

Basic Rules for DUS Test

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Contents

1. Purpose of DUS test

2. Role of DUS test

- definition of a variety**
- How to observe characteristics**
- Examination of DUS**

UPOV principles

■ Conditions for Protection

Article 5; 91 Act of the UPOV

[Criteria to be satisfied] The breeder's right shall be granted where the variety is

- **New**
- **Distinct**
- **Uniform**
- **Stable**

[Other conditions]denomination, fees

What is DUS?

Distinctness

D: must be distinguishable from any other varieties



candidate variety



What is DUS?

Uniformity

U: must be uniform



What is DUS?

Stability

S: must be unchanged after repeated propagation



Next generation



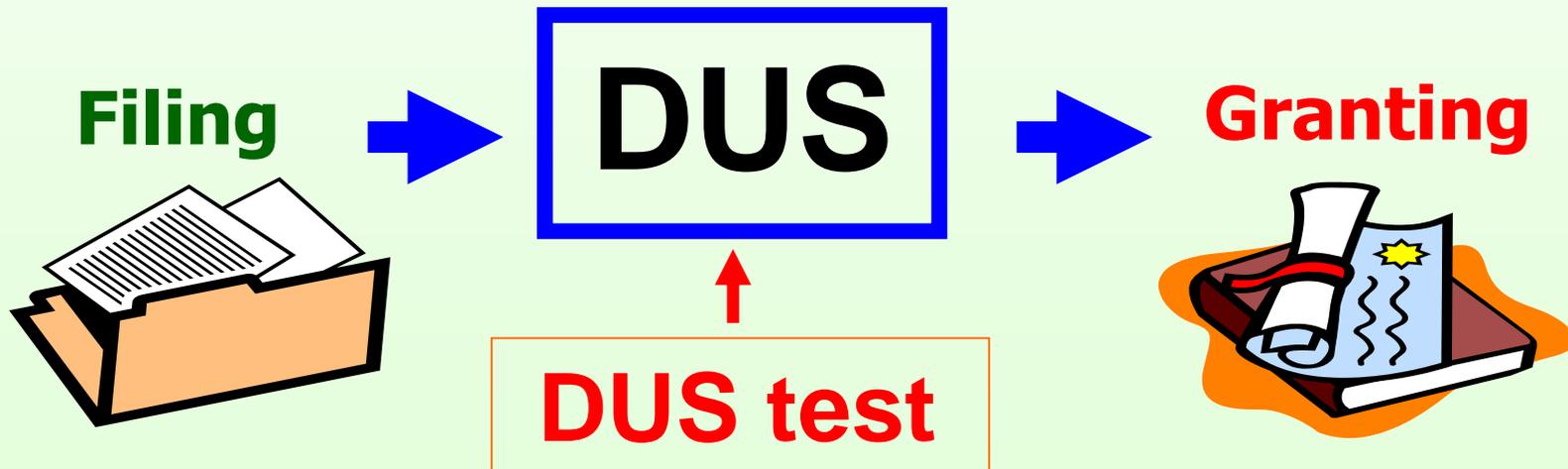
Next generation

UPOV principles

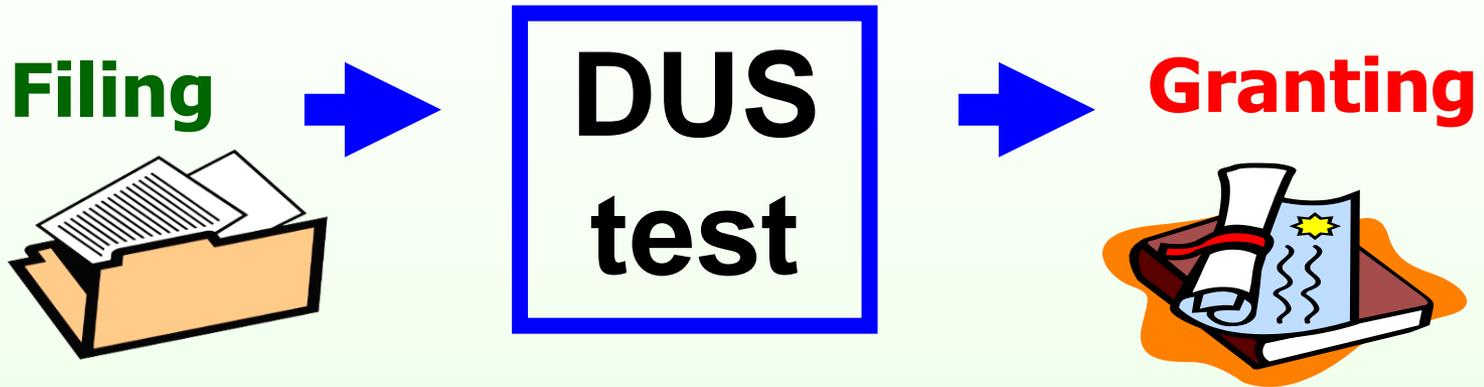
■ Examination of the Application

Article 12; 91 Act of the UPOV

Any decision to grant a breeder's right shall require an examination for compliance with the conditions under article 5 to 9.



DUS test



- ▶ **DUS test**
 - ✓ a test to be conducted before protection is granted for new varieties
 - ✓ to assess whether the variety meets the DUS requirements

What should we do in the DUS test?

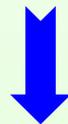
Purpose of DUS test

■ Characteristics as the Basis for Examination of DUS

TG/1/3: 2.4

1. For any variety to be capable of protection *it must first be clearly defined*.
2. Only after a variety has been defined *can it be finally examined for fulfillment of the DUS criteria* required for protection.
3. a *variety is defined by its characteristics* and that those characteristics are therefore the basis on which a variety can be examined for DUS.

characteristics →
basis for examining DUS of a variety.



purpose of DUS test

1. Definition of the variety using the characteristics
2. Examination of DUS

Role of

DUS test

- 1. Definition of a variety
using the characteristics**

Definition of a variety

■ How to define the variety



UPOV		TG/246/1 ORIGINAL: English DATE: 2007-03-28	E	
INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS GENEVA				
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> MARIGOLD UPOV Code: TAGET Tagetes L. </div>				
GUIDELINES FOR THE CONDUCT OF TESTS FOR DISTINCTNESS, UNIFORMITY AND STABILITY				
Alternative Names: (*)				
Botanical name	English	French	German	Spain
Tagetes L.	Marigold	Tagète, + Œillet d'Inde, +	Staudenblume	Clavel Clavel Comp
The purpose of these guidelines ("Test Guidelines") is to elaborate the principles of General Introduction (document TG1/5), and its associated TGP documents, into detailed guidance for the harmonized examinations of distinctness, uniformity and stability (DUS) in particular, to identify appropriate characteristics for the examination of DUS and harmonized variety descriptions. (*)				
ASSOCIATED DOCUMENTS These Test Guidelines should be read in conjunction with the General Introduction and TGP documents.				

TG/246/1
Marigold/Tagète/Staudenblume/Clavel de las Indias, Clavelón, Compositáceafl., 2007-03-28
8

7. Table of Characteristics/Tableau des caractères/Merkmalstabelle/Tabla de caracteres

	English	français	Deutsch	español	Example Varieties / Exemples / Ejemplos/varietes / Variedades ejemplo	Notes
1.	Hypocotyl anthocyanin coloration	Hypocotyle pigmentation anthocyanique	Hypokotyl Anthocyanfärbung	Hipocotilo pigmentación antocianica		
QL	absent	absente	fehlerd	ausente		1.
	present	présente	vorhanden	presente		9.
2.	Plant fragrance	Plante: parfum	Pflanze: Duft	Planta: fragancia		
QL	absent	absent	fehlerd	ausente	Havana	1.
	present	présent	vorhanden	presente	Cupidón/Double	9.
3.	Plant height	Plante: hauteur	Pflanze: Höhe	Planta: altura		
QN	very short	très basse	sehr niedrig	muy pequeña	Cupidón, Golden Boy	1.
	short	basse	niedrig	pequeña	Mistral Spry	3.
	medium	moyenne	mittel	media	Golden Jubilee, Monsieur Majestic	5.
	tall	haute	hoch	grande	Jaune Supreme, Sésame	7.
	very tall	très haute	sehr hoch	muy grande	Lemon Queen, + Orange Prince	9.
4.	Plant growth habit	Plante: port	Pflanze: Wuchsform	Planta: porte		
QN	upright	dressé	aufrecht	erecto	Puebla	1.
	semi upright	semi-dressé	halbaufrecht	semierecto	Nueva	3.
	spreading	étalé	breitwüchsig	aberto	Tepeaca	5.
5.	Plant branching	Plante: ramification	Pflanze: Verzweigung	Planta: ramificación		
QN	absent or weak	absente ou faible	fehlerd oder gering	ausente o débil	Morales	1.
	medium	moyenne	mittel	media	Chapango	3.
	strong	forte	stark	fuerte	Oriental	5.

Definition of a variety

■ Variety description

total 34 chars.



Char No.	Characteristics	States of Expression	Notes
1	Hypocotyl: anthocyanin coloration	absent	1
2	Plant: fragrance	present	9
3	Plant: height	medium	5
4	Plant: growth habit	semi upright	3
5	Plant: branching	strong	3
6	Stem: anthocyanin coloration	absent	9
7	Stem: intensity of anthocyanin coloration	--	
8	Leaf: type	pinnate	2
..	

The variety description → defined by the expression of characteristics

Definition of a variety

■ Variety description

total 65 chars.



Char No.	Characteristics	States of Expression	Notes
1	Coleoptile: anthocyanin coloration	weak	3
2	Basal leaf: sheath color	light purple	3
3	Leaf: intensity of green color	medium	5
4	Leaf: anthocyanin coloration	present	9
5	Leaf: distribution of anthocyanin coloration	margin only	2
6	Leaf sheath: anthocyanin coloration	present	9
7	Leaf sheath: intensity of anthocyanin coloration	weak to medium	4
8	Leaf: pubescence of blade	weak to medium	4
9

The variety description → defined by the expression of characteristics

Definition of a variety

Variety description

■ Characteristics as the Basis for Examination of DUS

TG/1/3: 2.4

* a *variety is defined by its characteristics* and that those characteristics are therefore the basis on which a variety can be examined for DUS.

Marigold			
Char No.	Characteristics	States of Expression	Notes
1	Hypocotyl: anthocyanin coloration	absent	1
2	Plant: fragrance	present	9
3	Plant: height	medium	5
4	Plant: growth habit	semi upright	3
5	Plant: branching	strong	3
6	Stem: anthocyanin coloration	absent	9
7	Stem: intensity of anthocyanin coloration	--	
8	Leaf: type	pinnate	2
..	

Rice			
Char No.	Characteristics	States of Expression	Notes
1	Coleoptile: anthocyanin coloration	weak	3
2	Basal leaf: sheath color	light purple	3
3	Leaf: intensity of green color	medium	5
4	Leaf: anthocyanin coloration	present	9
5	Leaf: distribution of anthocyanin coloration	margin only	2
6	Leaf sheath: anthocyanin coloration	present	9
7	Leaf sheath: intensity of anthocyanin coloration	weak to medium	4
..	

How to observe

Characteristics

- ✓ **Type of expression of characteristics**
- ✓ **Type of assessment**

Type of expression of characteristics

- QL
- QN
- PQ

Type of expression of characteristics: **QL**

QL

Qualitative

Characteristics

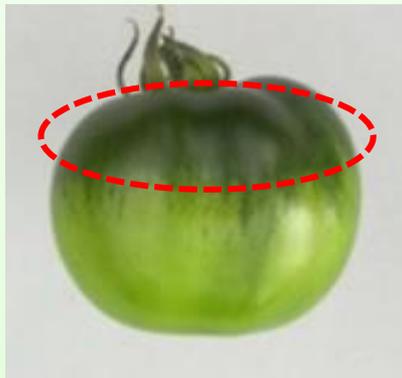
Type of expression of characteristics: **QL**

- ✓ Expressed in discontinuous states
- ✓ As a rule, the characteristics are not influenced by environment

Fruit : green shoulder (before maturity)



Absent 1



Present 9

Stem: anthocyanin coloration of nodes (rice)



Absent 1



Present 9

Type of expression of characteristics: QL

**Ligulate floret: incision of margin
(Marigold)**



Absent 1



Present 9

**flower: presence of eye zone
(Impatiens)**



Absent 1



Present 9

Type of expression of characteristics: **QL**

Tree: sex expression of flowers (persimmon)

16. (*)	(a) Tree: sex expression of flowers	Example variety	Notes
QL	female only	Fuyu, Hiratanenashi, Jiro	1
	female and male	Hanagosho	2
	female, male and hermaphrodite	Kubogataobishi, Meotogaki	3

ploidy (watermelon)

1	VG	Ploidy	Example variety	Notes
(*)				
(+)				
QL		diploid	SP 4, Sugar Baby, Yamato 3	2
		triploid	Boston, TRIX 313	3
		tetraploid		4

Type of expression of characteristics: **QN**

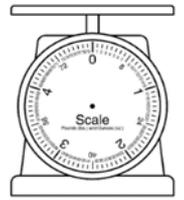
QN

Quantitative

Characteristics

Type of expression of characteristics: QN

- ✓ can be recorded on a one-dimensional scale and show continuous variation
- ✓ height, length, width, thickness, weight,...



	English	Example variety	Note
3	Plant: height		
(*)			
QN	short	Mistral, Spry	3
	medium	Golden Jubilee, Monsieur Majestic	5
	tall	Jaune Supreme, Sourire	7

Type of expression of characteristics: QN

“1-9” scale

notes	states
1	very small (or: absent or very small)
2	very small to small
3	small
4	small to medium
5	medium
6	medium to large
7	large
8	large to very large
9	very large

notes	states
1	very weak (or: absent or very weak)
2	very weak to weak
3	weak
4	weak to medium
5	medium
6	medium to strong
7	strong
8	strong to very strong
9	very strong

Type of expression of characteristics: **QN**

Ear: length of peduncle



3



5



7

Stem: anthocyanin coloration of brace roots



1



3



5



7



9

25

Type of expression of characteristics: QN

■ Limited range

“1-5” scale

Stem: attitude

note	states
1	erect
3	semi-erect
5	prostrate

“1-4” scale

leaf blade: angle of apex

note	states
1	acute
2	Right-angled
3	moderately obtuse
4	strongly obtuse

“1-3” scale

Flower: fragrance

note	states
1	Absent or very weak
2	weak
3	strong



Type of expression of characteristics: PQ

PQ

Pseudo Qualitative

Characteristics

Type of expression of characteristics: PQ

- ✓ range of expression is at least partly continuous, but varies in more than one dimension
- ✓ shape, color

	English	Example variety	Note
18 (+)	Ligulate floret: shape		
PQ	flat	Teo	1
	intermediate	Ah-Kin	2
	trumpet	Tlalocan	3



flat



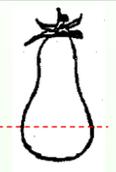
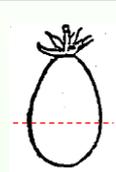
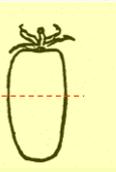
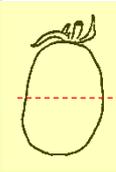
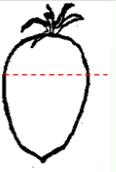
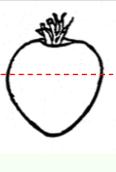
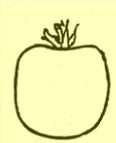
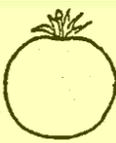
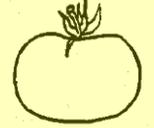
intermediate



trumpet

Type of expression of characteristics: PQ

(Tomato)
Fruit: shape in
longitudinal
section

		← broadest part →						
		(below middle)		at middle		(above middle)		
narrow (elongated) → width (ratio length/width) ← broad (compressed)	 10 pyriform	 8 ovate	 5 cylindric	 6 elliptic	 9 obovate	 7 cordate		
	 11 obcordate	 4 oblong	 3 circular					
				 2 oblate				
				 1 flattened				

Type of expression of characteristics: PQ

TG/44 Tomato

	English	Example variety	Note	
28	Fruit: shape in longitudinal section			
(*)				
(+)				
PQ		flattened	Campbell 28, Marmande VR	1
VG		oblate	Montfavet H 63.4, Montfavet H 63.5	2
		circular	Cerise, Moneymaker	3
		oblong	Early Mech, Peto Gro	4
		cylindric	Hypeel 244, Macero II, San Marzano 2	5
		elliptic	Alcaria, Castone	6
		cordate	Valenciano	7
		ovate	Dualrow, Soto	8
	obovate	Duquesa, Estelle Rimone, Rio Grande	9	
	pyriform	Europeel	10	
	obcordate	Cuore del Ponente, Magno	11	

Type of expression of characteristics: PQ

TGs for Rice

61 (*)	92 VS	Decorticated grain: color	Example varieties	Note
PQ		white	NTL1	1
		light brown	Bắc thơm số 7	2
		variegated brown		3
		dark brown		4
		light red		5
		red	DTL2	6
		variegated purple		7
		purple		
		dark purple/black		



1



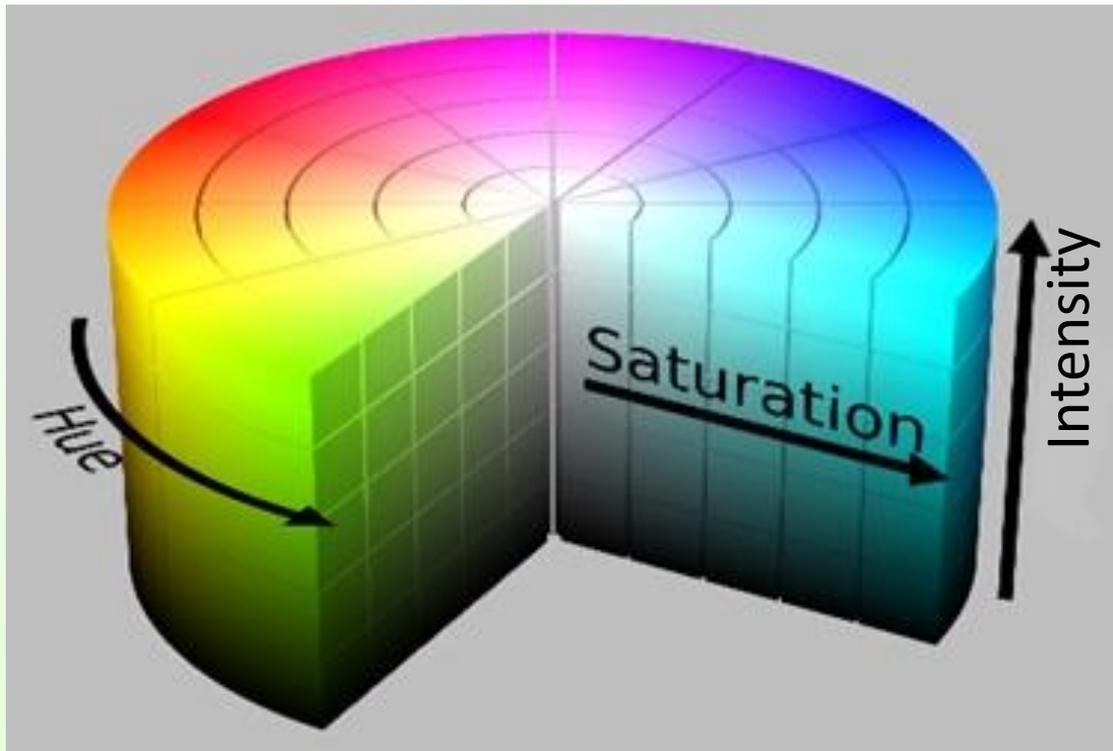
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31

Kaneda;2005

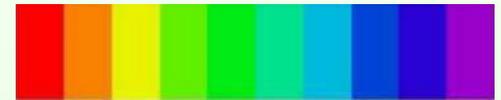
Type of expression of characteristics: PQ



<https://codewords.recurse.com>

Color: three dimension

Hue



Saturation

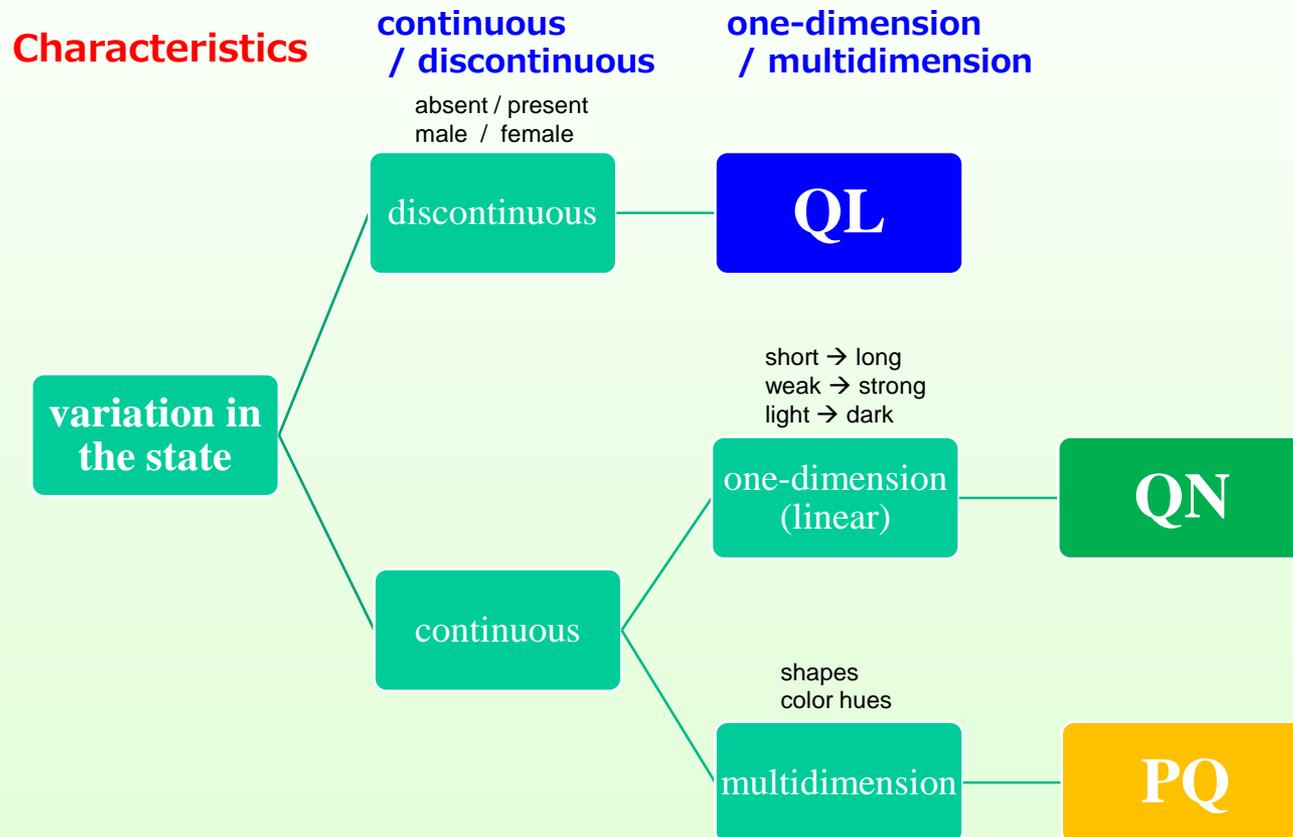


Intensity (Brightness)



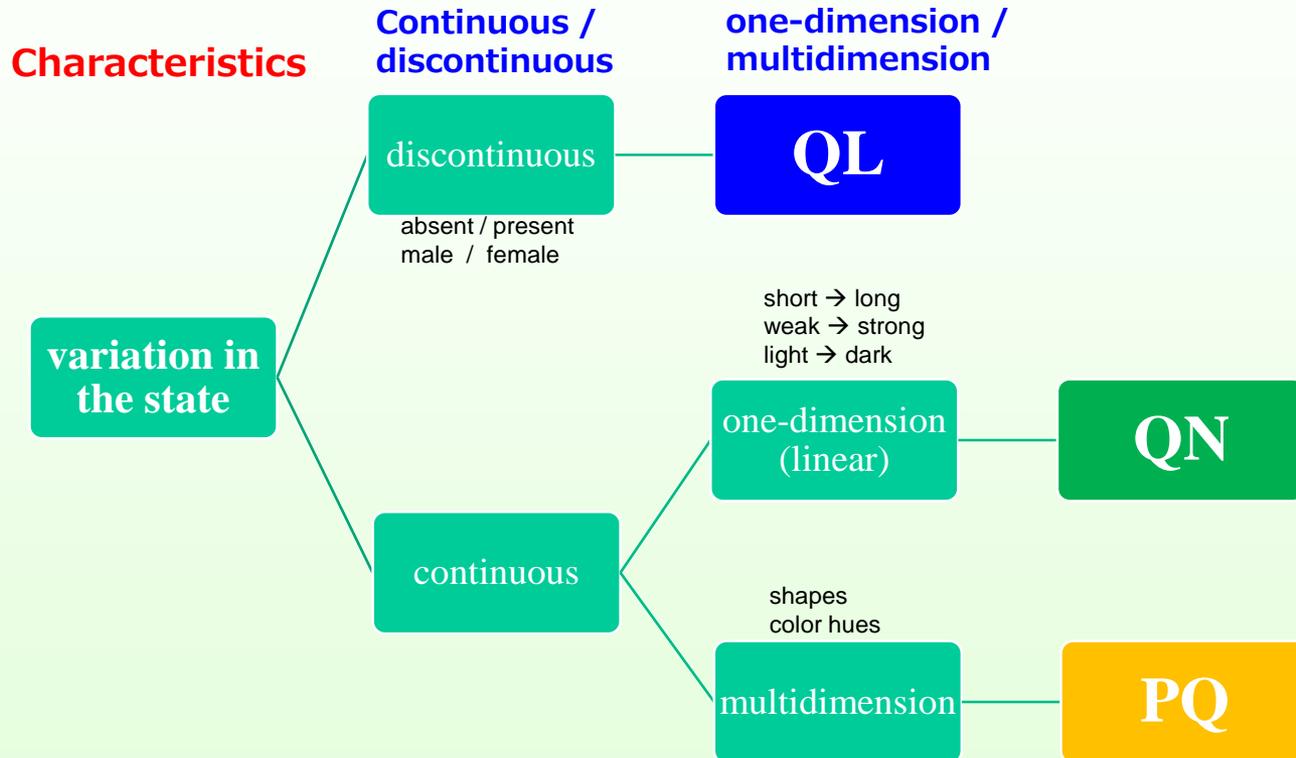
Type of expression of characteristics

Decision making chart



Type of expression of characteristics

Decision making chart



Leaf: intensity of green color



Type of assessment

- Method of Observation
- Type of record

Type of assessment

			Corn
16. (*)	VG	Ear: anthocyanin coloration of silks	
QN		absent or very weak weak medium strong very strong	Bonus (SC), F7, F195, El Toro (SC), F257 F244, Gyöngymazsola (SC) W401 1 3 5 7 9
8.	MG	Tassel: time of anthesis	
PQ	(c)	very early very early to early early early to medium medium medium to late late late to very late very late	Jazon, White Mirabell Goldene Königin, Yellow Pear Sungold Aichi First Daniela, Ferline, Montfavet H 63.5 Ozyrys Green Grape, Green Zebra AM1513 1 2 3 4 5 6 7 8 9

Type of assessment

Method of observation

M (measurement) : using a ruler, weighing scales, dates, counts, etc.

V (visual) : visual observation includes smell, taste and touch

Type of record

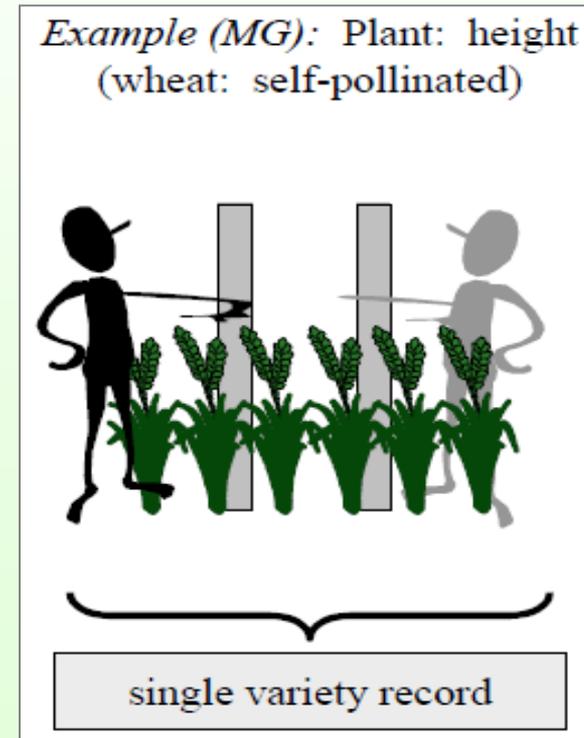
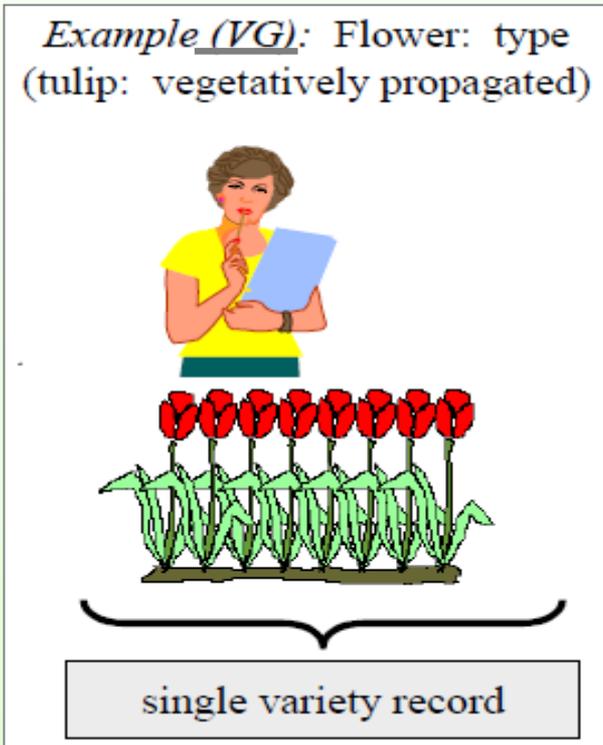
G (Group) : single record for a variety, or a group of plants or parts of plants

S (Single) : record for a number of single, individual plants or parts of plants

Type of assessment

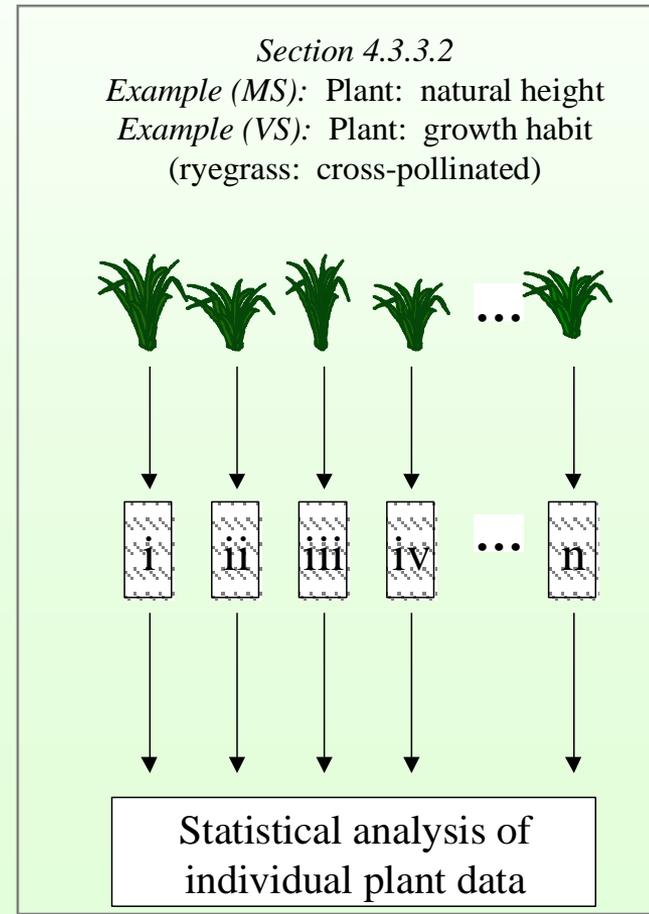
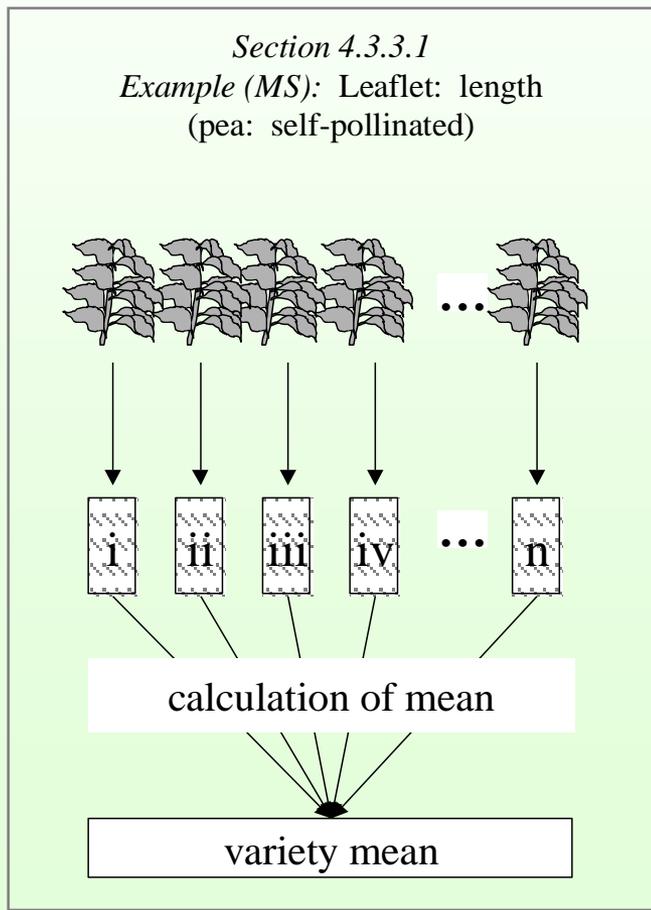
VG : Visual assessment by a single observation of a group of plants or parts of plants.

MG : Measurement by a single observation of a group of plants or parts of plants.



Type of assessment

- MS** : Measurement of a number of individual plants or parts of plants.
- VS** : Visual assessment by observation of a number of individual plants or parts of plants.



Type of assessment

28.

MS

Ear: length

QN

very short

1

short

F2

3

medium

A654, Spirit (SC)

5

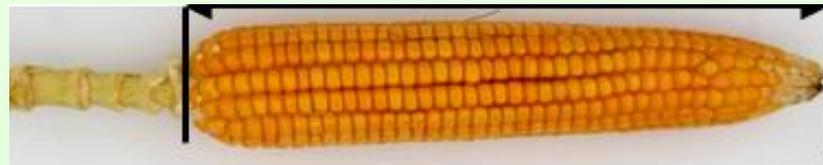
long

Empire (SC), MO17

7

very long

9



Type of assessment

■ Assessment of Distinctness

	Type of expression of characteristic		
Method of propagation of the variety	VG QL (visual observation)	VG PQ (visual observation)	VG (TGP/9 4.5) QN
Vegetatively propagated	VG	VG	VG/MG/MS
Self-pollinated	VG	VG	VG/MG/MS
Cross-pollinated	VG/(VS*)	VG/(VS*)	VS VG/MS/MG
Other hybrids	VG/(VS*)	VG/(VS*)	**

* Records of individual plants only necessary if segregation is to be recorded.

** To be considered according to the type of hybrid.

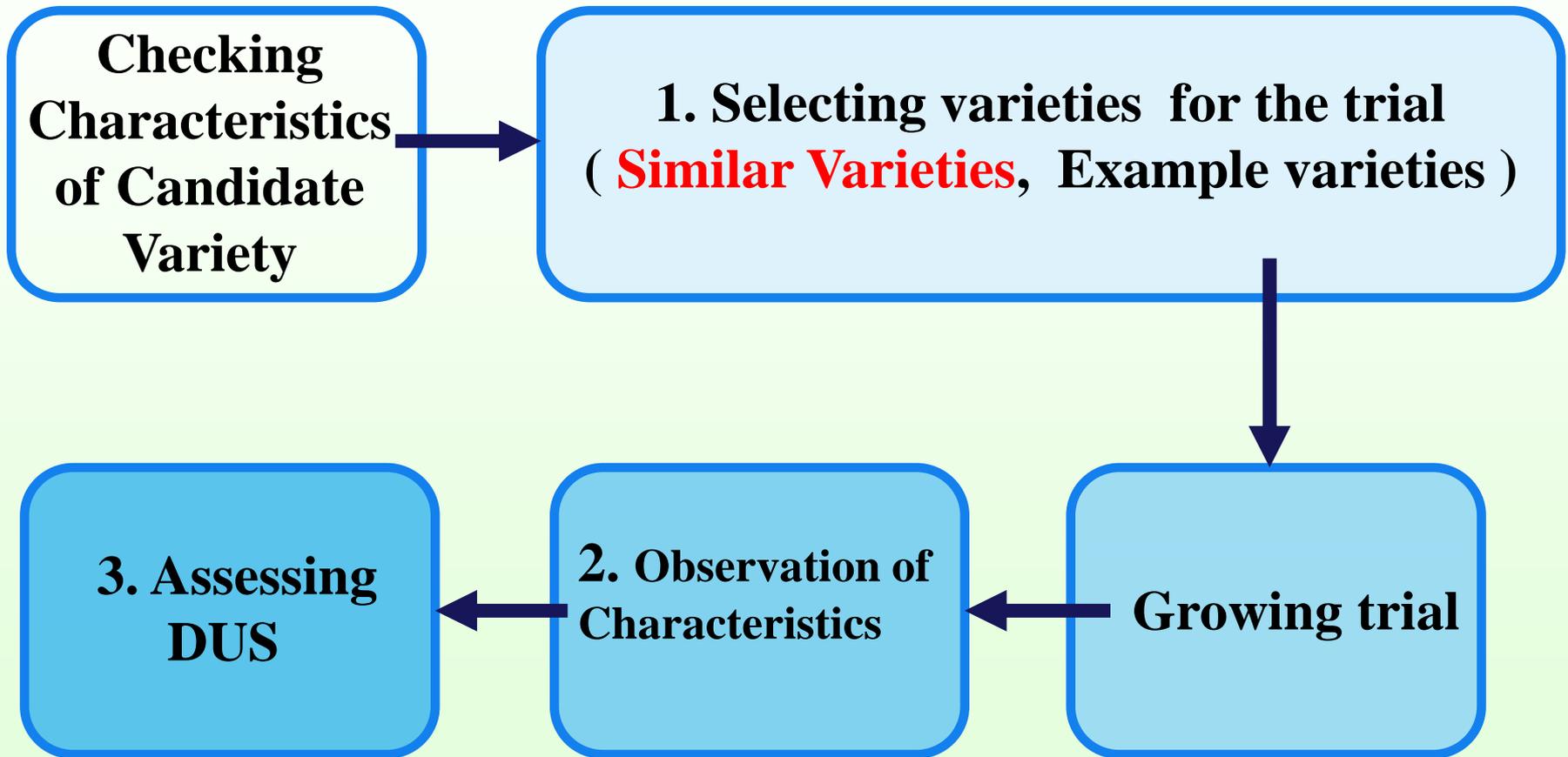
- listed first is most common method

Role of

DUS test

2. Examination of DUS

Workflow of the DUS test



DUS test

DUS test



Candidate variety



Similar varieties



Example varieties

Similar varieties: Varieties very close to the candidate varieties in morphological, physiological characteristics

Example varieties: Varieties to clarify the states of expression of a characteristic, then to assist with preparation of the description



Distinctness examination

- **Selection of similar varieties**
- **Clearly distinguishing new variety**

Distinctness

Requirement:

Article 7; 91 Act of the UPOV

- The variety shall be deemed to be distinct if it is **clearly distinguishable from any other variety** whose existence is a matter of common knowledge at the time of the filing of the application.

clearly distinguishable => **1. Consistent**
2. Clear

from any other variety => common knowledge

Clearly Distinguishable from any other varieties ?

TG/1/3: 5.3.1.1

"it is necessary to examine distinctness in relation to all varieties of common knowledge. However.."



VS



Compare Candidate variety VS Existing varieties 47

Selection of Similar Varieties

Where a candidate variety is sufficiently different from particular group of varieties,



VS



No need to compare the candidate variety with different group of varieties

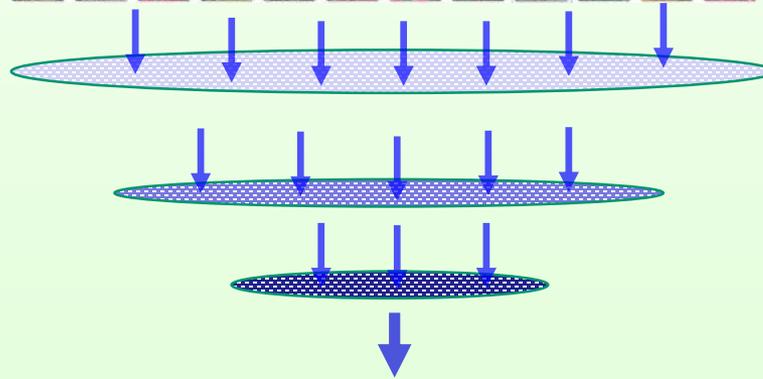
How to select different group of varieties?

Selection of Similar Varieties

Selecting the similar varieties



Candidate varieties



Grouping characteristics



Similar varieties 49

Grouping characteristics

■ Grouping characteristics: Cymbidium

(a) Plant: size (char. 1)

(b) Inflorescence: number of flowers (char. 20)

(c) Peduncle: attitude (char. 24)

(d) Flower: general impression of petals and sepals (char. 28)

(e) Flower: length (char. 29)

(f) Flower: width (char. 30)

(g) Flowering time (char. 100)

(h) Flower: predominant color (Technical Questionnaire 5.8)

Selection of Similar Varieties

No need to compare the candidate variety with different group of varieties



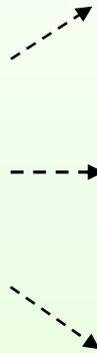
VS



Selection of Similar Varieties



Candidate varieties



≠



≠



≠



Similar varieties

the candidate variety is considered to be distinguished to all existing varieties

Selection of Similar Varieties



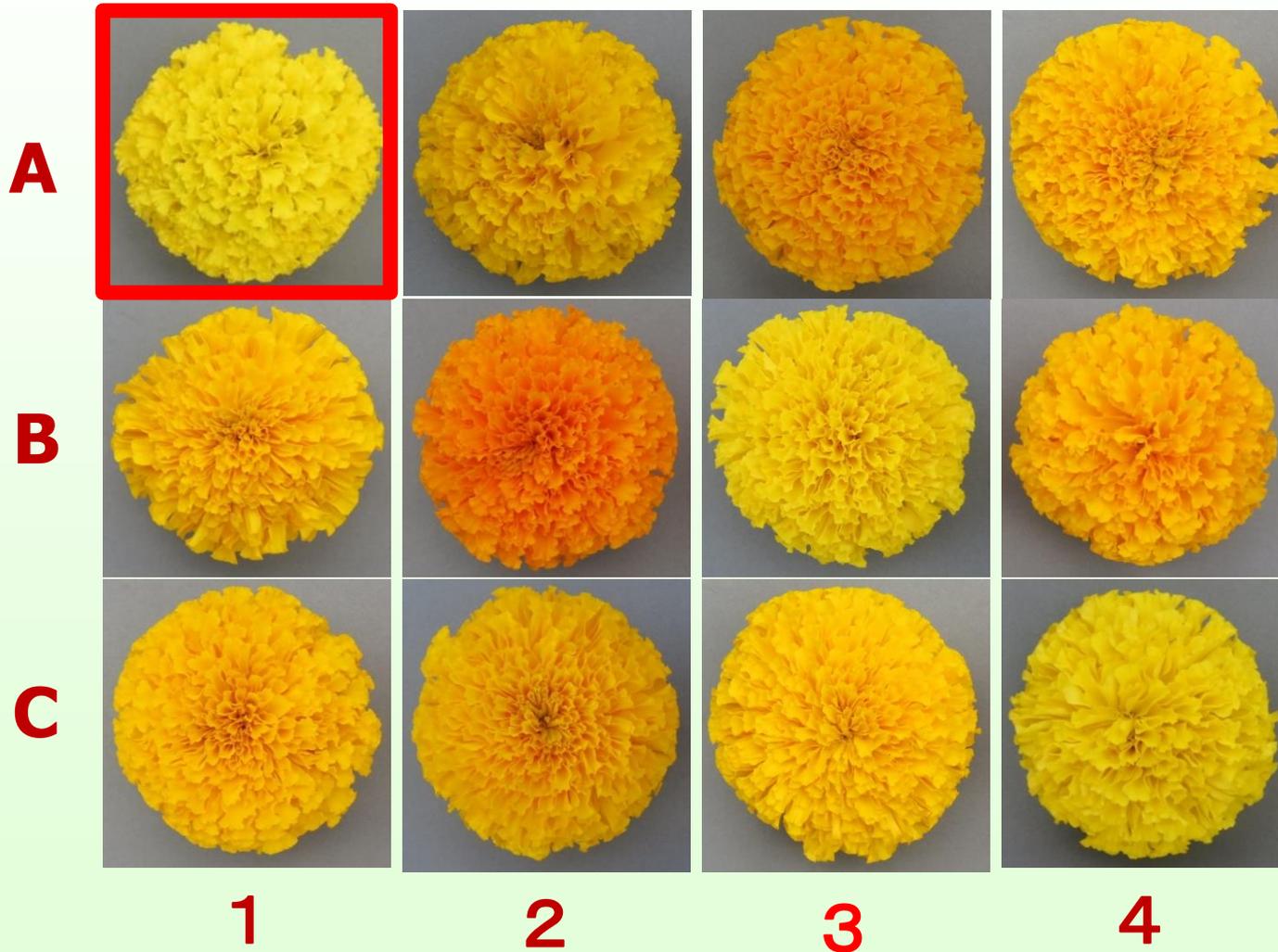
VS



No need to compare candidate variety with different group of varieties

Distinctness

Clear difference

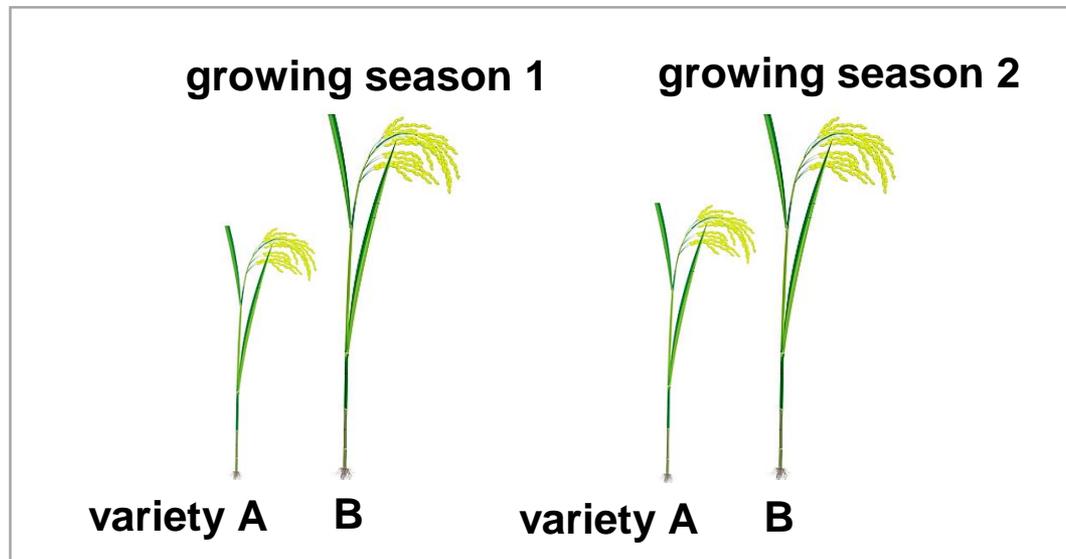


Distinctness

Consistent difference

1. Consistent difference:

To ensure sufficient consistent is to examine the characteristics in at two independent growing cycles.



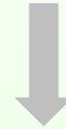
Differences have to occur in two growing cycles

Distinctness

Clear difference

2. Clear differences:

Determining whether a difference between two varieties is clear **depends on the type of expression of the characteristics.**



QL: Qualitative

QN: Quantitative

PQ: Pseudo-Qualitative

Distinctness

Clear difference

QL characteristics:

TG/1/3: 5.3.3.2.1

Requires:

- the difference between two varieties may be considered clear if one or more characteristics have expressions that **fall into two different states in the Test Guidelines**

Different "states" can be considered to be Distinct

Distinctness

Clear difference

QN characteristics:

TG/1/3: 5.3.3.2.2

- For QN, a **difference of two Notes often represents a clear difference**, but that is not an absolute standard for assessment of distinctness. Depending on factors, such as the testing place, the year, environmental variation or range of expression in the variety collection, a clear difference may be more or less than two Notes. Guidance is provided in document TGP/9, ‘Examining Distinctness’.”

✓ **“Two Notes” rule**

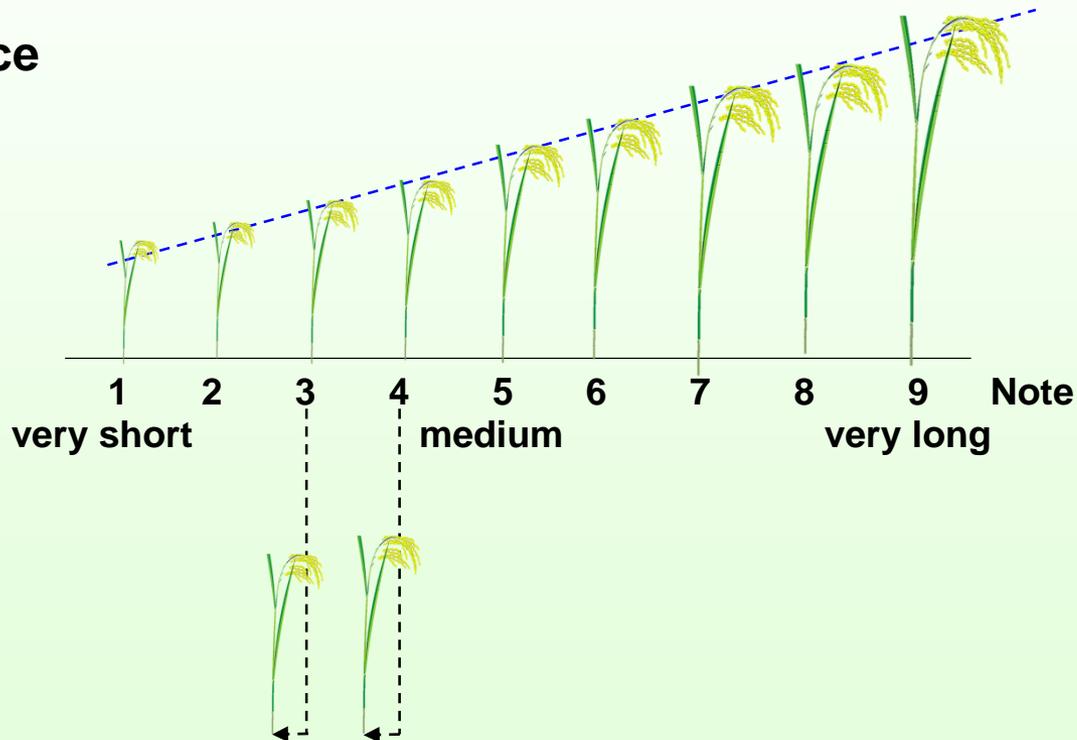
Distinctness

Clear difference

QN characteristics:

(stem: Length)

clear difference



Note 3: 4 → may NOT be clear difference

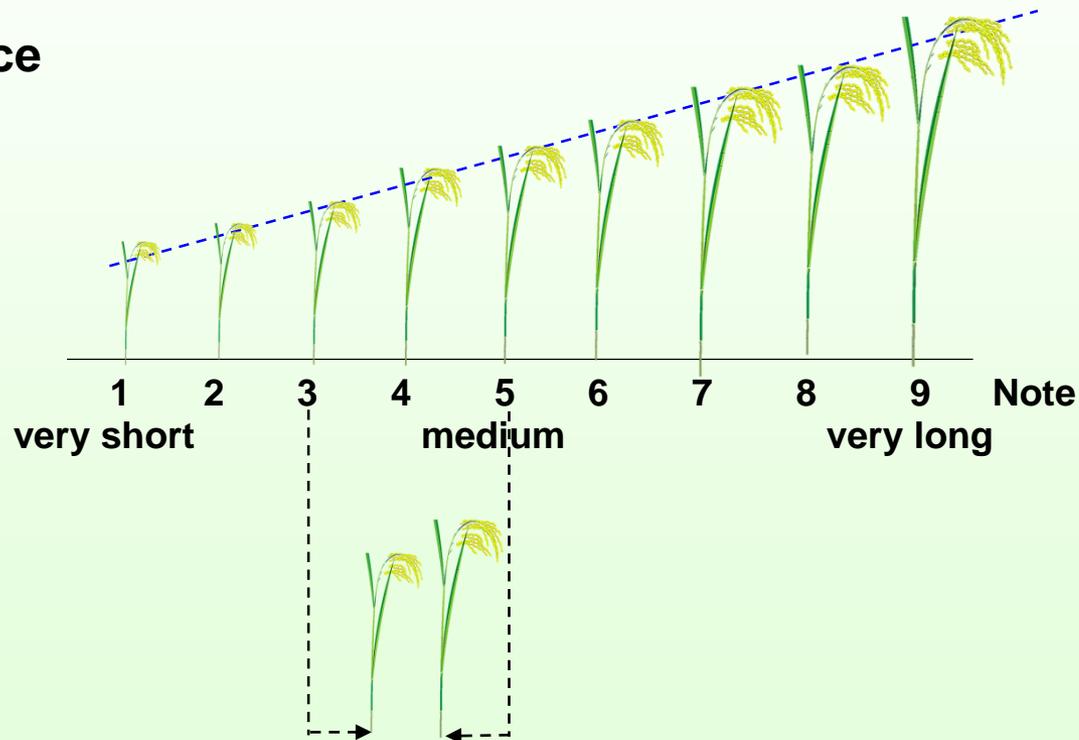
Distinctness

Clear difference

QN characteristics:

(stem: Length)

clear difference



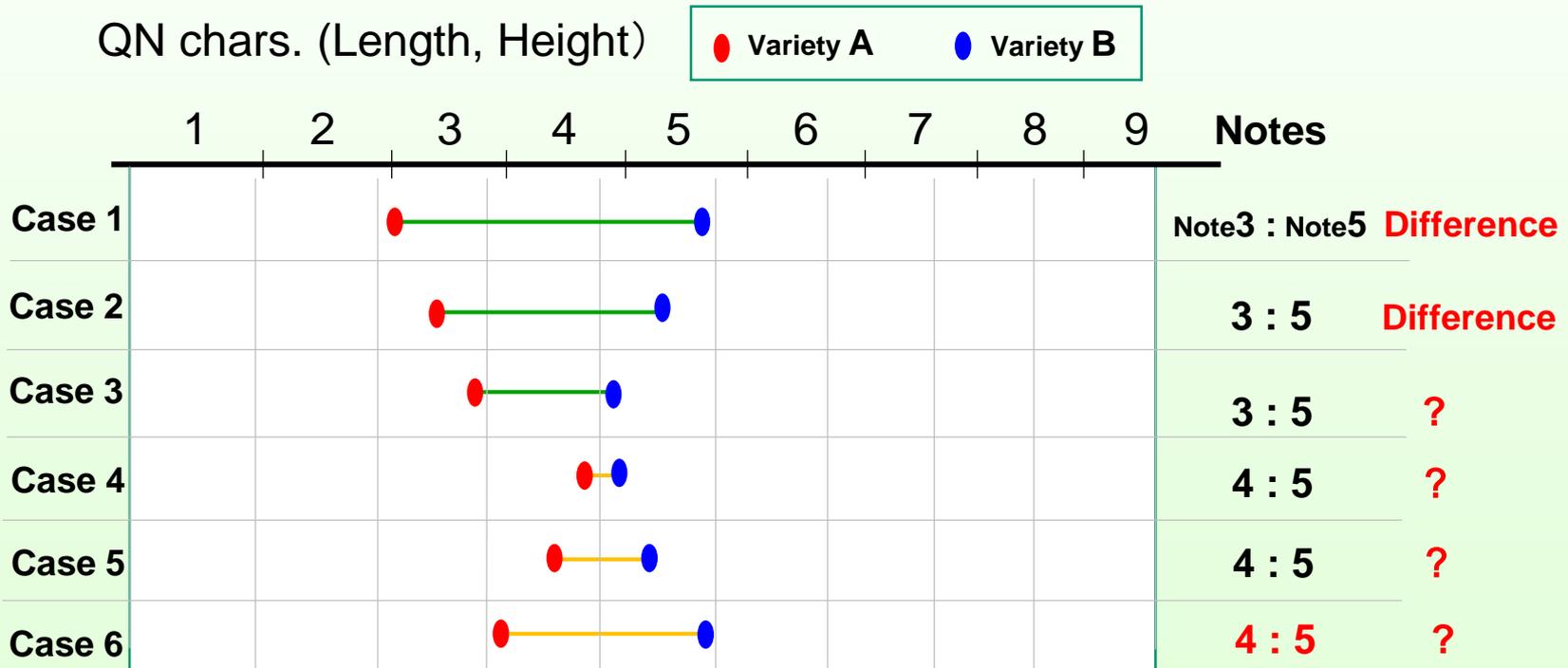
Note 3: 5 → may be clear difference

Distinctness

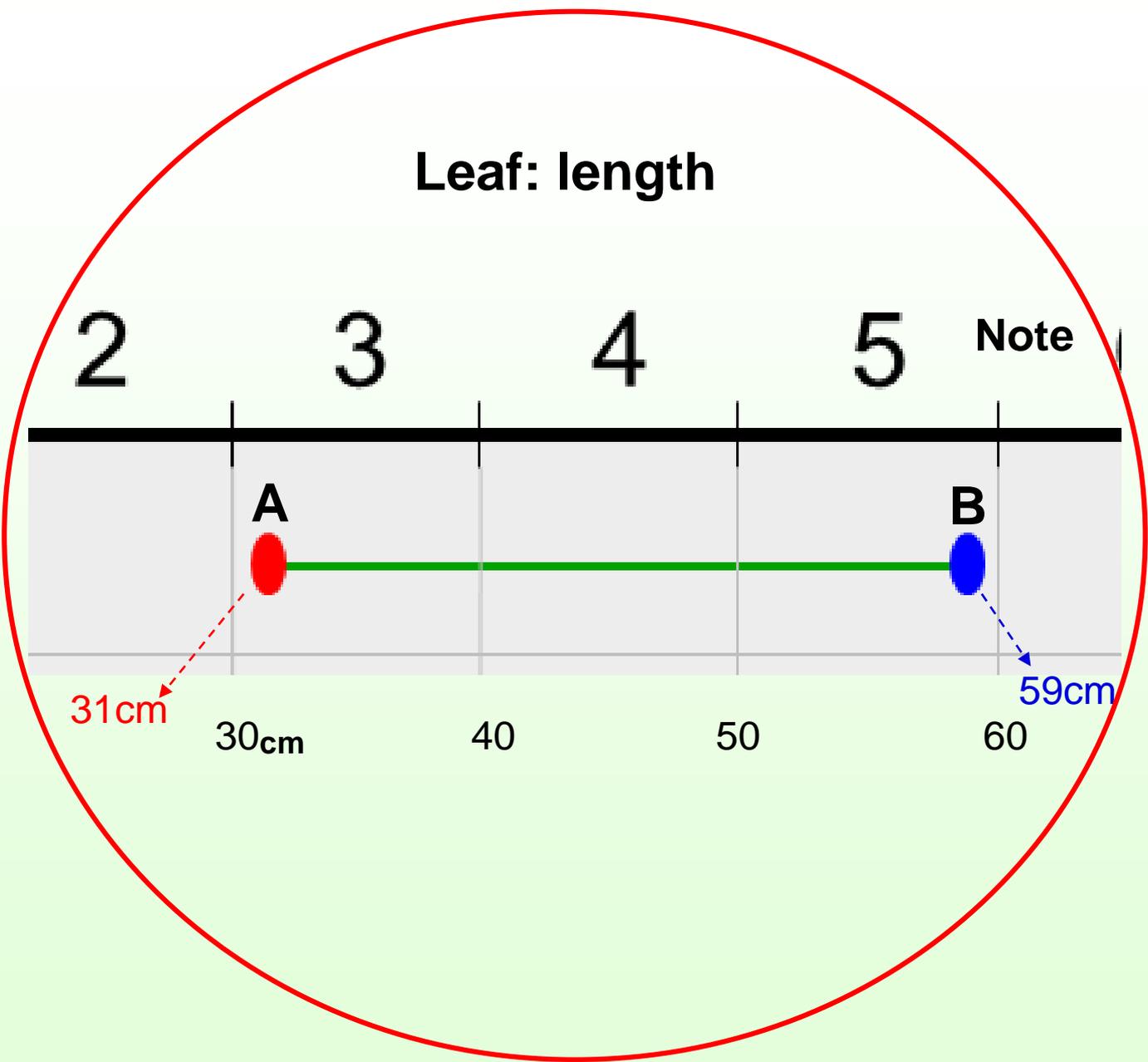
Clear difference

“a difference of two Notes often represents a clear difference”

“Two Note” rule



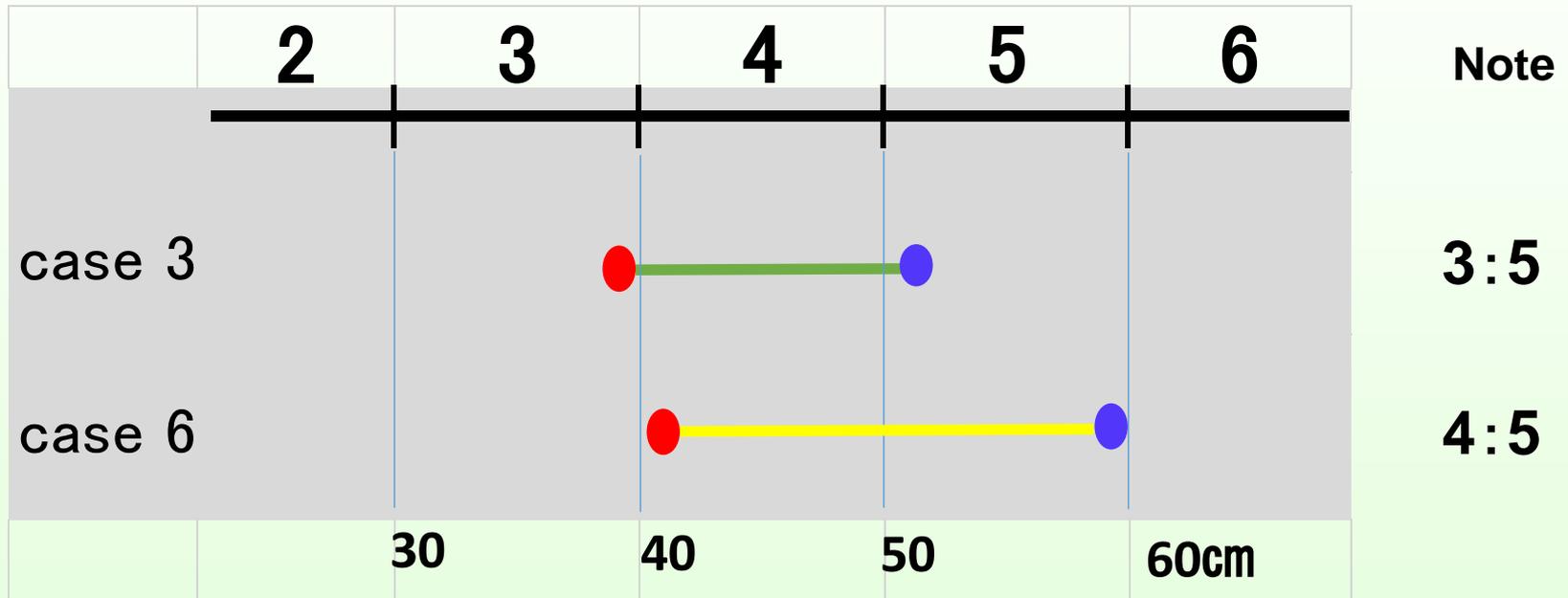
Case 1



Distinctness

Clear difference

QN: Stem: Length



case 3 < case 6

“Two Notes” rule means at least One note difference

Distinctness

Clear difference

PQ characteristics:

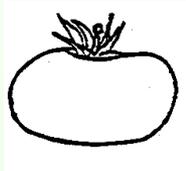
TG/1/3: 5.3.3.2.3

- **A different state in the Test Guidelines may not be sufficient to establish distinctness** (see also section 5.5.2.3). However, in certain circumstances, varieties described by the same state of expression may be clearly distinguishable.
- ✓ difficult to define a general rule on the difference in Notes to establish Distinctness
- ✓ need to compare the state of expression directly side by side in the field

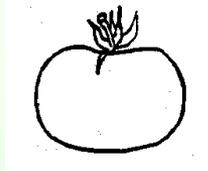
Distinctness

Clear difference

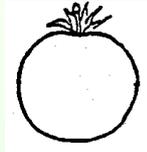
PQ: clear difference



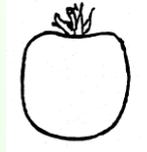
1.flattened



2.oblate



3.circular



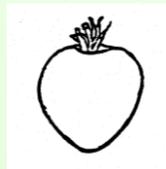
4.blong



5.cylindric



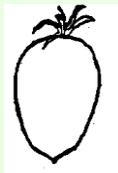
6.elliptic



7.cordate



8.ovate



9.obovate



10.pyriform



11.obcordate

Distinctness

Clear difference



Distinctness

Clear difference

	Characteristics	Assessment
QL	<ul style="list-style-type: none">- discontinuous states- absent / present	different states
QN	<ul style="list-style-type: none">- continuous states- length, width	two notes rule
PQ	<ul style="list-style-type: none">- more than one dimension- shape, color	A different state in the TGs may not be sufficient

Distinctness

■ Verity: Combination of expression of characteristics

char No.	8	9	15	16	24	36	39	41
characteristics	Tassel: time of anthesis	Tassel: anthocyanin coloration at base of glume	Ear: time of silk emergence	Ear: anthocyanin coloration of silk	Plant: length	Ear: type of grain	Ear: color of dorsal side of grain	Ear: anthocyanin coloration of glumes of cob
existing variety 1	5	5	5	5	5	3	4	1
variety 2	5	3	5	5	5	1	4	1
variety 3	5	5	3	5	5	1	4	1
variety 4	5	5	5	5	7	1	4	1
Candidate variety	5	5	5	5	5	1	4	1

New verity: new combination of expression of characteristics

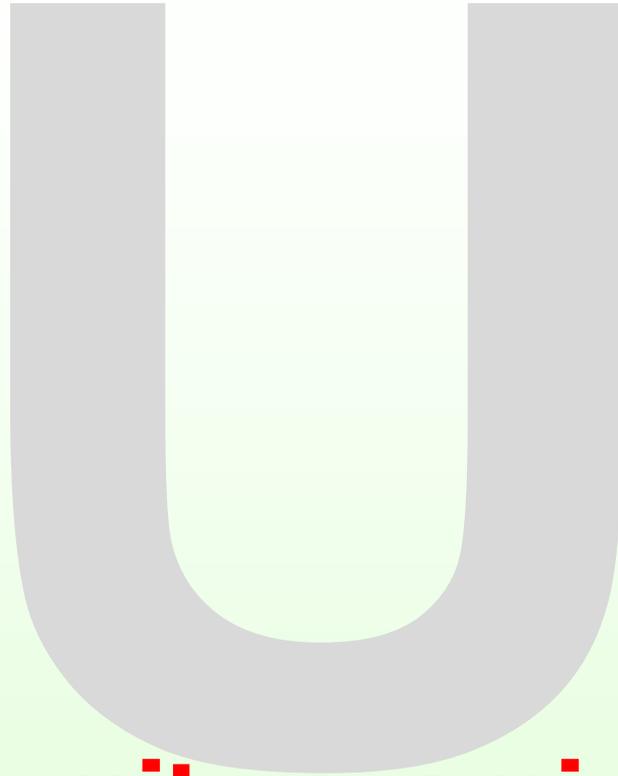
Definition of a variety

■ Compare the candidate variety with Similar variety

<i>Candidate var.</i>			
Char No	Characteristics	States of Expression	Notes
1	Hypocotyl: anthocyanin coloration	absent	1
2	Plant: fragrance	present	9
3	Plant: height	medium	5
4	Plant: growth habit	semi upright	3
5	Plant: branching	strong	3
..	

<i>Similar var.</i>			
Char No	Characteristics	States of Expression	Notes
1	Hypocotyl: anthocyanin coloration	absent	1
2	Plant: fragrance	present	9
3	Plant: height	tall	9
4	Plant: growth habit	semi upright	3
5	Plant: branching	strong	3
..	

Only after a variety has been defined, it can be examined for the DUS required for protection.



Uniformity examination

- **Features of propagation of the variety**

Uniformity

Requirement:

Article 8; 91 Act of the UPOV

- The variety shall be deemed to be uniform if, subject to the variation that may be expected from the particular features of its propagation, it is sufficiently uniform in its relevant characteristics.

✓ level of uniformity required for the variety will be different

Uniformity

■ Features of propagation of the variety

<u>Features of propagation</u>	<u>Genetic variation</u>	<u>How to assess U</u>
•Vegetatively propagated	Lower	?
•Truly Self-pollinated		?
•Mainly Self-pollinated		?
•Cross-pollinated		?
•Hybrids		?
		Higher

Uniformity

■ Assessment of Uniformity

QN: MS assessing



(TGP/10 2.5.2)

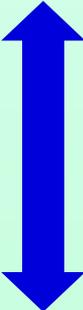
	Type of expression of characteristic		
Method of propagation of the variety	QL	PQ	QN
Vegetatively propagated	Off-types	Off-types	Off-types (visual observation) Standard Deviations (measurement)
Self-pollinated	Off-types	Off-types	Off-types (visual observation) Standard Deviations (measurement)
Cross-pollinated	Off-types	Off-types	Standard Deviations
Single-cross hybrid (in-bred parent lines)	Off-types	Off-types	Off-types (visual observation) Standard Deviations (measurement)
Other hybrids	*	*	*

* To be considered according to the type of hybrid
- The most common approaches are listed first.

Uniformity

■ Methods for Examining Uniformity

1. Off-types approach
2. Standard deviation approach

Features of propagation	Genetic variation	U assessment	
•Vegetatively propagated	Lower	Off-types	
•Truly Self-pollinated		Off-types	
•Mainly Self-pollinated		Off-types	
•Cross-pollinated		Higher	standard deviation
•Hybrids			depends on type of hybrid

Uniformity

1. Off-types approach

Where all the plants of a variety are very similar,
for vegetatively propagate and self-pollinated varieties,
Uniformity is assessed by the number of off-types

How many off-types should we accept?

Uniformity

How many off-types should we accept?

According to the **size of the sample** examined, statistical tables give the maximum **number of off-types** tolerated in that given samples

e.g.: *population standard = 1% and*
 acceptance probability = 95%

<i>Sample size</i>	<i>Number of off-types allowed</i>
<i>1-5</i>	<i>0</i>
<i>6-35</i>	<i>1</i>
<i>36-82</i>	<i>2</i>
<i>83-137</i>	<i>3</i>
<i>138-198</i>	<i>4</i>
<i>199-262</i>	<i>5</i>

Uniformity

How many off-types should we accept?

- **Population standard**

 - (Acceptable Number of off-types)

 - ✓ **Percentage of off types to be accepted** if all individuals of the variety could be examined

- **Acceptance probability**

 - ✓ Probability of correctly accepting that a variety is uniform

Uniformity

species and genera	Assessment of uniformity
soya bean	a population standard (P.S.) of 0.5% with an acceptance probability(A.P) of at least 95% should be applied. In the case of a sample size of 300 plants, the maximum number of off-types allowed would be 4.
tomato	P.S. of 1% and A.P. of at least 95% should be applied. In the case of a sample size of 20 plants, 1 off-type is allowed.
chrysanthemum	P.S. of 1% and A.P. of at least 95 % should be applied. In the case of a sample size of 20 plants, 1 off-type is allowed.
apple	P.S. of 1% and A.P. of at least 95% should be applied. In the case of a sample size of 5 plants, no off-types are allowed. In the case of a sample size of 10 plants, 1 off-type is allowed.
banana	P.S. of 1% and A.P. of at least 95% should be applied. In the case of a sample size of 15 plants, 1 off-type is allowed.
tulip	P.S. of 1% and A.P. of at least 95 % should be applied. In the case of a sample size of 25 plants, 1 off-type is allowed.
sugarcane	P.S. of 1% and A.P. of at least 95% should be applied. In the case of a sample size of 6 culms 1 off-type is allowed. In the case of a sample size of 24 culms, 1 off-type is allowed.

PS, AP in each UPOV TGs

population standard	Acceptance probability	sample size	Number of off types	species
0.1	95	1500	4	Rice
0.1	95	2000	5	Durum wheat
1	95	5	0	Almond, Blueberry, Persimmon, Avocado, coffee, fig, Dragon fruit, Mango
1	95	6	1	Nerium, BirdCherry, Buddleja, Papaya
1	95	7	1	Eucalyptus, Rubber
1	95	8	1	Alstromeria, Hydrangea, Clematis, Rose of Sharon, Canna, Hebe
1	95	9	1	Phalaenopsis, Oncidium
1	95	10	1	Bougainvillea, Camellia, Pineapple, Dendrobium, TeaTree, Brachyscome, Poinsetia
1	95	12	1	Dahlia
1	95	15	1	ZonalPelargonium, Banana, Lobelia, Osteospermum, Sutera
1	95	20	1	Yam, Peppermint, Pumpkin, Tomato, Lily, Melon, Gladiolus, Chrysanthemum
1	95	24	1	sugarcane
1	95	25	1	tulip
1	95	40	2	bitter gourd, asparagus, Brussels sprout, cucumber, Petunia, Antirrhinum, Onion
1	95	50	2	Amaranth, Sweet potato, Sesame
1	95	60	2	cornsalad, chinese Cabbage, broccoli, Calabres sprouting, chimes Chive, Shiitake
1	95	90	3	Oyster Mushroom
1	95	100	3	Chick Pea, Lentil
2	95	20	2	Elatior Begonia, Kalanchoe, Chili, Watermelon,
2	95	200	7	Beetroot, Carrot, Leek, Radish, Black Radish
3	95	40	3	Maize
5	95	40	4	Artichoke, Cardoon
Hybrids:2 inbred:2	Hybrids:95 inbred:95	Hybrids:100 inbred:200,30	Hybrids:5 inbred:7,2	Parsnip
Hybrids:2 inbred:3	Hybrids:95 inbred:95	Hybrids:100 inbred:100	Hybrids:5 inbred:6	Spinach,
inbred:1 (s)cross:3	inbred:95 (s)cross:95	inbred:60 (s)cross:60	inbred:2 (s) cross:4	Cauliflower

Uniformity



Off type 80

Uniformity

Off-type

TG/1/3

6.4.1.1 Determination of Off-Types by
Visual Assessment

- A plant is to be considered an off-type if it can be **clearly distinguished from the variety** in the expression of any characteristic of the whole or part of the plant that is used in the testing of distinctness, taking into consideration the particular features of its propagation.

clearly distinguished from the variety = same criteria as for **Distinctness**

Uniformity

2. Standard deviation approach

Cross-pollinated varieties, generally exhibit wider variations within the variety than vegetatively propagated or self-pollinated varieties, and it is more difficult to determine off-types.

- ✓ used in **cross-pollinated varieties**, and for **QN & MS**
- ✓ For the range of variation, **relative tolerance limits are set by comparison with comparable varieties or already known varieties.**
- ✓ The candidate variety should not be significantly less uniform than the comparable varieties.

Uniformity

2. Standard deviation approach

Example: TGP/8 10.1 Use of the relative variance method

variances of candidate and comparable varieties for plant height data (QN, MS)

Candidate variety	Comparable variety 1	Comparable variety 2	Comparable variety 3	Comparable variety 4
5.6	7.8	4.5	3.2	5.8

- ✓ The number of observations per variety: 60
- ✓ The **average variance for comparable varieties** is $(7.8 + 4.5 + 3.2 + 5.8) / 4 = 5.32$
- ✓ **Relative variance** = variance of the candidate / average variance of the comparable varieties = $5.6/5.32 = 1.05$
- ✓ From F-table, for a sample size of 60 : ∞ , the threshold = 1.47;
- ✓ Relative variance: $1.05 < 1.47$
- ✓ therefore, we can conclude that **the candidate variety is sufficiently uniform for that characteristic**

		F distribution $\alpha = 0.01$				df1			
df2	6	10	20	30	40	60	120	10000	
10	5.3858	4.849142	4.405365	4.246942	4.165258	4.081869	3.99649	3.910031	
20	3.871435	3.3682	2.937725	2.778478	2.694748	2.60772	2.516771	2.422368	
30	3.473474	2.979107	2.54866	2.385974	2.299203	2.207855	2.110767	2.007539	
40	3.291007	2.800533	2.368878	2.203379	2.114234	2.019405	1.917186	1.806136	
50	3.186443	2.69813	2.265239	2.097593	2.006587	1.909029	1.802597	1.684661	
60	3.118686	2.631751	2.197808	2.028472	1.936016	1.836256	1.72632	1.602288	
120	2.955858	2.472078	2.034582	1.860002	1.762849	1.655692	1.532992	1.382666	
100,000	2.802153	2.321102	1.87849	1.696598	1.592475	1.473214	1.324857	1.034879	

Uniformity

Calculation of Variance

Variance formula:

$$s^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}$$

Variety A
Leaf length: cm

1	2	3	4	5	6	7	8	9	10
4.2	6.7	7.3	7.5	8	8.5	8.7	8.8	9.2	9.3

n=10

Average = 7.82cm

$$\{(4.2-7.82)^2 + (6.7-7.82)^2 + \dots + (9.2-7.82)^2 + (9.3-7.82)^2\} / (10-1) = \underline{2.339}$$

Excel: =VAR.S(a:b)

S

Stability examination

Stability

Article 9; 91 Act of the UPOV

Requirement:

- The variety shall be deemed to be stable if its **relevant characteristics** remain unchanged after repeated propagation or, in the case of a particular cycle of propagation, at the end of each such cycle.
 - In practice, it is not usual to perform tests of stability that produce results as certain as those of the testing of distinctness and uniformity.
 - However, for many types of variety, when a variety has been shown to be uniform, it can also be considered to be stable

Stability

- Where appropriate, or in cases of doubt, stability may be tested, either by growing a further generation, or by testing a new seed or plant stock to ensure that it exhibits the same characteristics as those shown by the previous material supplied.
- Stability needs appropriate maintenance of the variety by the breeder continuously.

relevant characteristics:

The relevant characteristics include at least **all characteristics used for the examination of DUS** or included in the variety description established at the date of grant of protection of that variety.

Thank you for your attention