

**Guidelines for the Conduct of Test for
Distinctiveness, Uniformity and Stability
On
Almond
(*Prunus dulcis*)**



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

Almond (*Prunus dulcis*)

I. Subject

These test guidelines shall apply to all varieties of Almond (*Prunus dulcis*)

II. Material 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. 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. As a minimum the applicant may submit 10 grafted or budded plants of almond on rootstock for each centre.
2. The plant material supplied should be visibly healthy, not lacking in vigour, nor affected by any important pest or disease.
3. 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

1. The minimum duration of the DUS tests shall normally be for at least two fruiting season in succeeded years.
2. 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 evaluation. Each test should include total of 6 trees. In particular, it is essential that the trees produce a satisfactory crop of fruit in each of the two growing seasons.

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 |
| 2 | No. of replications | : Three |
| 3 | Treatment unit | : Two trees per replication (total 6 plants / location) |
| 4 | Spacing | : 3 x 3m |

IV. Methods and observations

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

1. For the assessment of Distinctiveness and Stability, observations shall be made on 6 plants or 18 parts taken from 6 plants with the exception of the observation on nut and kernel which should be made on at least 20 nuts. In the case of parts of plants, the number to be taken from each of the plant should be three.
2. For the assessment of uniformity a population standard of 1% with an acceptance probability of at least 95% should be applied. In the case of a sample size of 6 plants, the maximum number of off-types allowed would be 1.
3. All observations on the tree and the branches should be made during dormancy. Observations on the mature fruit/nut should be recorded when fruit is ready for harvest at 50% hull splitting.
4. All observations on the leaf should be made on fully developed leaves of the middle third of current season's shoot
5. Time of maturity should be recorded at 50% hull splitting from first of January.
6. All observations on the nut should exclude the pericarp and should be made on dried nuts.
7. All observations on the kernel should be made after harvest when the moisture content is about 8%.
8. Type of assessment of characteristics as indicated in column of Table VII 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*

VI. 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. It is recommended that the competent authorities use the following characteristics for grouping varieties
 - a. Tree growth habit
 - b. Bearing habit
 - c. Flower bud shape
 - d. Petal shape
 - e. Leaf blade margin
 - f. Nut shape
 - g. Nut outer shell markings
 - h. Shell softness

VI. Characteristics and symbols

- i. To assess Distinctiveness, Uniformity and Stability, the characteristics and their states as given in the Table of characteristics (Section VII) shall be used.
 - ii. Notes (1 to 9) shall be given for each state of expression for different characteristics for the purpose of electronic data processing.
 - iii. 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 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. 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.
- iv. A code number in the sixth column of Table of characteristics indicates the optimum stage for the observation of each characteristic during growth and development of plant. The relevant growth stages corresponding to these code numbers are described below:
 - a. Observations on tree vigour and habit should be made at the central third of the shoot during dormant season of adult trees relative to reference cultivars grafted on sweet seedling root stock.
 - b. The observations on the leaves should be made on mature leaves from current season's shoot.
 - c. Observations should be made at the time of full bloom (75% flowering)
 - d. Observation should be made at 50% splitting of the hull.
 - e. Observation should be made after harvest on dried nuts containing about 8 percent moisture.

VII. Table of characteristics

S. No.	Characteristics	States	Notes	varieties characterized in 2010-11/2011-2012	Stages of observation	Type of assessment
1	2	3	4	5	6	7
1.	Tree vigour	Weak	3	CITH-Almond-2, CITH-Almond-11	a	VG
		Intermediate	5	IXL, Makhdoom, Non Pareil CITH-Almond-9, CITH-Almond-14		
		Strong	7	California Paper Shell, Pranyaj, CITH-Almond-1, CITH-Almond-3,		
2. (+)	Tree habit	Upright	3	Non Pareil, Merced, Waris, CITH-Almond-1	a	VG
		Spreading	5	California Paper Shell, Makhdoom, Pranyaj, IXL, CITH-Almond-12,		
		Drooping	7	Primorskij, CITH-Almond-4, CITH-Almond-18		
3.	Ramification	Sparse	3	CITH-Almond-2	a	VG
		Intermediate	5	IXL, Non Pareil CITH-Almond-4, CITH-Almond-6		
		Dense	7	California Paper Shell, Makhdoom, Merced, Pranyaj, Waris, Primorskij CITH-Almond-12		
4.	Onset of flowering	Early	3	Pranyaj, Primorskij, Waris, Makhdoom, Almond-1, CITH-Almond-2,	c	MG
		Mid	5	California Paper Shell, I XL, Merced,		
		Late	7	Drake, CITH-Almond-21		
5.	Duration of blooming (days)	Short (<5)	1	CITH-Almond-8	c	MG
		Medium (5-10)	3	CITH-Almond-2, CITH-Almond-3, CITH-Almond-6		
		Long (>10)	5	Makhdoom, Pranyaj, Primorskij, Waris, CITH-Almond-1, CITH-Almond-4		
6. (*)	Colour of petals	White	1	IXL, Primorskij, Waris, CITH-Almond-12	c	MG
		Light pink	2	California Paper Shell, Merced, Non Pareil, Pranyaj, CITH-Almond-9		
		Pink	3	Shalimar, CITH-Almond-1, CITH-Almond-4		
7. (*)	Flower bud: Colour of sepals	Green	3	CITH-Almond-11	c	MG
		Brown	5	Primorskij, CITH-Almond-1		
		Red	7	California Paper Shell, CITH-Almond-4		
8. (*)	Flower: Bearing habit	Flowers on one year old	3	IXL, Makhdoom, Merced, Non Pareil, CITH-Almond-3	a	VG

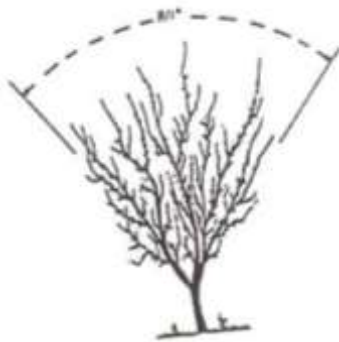
(+) (+)		shoot				
		Flowers on spurs	5	CITH-Almond-6, CITH-Almond-11		
		Mixed	7	California Paper Shell, Primorskij, CITH-Almond-1, CITH-Almond-2		
9. (*) (+)	Flower bud shape	Triangular	1	Non-Pareil, Merced, CITH-Almond-3, CITH-Almond-2,	a	VG
		Ovate	3	Makhdoom, Waris CITH-Almond-7		
		Circular	5	CITH-Almond-9, CITH-Almond-15		
10. (*) (+)	Petal shape	Elliptic	1	Waris, CITH-Almond-16	c	VG
		Circular	3	Shalimar, CITH-Almond-1, CITH-Almond-2, CITH-Almond-17		
		Rhombic	5	California Paper Shell, Makhdoom, CITH-Almond-9		
11.	Double flowers in shoot (%)	Few (< 25)	1	California Paper Shell, CITH-Almond-12	c	MS
		Mid (25-50)	2	Primorskij, CITH-Almond-1, CITH-Almond-3		
		Many (>50)	3	Non Pareil, Pranyaj, CITH-Almond-7, CITH-Almond-8		
12.	Leaf blade: Length (cm)	Short (< 8)	3	California Paper Shell, Waris, CITH-Almond-4	b	MS
		Medium (8-10)	5	Primorskii, CITH-Almond-8		
		Long (>10)	7	Non Pareil, CITH-Almond-2, CITH-Almond-20		
13.	Leaf blade: Width (cm)	Narrow (< 2)	3	Primorskij, California Paper Shell, Waris CITH-Almond-9	b	MS
		Medium (2-2.5)	5	Makdoom CITH-Almond-18, CITH-Almond-17		
		Broad (>2.5)	7	CITH-Almond-15 CITH-Almond-11		
14.	Petiole: Length (cm)	Short (<1.5)	3	IXL, CITH-Almond-14, CITH-Almond-5	b	MS
		Medium (1.5-2)	5	Merced, CITH-Almond-2, CITH-Almond-13		
		Long (>2)	7	CITH-Almond-1, CITH-Almond-6, CITH-Almond-18		
15.	Leaf blade color	Light green	3	Waris	b	VG
		Green	5	Non-Pareil, CITH-Almond-3, CITH-Almond-4		
		Dark green	7	Makdoom, CITH-Almond-9, CITH-Almond-10		
16. (*) (+)	Leaf Blade: Incisions of margins	Serrate	3	IXL, CITH-Almond-10, CITH-Almond-13	b	VG
		Crenate	5	Merced, CITH-Almond-2		
17. (*) (+)	Shoot tip: Anthocyanin colouration	Low	3	California Paper Shell, IXL	a	VG
		Medium	5	Merced, Non Pareil, Pranyaj, Primorskij CITH-Almond-2,		

				CITH-Almond-18		
		High	7	Makhdoom, CITH-Almond-11, CITH-Almond-12		
18. (*)	Suture opening of the hull	Closed	1	California Paper Shell, Makhdoom, Merced, Non Pareil, Primorskij, Waris CITH-Almond-1, CITH-Almond-2, CITH-Almond-3	d	VG
		Half open	3	Pranyaj		
		Open	5	IXL		
19.	Harvest maturity	Early	3	Primorskij, Waris, CITH-Almond-1, CITH-Almond-2	d	VG
		Med	5	California Paper Shell, IXL, Merced, Non-Pareil, CITH-Almond-16		
		Late	7	Drake		
20.	Ease of hulling	Easy	3	California Paper Shell, Makhdoom, Non Pareil, Primorskij, Shalimar, CITH-Almond-4, CITH-Almond-9	d	VS
		Intermediate	5	IXL, Merced, Pranyaj, Waris CITH-Almond-1, CITH-Almond-2		
		Difficult	7	CITH-Almond-14, CITH-Almond-18		
21. (+) (*)	Nut shape	Elongated	1	California Paper Shell	e	VG
		Cordate	3	Shalimar, Non Pareil, CITH-Almond-7, CITH-Almond-16		
		Oblong	5	CITH-Almond-2, CITH-Almond-9, CITH-Almond-13		
		Ovate	7	Waris, Makhdoom, IXL, CITH-Almond-1		
22.	Nut weight(g)	Small (< 2)	3	CITH-Almond-9, CITH-Almond-10	e	MS
		Medium (2-4)	5	IXL, Makhdoom, Non Pareil, Primorskij, Waris, Merced		
		Large (>4)	7	Pranyaj, California Paper Shell		
23. (*) (+)	Marking of outer shell	Without pores	1	CITH-Almond-8	e	VG
		Sparsely pored	3	Non Pareil CITH-Almond-3, CITH-Almond-6		
		Intermediate	5	Shalimar, Makhdoom, CITH-Almond-1, CITH-Almond-2		
		Densely pored	7	Primorskij, IXL, CITH-Almond-4, CITH-Almond-5, CITH-Almond-7		
		Scribed	9	Pranyaj		
24.	Shell colour intensity	Extra light	3	California Paper Shell, Merced, Primorskij, CITH-Almond-1, CITH-Almond-2,	e	VS
		Light	5	Pranyaj, IXL, CITH-Almond-3, CITH-Almond-6		
		Dark	7	Makhdoom, Non Pareil, CITH-Almond-4		

25.	Softness of shell	Very soft	1	California Paper Shell, IXL, Waris, Pranyaj	e	VG
		Soft	3	Primorskij, Shalimar, Makdoom, Merced, Non Pareil		
		Semi hard	5	CITH-Almond-2, CITH-Almond-4, CITH-Almond-6, CITH-Almond-9		
		Hard	7	CITH-Almond-3, CITH-Almond-5, CITH-Almond-8, CITH-Almond-12		
		Extremely hard	9	CITH-Almond-1		
26.	Kernel weight (g)	Small (<1)	3	CITH-Almond-7, CITH-Almond -8, CITH-Almond -9	e	MG
		Medium (1-2)	5	Non Pareil, CITH-Almond -1, CITH-Almond -2		
		Large (>2)	7	Waris, Makhdoom, Pranyaj, IXL, California Paper Shell		
27. (* (+)	Kernel shape	Cordate	3	California Paper Shell, Waris, Makdoom, Pranyaj, IXL, Primorskij	e	VG
		Oblong	5	Waris, Makhdoom, Merced, CITH-Almond-13		
		Ovate	7	CITH-Almond-3, CITH-Almond-5		
28.	Kernel colour	Light	3	California Paper Shell, Merced, Non Pareil, Waris,IXL, Makhdoom, Pranyaj	e	VG
		Amber	5	CITH-Almond-5, CITH-Almond-12		
		Dark Amber	7	CITH-Almond-1, CITH-Almond-20, CITH-Almond-2, CITH-Almond-3		
29.	Shriveling of kernel	Low	3	California Paper Shell, Makhdoom, Merced, Non Pareil, Waris, CITH-Almond-2, CITH-Almond-4	e	VG
		Medium	5	IXL, Pranyaj, Primorskij CITH-Almond-1, CITH-Almond-3,CITH-Almond-9		
		High	7	CITH-Almond-8, CITH-Almond-12		
30.	Percentage of twin kernels	Low	1	CITH-Almond-3, CITH-Almond-11, CITH-Almond-16	e	MS
		Medium	2	CITH-Almond-13, CITH-Almond-15		
		High	3	Makhdoom, IXL, Merced, Non Pareil, Primorskij, CITH-Almond-1,CITH-Almond-2		

VIII. Explanation for the Table of characteristics

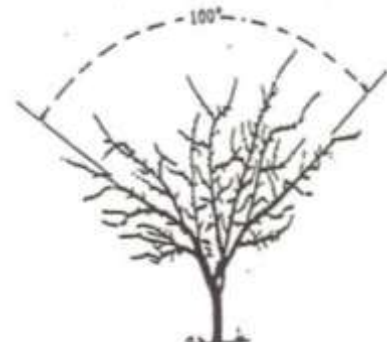
Characteristics 2: Tree habit



Upright
(3)



Spreading
(5)



Drooping
(7)

Characteristics 8: Bearing habit



One most buds on one
year old shoots
(3)



Two most flower buds
on spurs
(5)



Three mixed
(7)

Characteristics 9: Flower bud shape



Triangular
(1)



Ovate
(3)



Circular
(5)

Characteristics 10: Petal shape



Elliptic
(1)

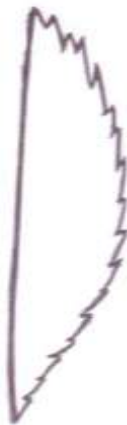


Circular
(3)



Rhombic
(5)

Characteristics 16: Leaf Blade - Incisions of margin



Serrate
(3)



Crenate
(5)

Characteristics 21: Nut shape



Elongated
(1)



Cordate
(3)



Oblong
(5)



Ovate
(7)

Characteristics 23: Marking of outer shell



Without pores
(1)



Sparsely pored
(3)



Intermediate
(5)



Densely pored
(7)



Scribed
(9)

Characteristics 27: Kernel shape



Cordate
(3)



Oblong
(5)



Ovate
(7)

Working Group details:

The Test Guidelines were developed at Central Institute of Temperate Horticulture, Srinagar, J&K. Under the supervision of Prof. Nazeer Ahmed, Director as PI and Assisted by Dr. S. R. Singh, Sr. Scientist and Research Associates Dr. Megna Rashid, Dr. Hidayat-ullah-Mir and Dr. Tejbir Singh, Registrar, PPV&FRA New Delhi. The suggestions and technical inputs were provided by the following task force (4/2012) constituted by the PPV&FR Authority in development and finalization of this DUS test guidelines.

The Members of the Task Force (4/2012)

- Shri K. K. Jindal,** : Chairman
Ex.ADG and Emeritus Scientist, Department of Fruit Science,
Dr. YSPUH&F, Nauni,Solan-173230 (H.P.).
- Dr. M.C. Nautiyal,** : Member
Ex. Dean, GBPUAT, Doon Enclave,
Nakraunda Road, Harrawala Dhera Doon-248001.
- Dr. M.S. Mankotia,** : Member
Professor (Horticulture), Regional Horticultural Research Station,
Dr. YSPUH&F, Nauni, Solan-173230 (H.P.).
- Dr. D.R. Gautam,** : Member
Ex. Director Extension Education,
Dr. YSPUH&F, Dass Niwas, Near JBT School Officer Colony
P.O. Galanagolan Town-173212. (H.P.).
- Dr. Nazeer Ahmed** : Member
Director, Central Institute of Temperate Horticulture,
Rangreth, Srinagar-190007 (J&K).
- Dr. K.K. Srivastava,** : Member
Senior Scientist, Central Institute of Temperate Horticulture,
Rangreth, Srinagar-190007 (J&K).
- Dr. Manoj Srivastava,** : Member Secretary
Registrar PPV&FR Authority, New Delhi.

Nodal Scientist

Prof. Nazeer Ahmed
Director, Central Institute of Temperate Horticulture, Rangreth, Srinagar, J&K.

Associated Scientist

Dr. S.R. Singh
Senior Scientist, Central Institute of Temperate Horticulture, Rangreth, Srinagar, J&K.

Special Invitee

Dr. A. A. Sofi,
Former Director, Central Institute of Temperate Horticulture,
Iqbal colony, Zaniakot, Srinagar-190012 (J&K).

Dr. B. S. Thakur,
Professor, Horticulture Department of Fruit Science and Breeding,
Dr. YSPUH&F, Nauni, Solan-173230 (H.P.).

Nodal DUS Test Centre	Other DUS Test Centre
Central Institute of Temperate Horticulture, Rangreth, Srinagar (J&K)	---