



केन्द्रीय आलू अनुसंधान संस्थान परिसर, मोदीपुरम



DUS Test in Potato

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Why do we need DUS test?

- **GATT recognised agriculture as a rule bound enterprise of investment and profit making (1986-1994)**
- **WTO (Jan 1995) of which India is signatory**
- **TRIPs agreement was ratified by India and made provisions related to protection against unlawful commercial exploitation of new plant varieties, the right of farmers, plant breeders and to encourage the development of new varieties of plants**
- **PPV&FR Act (2001) provides the registration of new variety of plant if it conforms to the criteria of distinctness, uniformity and stability**
- **The identification of varieties of potatoes and other crops is important at all stages of production.**
- **Before a variety is registered as a cultivar and/or granted Plant Breeder's Rights, its distinctness, uniformity and stability (DUS) should be tested using morphological characters (descriptors).**
- **The identification of varieties of potatoes and other crops is important at all stages of production.**

Morphological descriptors in potato

- **The morphological descriptors of potato (e.g. plant height, leaf shape, time of flowering etc.) proposed by**
- **Pushkarnath,**
- **the International Union for the Protection of New Varieties of Plants (UPOV),**
- **the International Board of Plant Genetic Resources (IBPGR)**
- **and the Central Potato Research Institute (CPRI) at various times**
- **Currently a set of 51 DUS characters in potato are defined by CPRI**

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आलू

(*Solanum tuberosum* L.)

पर

विशिष्टता, एकसूत्रता तथा स्थायित्व
परीक्षण के लिए
दिशानिर्देशिका

**Guidelines
for the Conduct of Test for
Distinctiveness, Uniformity and Stability
On**

Potato

(*Solanum tuberosum* L.)



पौधा विभिन्न और कृषक अधिकार संरक्षण प्राधिकरण
Protection of Plant Varieties and Farmers' Rights Authority

(PPV & FRA)

भारत सरकार

Government of India

Test guidelines

◎ Planting material required

- **300 fully matured, skin cured tubers immediately (not later than 15 days) after harvest for each year of testing.**
- **The diameter of the tubers should be between 3.5 to 5.0 cm. The tubers supplied should be visibly healthy, not lacking in vigor or affected by any pest or disease or mechanical damage.**
- **The tubers shall not have undergone any chemical or bio-physical treatment unless the competent authority allow or request such treatment. If it has been treated, full details of the treatment must be given.**

Conduct of tests

- The tests should normally be at least two independent similar growing seasons with reference to the ecosystem of the candidate variety.
- The tests should normally be conducted at two test locations. If any important characteristic of the variety can not be seen at these places, variety may be tested at an additional location

- **Test plot details:**

No. of rows	:	4
Row length	:	2 m
Row to row distance	:	60 cm
Plant to plant distance	:	20 cm
Replications	:	3



- Observations should not be recorded on the border rows

Methods and observations

- **For the assessment of Distinctiveness and Stability, observations shall be made on 30 plants or parts of 30 plants, which should be divided among three replications (10 plants per replication).**
- **For the assessment of Uniformity of characteristics on the plot as a whole (visual assessment by a single observation on group of plants or parts of plants), a population standard of 1% with an acceptance probability of 95% shall be applied. In case of sample size of 120 plants, the number of off-types shall not exceed 2.**
- **Unless otherwise indicated all leaf/ leaflet characteristics will be observed on 4th fully developed leaf from the top of the plant.**
- **For the assessment of colour characteristics, latest Royal Horticultural Society (RHS) colour chart shall be used.**

Grouping of varieties

- **The candidate varieties for DUS testing should 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 purposes.**

- **The following characteristics shall be used for grouping of Potato varieties:**
 - a) **Light sprout : Predominant colour (Characteristic 1)**
 - b) **Stem : Predominant colour (Characteristic 11)**
 - c) **Flower : Corolla colour (Characteristic 29)**
 - d) **Tuber : Predominant skin colour (Characteristic 43)**

Growth stages code

- **30 days after withdrawal from cold storage** **30**
- **Full foliage growth (50 days after planting)** **50**
- **Full flowering: about 50% of flowers open** **65**
- **Ripening stage**
 (foliage turns yellow, after 90 days of planting) **90**
- **Harvest maturity (115 days after planting)** **115**

Type of assessment of characteristics

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 plant or parts of plants

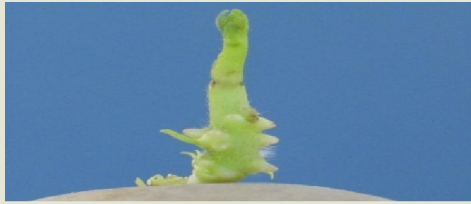
Major characters at various growth stages

Characters	No. of characters observed	Stage of observation
Sprout	6	30
Stem and leaves	18	50
Inflorescence	17	65
Duration	1	90
Tuber	9	115

Sprout

S. No.	Characters	State	Notes	Stage of Observation	Type of Assessment
1	Light sprout : predominant colour	White-green	1	30	VG
		Pink	2		
		Red-purple	3		
		Purple	4		
		blue-violet	5		
2	Sprout : shape	spherical	1	30	VG
		conical	2		
		cylindrical	3		
3	Light sprout : intensity of anthocyanin colouration at the base of sprout	light	3	30	VG
		medium	5		
		dark	7		
4	Light sprout : intensity of anthocyanin colouration at sprout tip	light	3	30	VG
		medium	5		
		dark	7		
5	Light sprout : pubescence	absent	1	30	VG
		weak	3		
		strong	5		
6	Light sprout : length of apical sprout	small (<2cm)	3	30	MS
		medium (2-5cm)	5		
		long (>5 cm)	7		

Predominant sprout color



Green



Pink



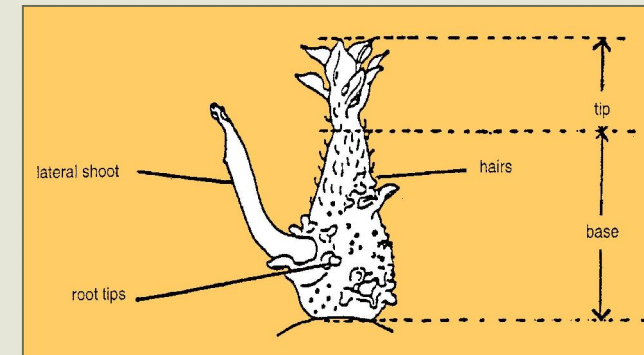
Red Purple



Purple



Dark Blue



Intensity of anthocyanin at base of sprout



Light



Medium



Dark

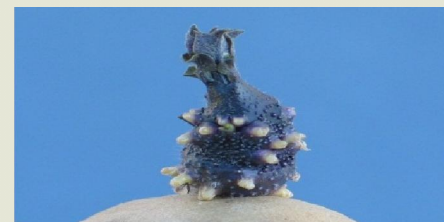
Intensity of anthocyanin at sprout tip



Light



Medium



Dark

Sprout shape



Bulbous



Cylindrical



Conical

Pubescence of Sprout



Absent



Slightly hairy



Hairy

Stem and Leaves

S. No.	Characters	State	Notes	Stage of Observation	Type of Assessment
7	Plant foliage structure	compact	1	50	VG
		semi-compact	2		
		open	3		
8	Stem : solidity	solid	1	50	VS
		hollow	2		
9	Stem : cross-section	round	1	50	VS
		angular	2		
10	Plant : height of main stem	short	3	50	MS
		medium	5		
		tall	7		
11	Stem : predominant colouration	green	1	50	VG
		Red-purple	2		
		Purple	3		
		dark purple	4		
12	Stem : secondary colouration	absent	1	50	VG
		green	2		
		red-brown	3		
		Purple	4		
		dark purple	5		

Stem and Leaves

S. No.	Characters	State	Notes	Stage of Observation	Type of Assessment
13	Stem : distribution of secondary colour	absent	1	50	VG
		only at base or lower nodes	2		
		lightly scattered throughout	3		
		highly scattered throughout	4		
14	Plant : wings	poorly developed	1	50	VG
		Highly developed	2		
15	Plant : wing type	straight	1	50	VG
		wavy	2		
16	Leaf : structure	open	1	50	VG
		intermediate	2		
		close	3		
17	Leaf : anthocyanin colour of rachis	absent	1	50	VG
		present	9		
18	Leaf : anthocyanin colour of mid-rib	absent	1	50	VG
		present only at the base	2		
		present throughout	3		

Stem and Leaves

S. No.	Characters	State	Notes	Stage of Observation	Type of Assessment
19	Leaf : length	small	3	50	MS
		medium	5		
		large	7		
20	Leaf : width	narrow	3	50	MS
		medium	5		
		broad	7		
21	Leaf : leaflet (lateral) shape	narrow lanceolate	1	50	VG
		lanceolate	2		
		ovate lanceolate	3		
		ovate	4		
		oval	5		
22	Leaflet : waviness of margin	weak	3	50	VG
		medium	5		
		strong	7		
23	Leaflet : glossiness of upper side	weak	3	50	VG
		medium	5		
		strong	7		
24	Leaflet : pubescence of blade at apical rosette	absent	1	50	VG
		present	9		

Plant canopy Structure



Compact



Medium Compact

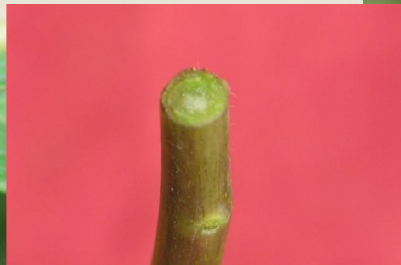


Open

Stem Solidity



Solid



Hollow

Stem cross section



Round



Angular

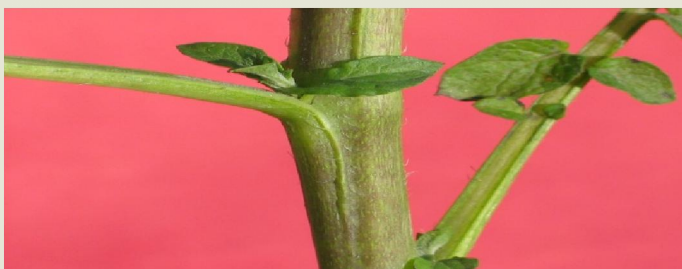
Stem pigmentation



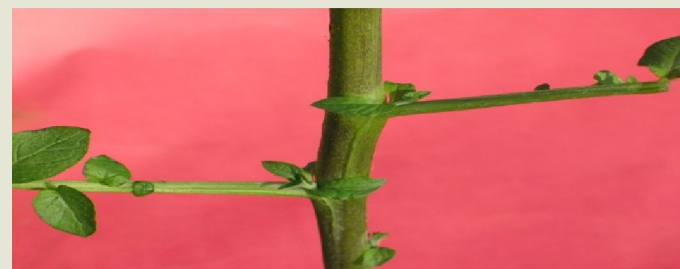
Green only



Green with some red-brown/purple pigment only at base or lower nodes



Mainly red-brown/ purple and some pigment may also be present in leaf midrib



Green with some red-brown/purple pigment randomly distributed through out the stem but always absent in leaf midrib

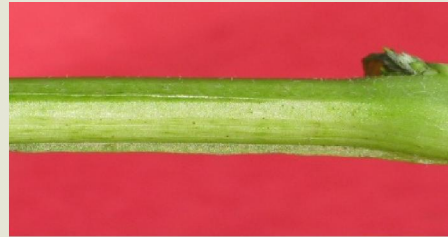


Dark purple

Wings type



Poorly developed



Straight



Wavy

Leaf structure



Closed



Medium



Open

Anthocyanin in rachis



Absent



Present

Leaflet shape



lanceolate



Ovate lanceolate



Narrow
Lanceolate



Oval



Ovate

Midrib color



Green only



Present only at base
of midrib



Through out the midrib

Inflorescence

S.No.	Characters	State	Notes	Stage of Observation	Type of Assessment
25	Flower : anthocyanin colouration of bud	absent	1	65	VG
		present	9		
26	Flower : anthocyanin colouration of floral stalk	absent	1	65	VG
		present	9		
27	Flower : anthocyanin colouration of pedicel articulation	absent	1	65	VG
		present	9		
28	Flower : pedicel articulation position	below the middle	1	65	VG
		at the middle	2		
		above the middle	3		
29	Flower : corolla colour	white	1	65	VG
		red-violet	2		
		blue-violet	3		
30	Flower : corolla size	smal	3	65	VG
		medium	5		
		large	7		

Inflorescence

S. No.	Characters	State	Notes	Stage of Observation	Type of Assessment
31	Inflorescence size	small	3	65	VG
		medium	5		
		large	7		
32	Flower : anthocyanin colouration of outer side in white flower	absent	1	65	VG
		present	9		
33	Flower : intensity of anthocyanin colouration of corolla on inner side	absent	1	65	VG
		weak	3		
		medium	5		
		strong	7		
34	Flower : anther colour	greenish yellow	1	65	VG
		yellow	2		
		orange	3		
35	Flower : anther cone type	normal	1	65	VG
		irregular	2		
36	Flower : pistil type	normal	1	65	VG
		irregular	2		

Inflorescence

S.No.	Characters	State	Notes	Stage of Observation	Type of Assessment
37	Flower : stylar length (in comparison to stamen column)	shorter	1	65	VG
		equal	2		
		longer	3		
38	Flower : stigma shape	round	1	65	VG
		lobed	2		
39	Flower : stigma lobe	uni-lobed	1	65	VG
		bi-lobed	2		
		tri-lobed	3		
40	Flower : frequency of flowers	absent	1	65	VG
		low	2		
		medium	3		
		high	4		
41	Flower : premature bud dropping	absent	1	65	VG
		present	9		

Inflorescence size



Small



Medium

Color of floral stalk



Green only



Pigmented

Floral stalk pedicel articulation



Below the middle



At the middle



Above the middle

Corolla color



White



Red-violet



Blue-violet

Intensity of corolla color



Weak



Medium



Strong

Anthocyanin of outer side in white flowers



Absent



Present

Anther color



Greenish yellow



Pale yellow



Orange

Anther cone formation



Normal

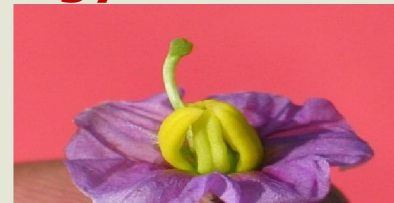


Irregular

Pistil morphology



Normal



Irregular

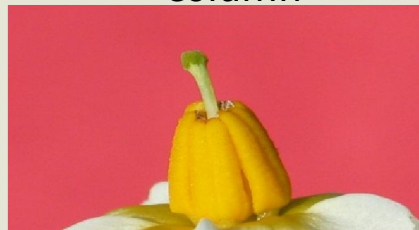
Stylar length



Shorter than stamen
column



Equal to stamen
column



Longer than stamen column



Much longer

Flower: Stigma lobes



Single



Bi-lobed



Tri-lobed

Flower: Premature bud abscission



Absent



Present

Flower: Degree of Flowering



Nil/Scanty



Moderate



Profuse

Tuber

S. No.	Characters	State	Notes	Stage of Observation	Type of Assessment
42	Plant : time of maturity	early	1	90	MG
		medium	2		
		late	3		
43	Tuber : predominant skin colour	white cream	1	115	VG
		yellow	2		
		orange	3		
		brown	4		
		pink	5		
		red	6		
		reddish purple	7		
		purple	8		
		dark purple-black	9		
44	Tuber : secondary skin colour	absent	1	115	VG
		white cream	2		
		orange	3		
		brown	4		
		pink	5		
		red	6		
		reddish purple	7		
		purple	8		
		dark purple-black	9		

Tuber

S.No.	Characters	State	Notes	Stage of Observation	Type of Assessment
45	Tuber : distribution of secondary skin colour	absent	1	115	VG
		confined to eyes	2		
		present on eye-brow only	3		
		spectacled (only around eues)	4		
		splashed	5		
		stipples	6		
46	Tuber : skin type	smooth	1	115	VG
		rough	2		
47	Tuber : shape	flattened	1	115	VG
		round	2		
		ovoid	3		
		oblong	4		
		pear shaped	5		
		long-oblong	6		
		reniform	7		
		irregular	8		

Tuber: Tuber Skin color



White-Cream



Yellow



Orange



Brownish



Pink



Red



Purplish Red



Purple

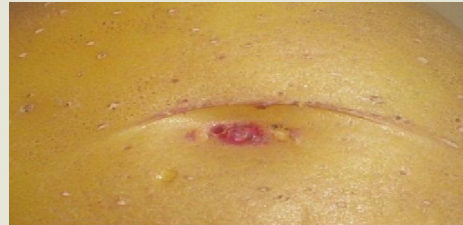


Black

Tuber: distribution secondary skin colour



Absent



Confined to eyes



Present on eye brow



Only around eyes



Splashed all over tuber

Tuber: Skin Type



Smooth



Rough

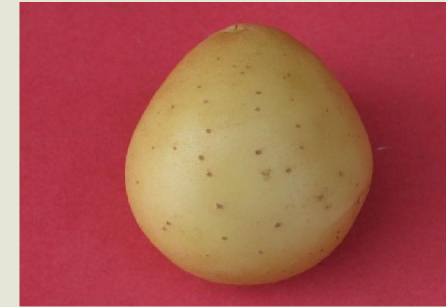
Tuber: General tuber shape



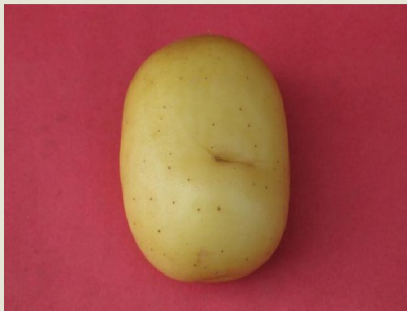
Flattened



Round



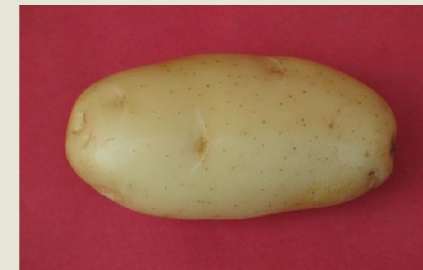
Ovoid



Oblong



Pear Shape



Long-Oblong



Reniform



Irregular

Tuber: Eye Depth



Protruding



Shallow



Medium Deep



Deep

Tuber: Predominant flesh color



White



Cream



Yellow

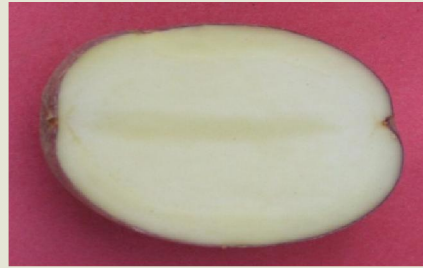


Dark purple

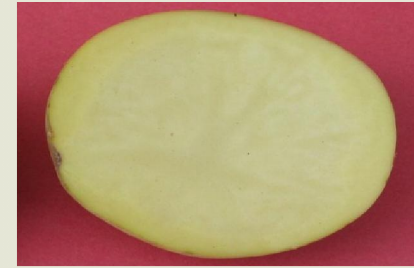
Tuber: Secondary flesh color



Absent



White



Cream



Yellow



Red-purple



Dark purple

Tuber: Distribution of secondary flesh color



Outer cortex



Inner cortex



Vascular ring



Thank You



भारत
ICAR



*Agr*search with a human touch

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

