majestic, Sweet Heart, Shimla Delicious	d	VS
		Downwards	2	Kimberley, Doughlas, Howard,		
		Outward	3	Tillamook, Elista, Red Cross		
35.	Fruit: Diameter of calyx in relation to diameter of fruit (mm)	smaller (<0.8)	3	Kimberley, Elista, Tillamook	d	MG
		Equal (0.8-1.2)	5	Howard, Cammarosa,		
		Slightly larger (>1.2)	7	Red Cross, Missionary, Brighton		
36.	Fruit: Adherence of calyx	Weak	3	Cavaliar Missionary, Majestic	d	VS
		Medium	5	Heera, Blackmore, Howard		
		Strong	7	Tillamook, Kimberley, Camarosa		
37.	Fruit: Firmness (RI)	Soft (<20)	3	Brighton, Tillamok, Missionary	d	MG
		Medium (20-30)	5	Katrain Sel-2, Heera,		
		Firm (>30)	7	Phenomenon, Majestic, Kimberley, Howard		
38. (+)	Fruit : Colour of flesh (excluding core)	Whitish	1	Blackmore, Shasta, Howard	d	VS
		Light Pink	2	Sweet Heart, Addie		
		Orange Red	3	Red Cross, Kimberley, Missionary		
		Red	4	Douglas, Gorella		
39. (+)	Fruit: Colour of core	White	1	Blackmore, Shasta, Banglora	d	VS
		Pink	2	Catskill		
		Orange	3	Heera		
		Red	4	Swiss-2, Anthea ,		
40. (+)	Fruit: Cavity	Small	3	Kimberley, Doughlas, Missionary	d	VS
		Medium	5	Brighten, Camarosa, Cavaliar		
		Large	7	Zem, Howard, Heera		

41. (*)	Time of beginning of flowering	Early	3	Brighton, Cavalier, Swiss-2	b	VG
		Medium	5	Phenomen, Jutogh Special, Missionary		
		Late	7	Addie, Blackmore, Fair Fax		
42.	Time of beginning of ripening	Early	3	Kimberley, Lucundi, Sweet Heart	d	VG
		Mid season	5	Phenomenon, Jutogh Special, Douglas		
		Late	7	Camarosa, Katrain Sweet, Howard		
43. (*)	Type of bearing	Not remontant	1	Kimberley, Missionary, Elista,	d	VS
		Partially remontant	2	Sweet Charlie		
		Fully remontant	3	-		
		Day neutral	4	-		

XIII. Explanation for the Table of characteristics

Characteristics 1: Plant growth habit



Upright
(1)



Semi- upright
(2)



Spreading
(3)

Characteristics 2: Density of foliage



Sparse
(3)

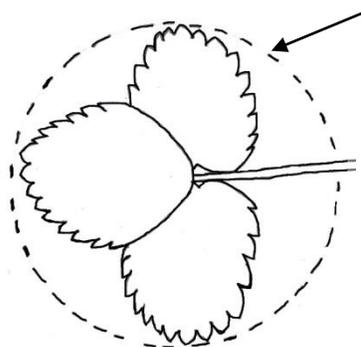


Medium
(5)



Dense
(7)

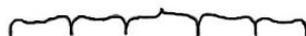
Characteristics 7: Leaf Circumference



Characteristics 9: Leaf: blistering



Absent
(1)

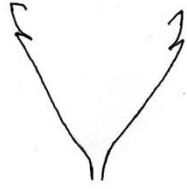


Medium
(3)

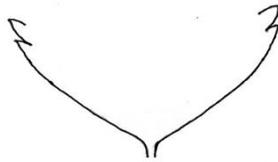


Strong
(3)

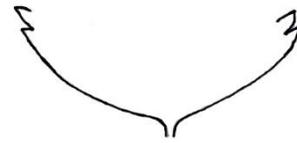
Characteristics 12: Terminal leaflet: Shape of base



Acute
(1)



Obtuse
(2)



Rounded
(3)

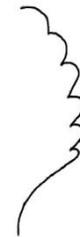
Characteristics 13: Terminal leaflet: Margin



Serrate
(1)



Intermediate
(2)

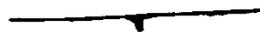


Crenate
(3)

Characteristics 14: Terminal leaflet: shape in cross section



Concave
(1)



Straight
(2)



Convex
(3)

Characteristics 16: Petiole: attitude of hairs



Upwards
(1)



Slightly
Outwards
(2)

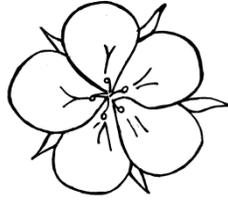


Horizontal
(3)

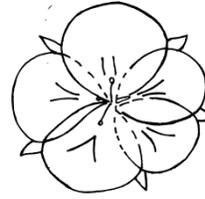
Characteristics 20: Flower: relative arrangement of petals



Free
(1)

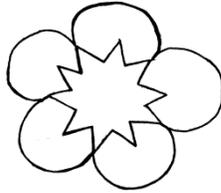


Touching
(2)

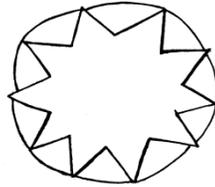


Overlapping
(3)

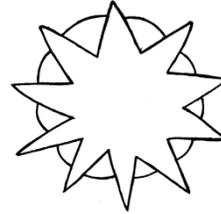
Characteristics 21: Flower: size of calyx in relation to corolla



Smaller
(3)

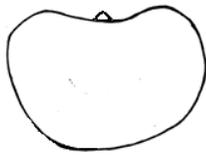


Same size
(5)

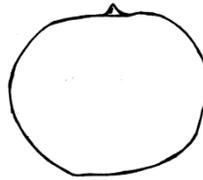


Larger
(7)

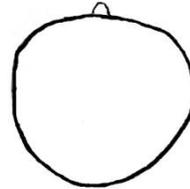
Characteristics 26: fruit: shape



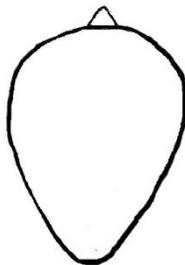
Reniform
(1)



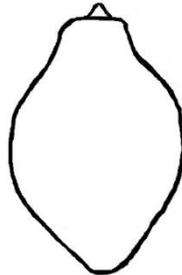
Obloid
(2)



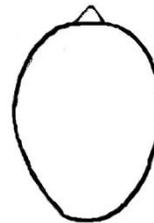
Globose
(3)



Conic
(4)



Rhomboid
(5)



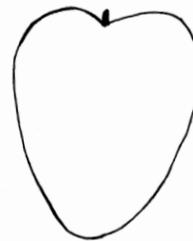
Ovoid
(6)



Cylindric
(7)

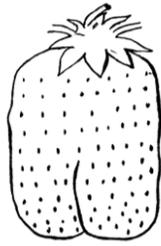


Wedged
(8)

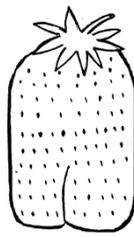


Cordiform
(9)

Characteristics 31: Fruit: width of band without achenes



Narrow
(3)

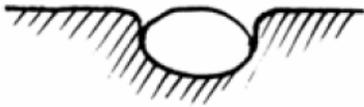


Medium
(5)

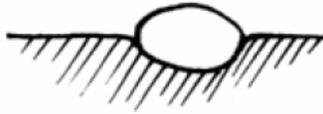


Broad
(7)

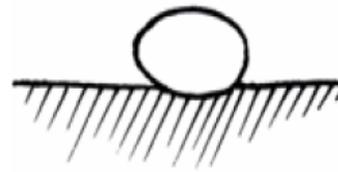
Characteristics. 37: Fruit: Position of achnes



Below Surface
(1)

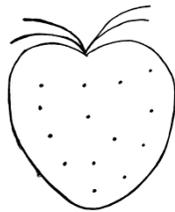


Level With Surface
(2)

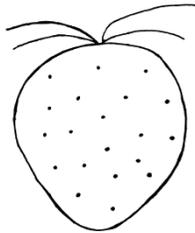


Above surface
(3)

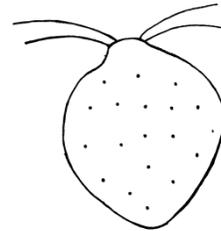
Characteristics. 33: Fruit: position of calyx attachment



Inserted
(1)

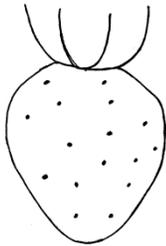


Level with
fruit
(2)

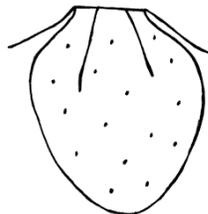


Exerted
(3)

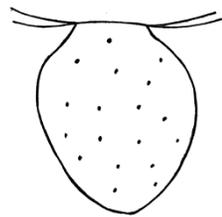
Characteristics 34: Fruit: attitude of sepals



Upwards
(1)



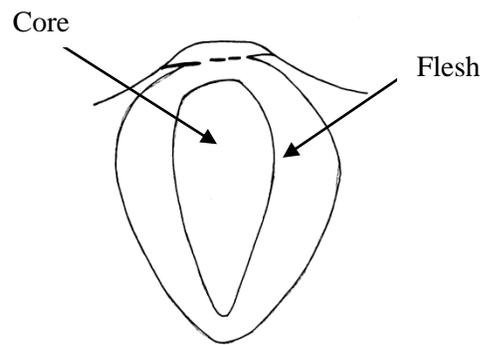
Downwards
(3)



Outwards
(2)

Characteristics 38: Fruit: color of Flesh (excluding Core)

Characteristics 39: Fruit: color of core (excluding Flesh)



Characteristics 40: Fruit: Cavity



Absent
(1)



Medium
(2)



Large
(3)

Working Group details:

The task force has finalized the DUS test guidelines for Strawberry with support of Dr. S. R. Singh, Prof. Nazeer Ahmed and Senior Research Fellow Dr. Raja Hadin Shafi Raja from nodal centre and Dr. BNS Murthy, Nodal office of sub centre, IIHR, Bangalore. The officials of the PPV&FR Authority including Dr. Tejbir Singh, Registrar and Sh. Dipal Roy Choudhury, Joint Registrar also provided technical input

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