Pumpkin (*Cucurbita moschata* Duch. ex Poir.)

I. Subject

These test guidelines apply to all varieties, hybrids and parental lines of pumpkin (*Cucurbitamoschata*Duch. ex Poir.)

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 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 formalities are complied with.

2. The minimum quantity of seed to be supplied by the applicant should be:

   Varieties, Hybrids and parental lines

   - For open field cultivation: 200g or 1500 seeds (in one submission only)

3. The seed should meet the minimum requirements 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 tests should normally be two independent but similar growing seasons 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 characteristics 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 120 plants for open field cultivation, which should be divided among 3 replications.

Separate plots for observation 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	:	6.4 m
Row to row distance	:	4.5 m
Plant to plant distance	:	0.80 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 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 on 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 the case of a sample size of 120 plants, the number of off-types should not exceed 3.
4. For the assessment of colour characteristics, it is recommended that Royal Horticultural Society (RHS) colour chart be used.
5. Observation of leaf will be recorded on one leaf above the first fruit set nodes.
6. Observations on the leaf blade should be made on a fully developed leaf blade, from the 15^{th} node upwards to 20^{th} node.
7. All observations on the flowers should be made on flowers between the 10th and the 20th node.
8. All observations on the seed should be made on fully developed and dry seed, after washing and drying in the shade.

9. All observations on the immature fruit should be made on fruits around 8-14 days after anthesis, between the 10th and 20th node.

10. Main vine length to be observed at the time of mature fruit stage.

11. The main skin colour of fruit is the colour with the largest area over the whole fruit excluding the scar area.

12. The fruit diameter should be observed at the broadest part.

13. Stage of recording of different observation will be as follows:

	Description	**Code**
a	Cotyledons completely unfolded	10
b	Active vegetative growth	20
c	50 % flowering stage (first pistillate flower appears in 50% plant)	30
d	Immature fruit harvest stage (first to third green fruit harvest)	40
e	Full fruit maturity stage (seed harvest maturity)	50

V. Grouping of varieties

1. The collection of varieties to be grown 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 slightly, 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 varieties:

k. Fruit : Main color of skin at immature harvest stage (characteristic 14)

l. Fruit : Surface grooves (characteristic 18)

m. Fruit : Length (characteristic 20)

n. Fruit : Diameter (characteristic 21)

o. Fruit : Shape (characteristic 22)

VI. Characteristics and symbols

3. To assess distinctiveness, uniformity and stability, the characteristics and their states as given in the table of characteristics should be used.

4. Notes (1-9) should be used for the purposes of recording the data and electronic processing of data. Each state of expression is allotted a corresponding numerical note (1-9) for the different characteristics.

5. 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 explanations on the table of characteristics in section-VIII.

6. Type of assessment of characteristics indicated in column 7 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 characterstics						
S. No	**Characteristics**	**States**	**Note**	**Example varieties**	**Stage of observation**	**Type of assessment**
1	**2**	**3**	**4**	**5**	**6**	**7**
1.	Cotyledon: length	Short (<4.5cm)	3	NarendraAgrim	10	MS
		Medium (4.5-5.5cm)	5	Arka Chandan, Kashi Harit, Narendra Amrit		
		Long (>5.5cm)	7	KPS-1, PusaVishwas		
2.	Cotyledon: width	Narrow (<2.5cm)	3	ArkaChandan	10	MS
		Medium (2.5-3.5cm)	5	NarendraAgrim, KashiHarit		
		Broad (>3.5cm)	7	NarendraAmrit, Sooraj		
3. (*)	Plant: length of main vine	Short (<3m)	3	KashiHarit, NarendraAgrim	50	MS
		Medium (3-4.5m)	5	Pusa Vikas, Narendra Amrit, Punjab Samrat		
		Long (>4.5m)	7	CO-2, Arka Chandan		
4.	Plant: stem shape	Angular	1	Kashi Harit, Arka Chandan, Pusa Vikas	20	VG
		Round	2	-		
5.	Leaf blade: length	Short (<15cm)	3	VRPK-222-2-1 (genotype)	20	MS
		Medium (15-20cm)	5	Kashi Harit, Arka Chandan, CO-2 Narendra Agrim, Narendra Amrit, Punjab Samrat		
		Long (>20cm)	7	Sooraj, PusaVishwas		
6.	Leaf blade: width	Narrow (<15cm)	3	VRPK-222-2-1 (genotype)	20	MS
		Medium (15-20cm)	5	Kashi Harit, Arka Chandan, Narendra Agrim, KPS-1		
		Broad (>20cm)	7	Narendra Amrit, Pusa Vishwas, Sooraj		

7. (+)	Leaf blade: margin	Entire or very weakly incised	1	PusaVikas	20	VG
		Weakly incised	2	Sooraj, KashiHarit		
		Moderately incised	3	ArkaChandan		
8. (*)	Leaf blade: intensity of green colour of upper side	Light (137a)	3	PusaVikas	20	VG
		Medium (137b)	5	CO-2, Arka Chandan, Punjab Samrat		
		Dark (139a)	7	KashiHarit, NarendraAgrim, Sooraj		
9.	Leaf blade: silver patches	Absent	1	PusaVikas	20	VG
		Present	9	Kashi Harit, Arka Chandan, Narendra Agrim, Narendra Amrit		
10.	Petiole: length	Short (<12cm)	3	NarendraAmrit	20	MS
		Medium (12-18cm)	5	Pusa Vikas, KPS-1, Punjab Samrat		
		Long (>18cm)	7	CO-2, Arka Chandan, Pusa Vikas		
11.	Peduncle: length	Short (<5cm)	3	ArkaChandan, PusaVishwas	40	MS
		Medium (5-10cm)	5	Narendra Agrim, Pusa Vikas, Narendra Amrit		
		Long (>10cm)	7	Sooraj, PusaVikas		
12.	Peduncle: diameter (point of attachment at immature stage)	Small (<1cm)	3	NarendraAgrim	40	MS
		Medium (1-1.4cm)	5	Pusa Vishwas, Kashi Harit, Arka Chandan		
		Large (>1.4cm)	7	CO-2		
13.	Peduncle: pubescence (at immature fruit stage)	Absent	1	-	40	VG
		Present	9	Sooraj, PusaVishwas		

14. (*)	Fruit: main colour of skin (at immature fruit stage)	Cream	1	NarendraAmrit	40	VG
		Light green	2	Arka Chandan, Pusa Vikas, Narendra Agrim		
		Medium green	3	KashiHarit		
		Dark green	4	NarendraAgrim		
15. (*)	Fruit: skin colour pattern	Uniform	3	NarendraAgrim	40	VG
		Mottled	5	KashiHarit		
		Striped	7	PusaVishwas		
16. (*) (+)	Fruit: shape at peduncle end	Raised	1	PusaVishwas	50	VG
		Flat	2	Punjab Samrat		
		Moderately Depressed	3	Narendra Agrim, KPS-1, Kashi Harit, Arka Chandan, Narendra Amrit, Sooraj, CO-2		
		Strongly depressed	4	-		
17. (*) (+)	Fruit: shape at blossom end	Depressed	1	Narendra Amrit, Kashi Harit, Arka Chandan, Sooraj	50	VG
		Flat	2	-		
		Raised	3	PusaVishwas		
18. (*)	Fruit: surface grooves	Absent	1	-	50	VG
		Present	9	Narendra Amrit, CO-2, Sooraj, Kashi Harit, KPS-1		
19.	Fruit: marbling (immature stage)	Absent	1	Narendra Amrit,Narendra Agrim,	50	VG
		Weak	3	PusaVishwas, PusaVikas		
		Medium	5	KashiHarit, Punjab Samrat		
		Strong	7	-		
20. (*)	Fruit: length (mature stage)	Short (<12cm)	3	NarendraAgrim	50	MS
		Medium (12-20cm)	5	Kashi Harit, Pusa Vikas, Sooraj		
		Long (21-30cm)	7	PusaVishwas		
		Very long (>30cm)	9	-		

21. (*)	Fruit: diameter (mature stage)	Small (<15cm)	3	ArkaChandan	50	MS
		Medium (15-30cm)	5	KashiHarit, Sooraj, Pusa Vishwas,CO-2		
		Large (>30cm)	7	KPS-1, NarendraAmrit		
22. (*) (+)	Fruit: shape	Heart shaped	1	CO-2	50	VG
		Round flat	2	NarendraAmrit		
		Oval or oblong	3	PusaVishwas		
		Rectangular	4	-		
		Spherical	5	NarendraAgrim		
		Pear shaped	6	-		
		Club shaped	7	-		
		Cylindrical	8	-		
23.	Fruit: main colour of skin (mature stage)	Cream (GYG-161C)	1	NarendraAmrit, CO-2	50	VG
		Green with creamy patches (GYG-162C)	2	Kashi Harit, Pusa Vishwas		
		Orange (OG-24D)	3	ArkaChandan		
24.	Fruit: waxiness of skin (at mature fruit stage)	Absent	1	-	50	VG
		Present	9	ArkaChandan, CO-2, PusaVishwas		
25.	Fruit: main colour of flesh	Creamy white (YG-11D)	1	NarendraAmrit	50	VG
		Yellowish orange (YOG-13C)	2	Pusa Vikas,Kashi Harit, Punjab Samrat		
		Greenish orange (GYG-1C)	3	Sooraj,CO-2		
		Orange	4	-		
		Dark orange (YOG-17C)	5	ArkaChandan, PusaVishwas		
26.	Fruit: thickness	Thin	3	Sooraj, Kashi Harit	50	MS

(*)	of flesh	(<2.5cm)				
		Medium (2.5-4.5cm)	5	Narendra Agrim, Sooraj, Pusa Vishwas		
		Thick (>4.5cm)	7	Narendra Amrit,CO-2		
27.	Fruit: diameter of scar (blossom end)	Small (<1cm)	3	NarendraAgrim	50	MS
		Medium (1-2cm)	5	Kashi Harit, KPS-1, Pusa Vishwas		
		Large (>2cm)	7	ArkaChandan, Sooraj		
28.	Seed: length	Short (<1.2cm)	3	Arka Chandan, Narendra Agrim, Sooraj	50	MS
		Medium (1.2-1.6cm)	5	Kashi Harit, KPS-1, Narendra Amrit, Punjab Samrat		
		Long (>1.6cm)	7	CO-2, PusaVikas		
29.	Seed: width	small (<0.6cm)	3	ArkaChandan	50	MS
		medium (0.6-0.9cm)	5	Sooraj, KashiHarit		
		large (>0.9 cm)	7	CO-2, PusaVishwas		
30.	Seed: colour of coat	cream (YW-158a, OW-159b)	1	NarendraAgrim, CO-2, KashiHarit	50	VG
		yellow (GY-162c)	2	Pusa Vikas, Narendra Amrit, Sooraj		
		White	3	-		
		Brown	4	-		

VIII. Explanation of table of characteristics

Ch.7: Leaf blade: margin

Entire or very weakly incised (1) Weakly incised (2) Moderately incised (3)

Ch. 16: Fruit: shape at peduncle end

Raised (1) Flat (2) Moderately depressed (3) Strongly depressed (4)

Ch. 17: Fruit: shape of blossom end (flower scar included)

Depressed (1) Flat (2) Raised (3)

Ch. 22: Fruit: shape

Heart Shaped (1) Flat round (2) Oval (3)

Rectangular (4)

Spherical (5)

Pear shaped (6)

Club shaped (7)

Cylindrical (8)

IX. DUS test centres

Nodal Centre	**Other Centre**
Indian Institute of Vegetable Research, P.B. No.- 01, P.O. -Jakhini (Shahanshahpur), Varanasi-221 305 (U.P.)	5. Indian Institute of Horticultural Research, Hessarghatta, Lake Post, Bengaluru-560089 (Karnataka). 6. Indian Agricultural Research Institute, Pusa, New Delhi-110012