

Basic Rules for DUS test



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- 1. Purpose of DUS test**
- 2. How to observe characteristics**
- 3. Examining 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?

D: must be distinguishable from any other varieties



What is DUS?

U: must be uniform



What is DUS?

S: must be unchanged after repeated propagation



Next
generation



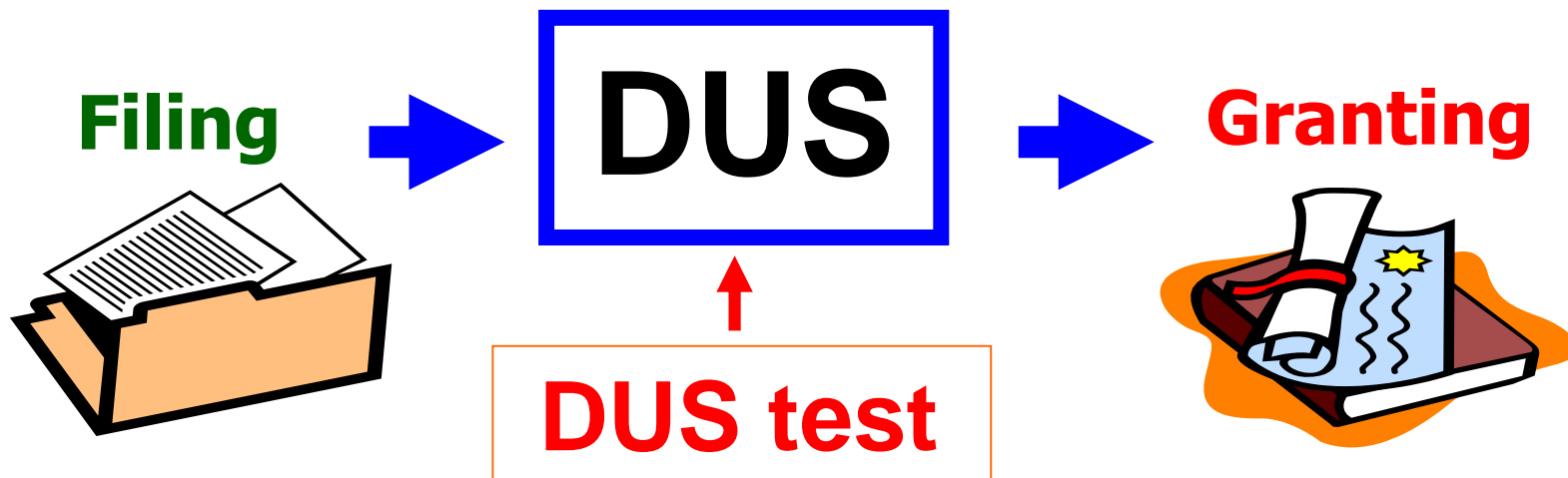
Next
generation

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 Articles 5 to 9.



Purpose of DUS test: to assess whether the candidate variety comply with 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.



purpose of DUS test

1. To define the variety by the expression of characteristics
2. To examine the DUS

D efinition

of the variety

by the expression of characteristics

Definition of a variety

**To define the variety
by the expression of characteristics**



**To clarify the expression of
characteristics , then make a variety
description of the variety**

example; variety description of Rice

Definition of a variety

Example: Characteristics for definition of a variety

	Characteristics
1	Leaf: anthocyanin coloration of auricles
2	Time of heading
3	Stem: length
4	Decorticated grain: length
5	Decorticated grain: color

Definition of a variety

TGs for Rice

9 (*)	40 VS	Leaf: anthocyanin coloration of auricles	Example varieties	Note
QL	(a)	absent	Khang dân 18, Bắc thơm số 7	1
		present	Trân châu lùn	9



1



9

Definition of a variety

TGs for Rice

19 (*)	55 VG	Time of heading (50% of plants with heads)	Example varieties	Note
QN		very early		1
		early	Koshihikari kazusa 2 go	3
		medium	NTL1, Q5	5
		late		7



Definition of a variety

TGs for Rice

26(*)	70VS	<u>Non-prostrate varieties only: Stem length (excluding panicle)</u>	Example varieties	Note
QN		very short		1
		short	Koshihikari kazusa 2 go	3
		medium	Bắc thơm số 7	5
		long	BM9962	7
		very long		9



Definition of a variety

TGs for Rice

58 (*)	92 MS	Decorticated grain: length	Example varieties	Note
QN		short	Koshihikari kazusa 2 gou	3
		medium	Hoa khôi 4	5
		long		7



Definition of a variety

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



6



Kaneda;2005

Definition of a variety

Example: Results of observation, measurement: using five characteristics

		Characteristics	states of expression	note
QL	VS	Leaf: anthocyanin coloration of auricles	present	9
QN	VG	Time of heading	medium	5
QN	VS	Stem: length	long	7
QN	MS	Decorticated grain: length	medium	5
PQ	VS	Decorticated grain: color	white	1

Description table

Observe

Observation of Characteristics

- ✓ **Type of Expression of characteristics**
- ✓ **Method of Observation / Type of Record**

Type of Expression

QL

Qualitative

Characteristics

Type of Expression

QN

Quantitative

Characteristics

Type of Expression

PQ

Pseudo Qualitative

Characteristics

Type of Expression: QL

- ✓ are expressed in discontinuous states (e.g. sex of plant: female, male)
- ✓ As a rule, the characteristics are not influenced by environment

		Characteristics	States of expression
6	QL	Leaf sheath: anthocyanin coloration	absent, present
27	QL	Stem: anthocyanin coloration of nodes	absent, present
32	QL	Panicle: awns	absent, present
40	QL	Panicle: presence of secondary branching	absent, present



Type of Expression: QL

Fruit: anthocyanin coloration (chili)

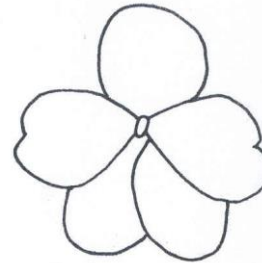


Absent 1

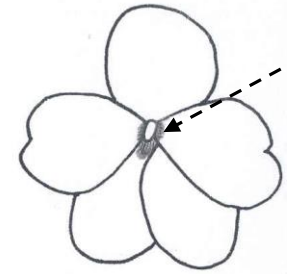


Present 9

flower: presence of eye zone (Impatiens)



Absent 1



Present 9

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	Hanagoshō	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: QL

TG/16/8 Rice

6. VG

**Leaf sheath:
anthocyanin
coloration**

**Example
varieties**

Note

QL (a)

absent
present

1
9

(PQ)
(QN)

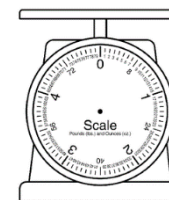
Type of expression

States of expression

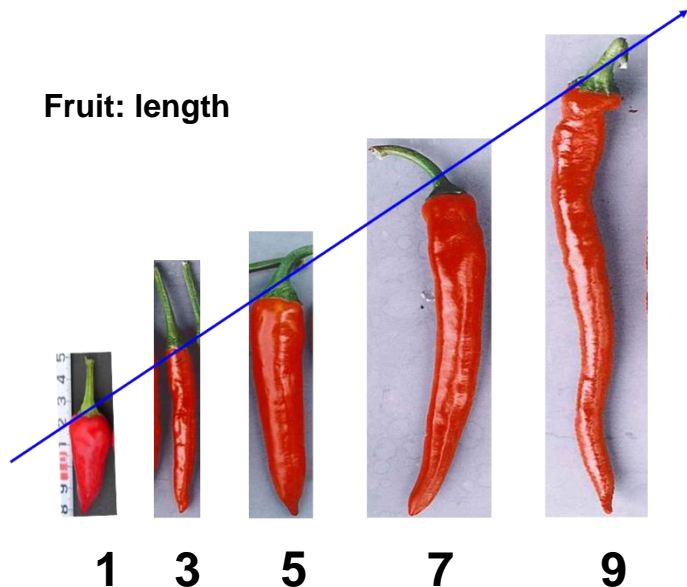
Notes

Type of Expression: QN

- ✓ are measurable on a one-dimensional scale and show continuous variation
- ✓ length, height, width, thickness, weight, ..



Fruit: length



states of expression

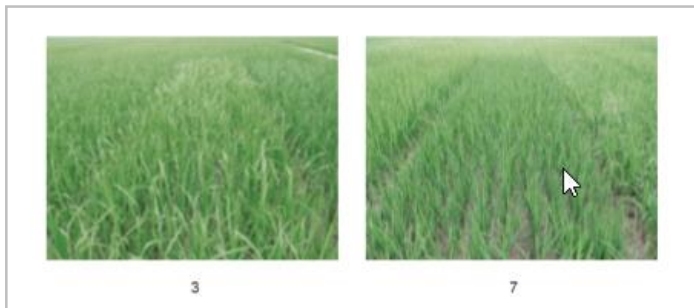
- very short
- very short to short
- short
- short to medium
- medium
- medium to long
- long
- long to very long
- very long

Notes

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

Type of Expression: QN

		Characteristics	States of expression
3	QN	Leaf: intensity of green color	light, medium, dark
13	QN	Leaf blade: Length	short, medium, long
44	QN	Time of maturity	early, intermediate, late



Type of Expression: QN

1	40	Leaf blade: pubescence of surface	TG/16/8	Rice
VS				
QN	(a)	absent or very weak		1
		weak	Bắc thom số 7	3
		medium	DT122	5
		strong	Khang dân 18	7



3
weak



5
medium



7
strong

14.	(c)	Flower: arrangement of petals	TG/214/1	Catharanthus
(*)				
(+)				
PQ		free	Kururi White	1
		touching	Flappe Coconut	2
		slightly overlapping	Flappe Lilac	3
		strongly overlapping	Peppermint Cooler	4



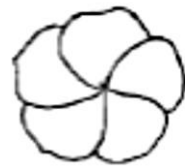
1
free



2
touching



3
slightly overlapping



4
strongly overlapping

13.	(b)	Leaf blade: angle of apex (excluding tip)	TG/70/4	Apricot
(+)				
QN		acute	San Castrese	1
		right-angled	Canino, Ceglédi óriás	2
		moderately obtuse	Bergeron, Polonais, Portici	3
		strongly obtuse	Hargrand, Moniquí	4



1
acute



2
right-angled



3
moderately obtuse



4
strongly obtuse

Type of Expression: 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: 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

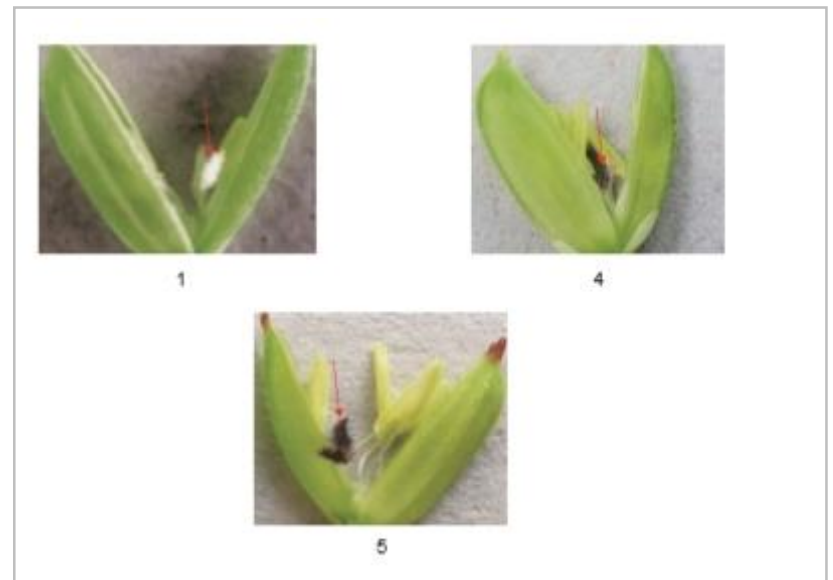
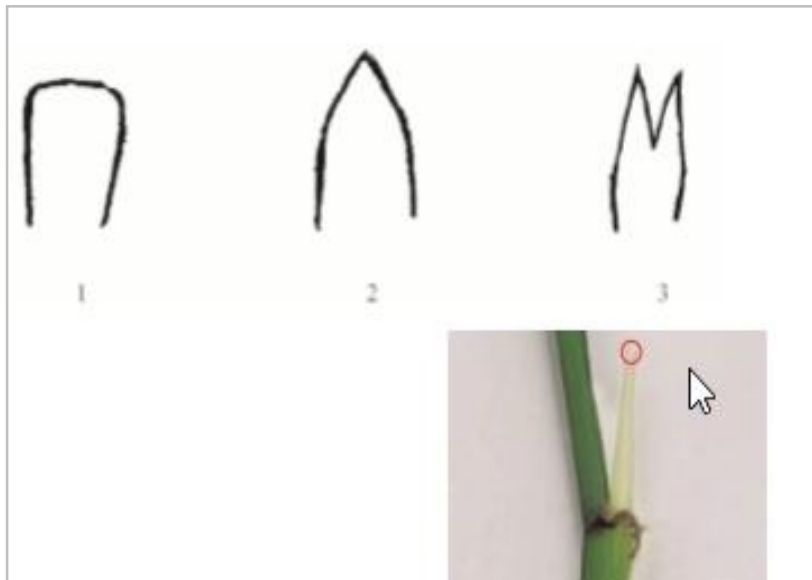
Flower: fragrance

note	states
1	Absent or very weak
2	weak
3	strong



Type of Expression: PQ

		Characteristics	States of expression
11	PQ	Leaf: shape of ligule	truncate, acute, cleft
24	PQ	Spikelet: color of stigma	white, light green, yellow, purple



Type of Expression: PQ

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

Fruit: shape in longitudinal section

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

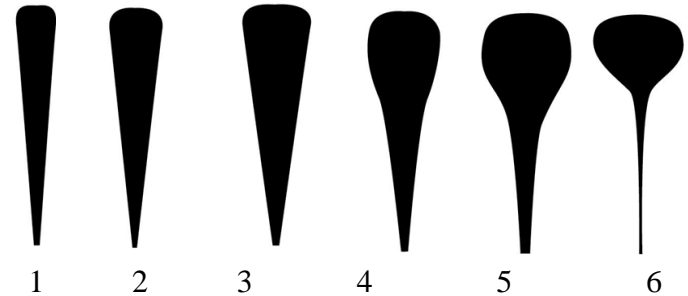
Type of Expression: PQ

TG/44 Tomato

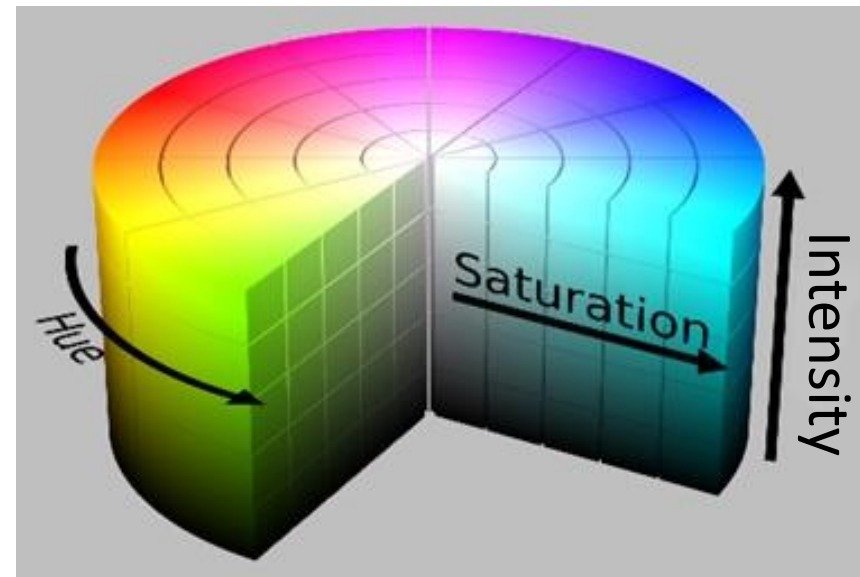
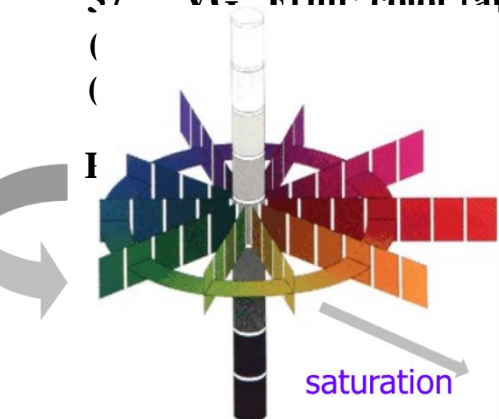
28. (*) (+)	VG MS	Fruit: shape in longitudinal section	Example Varieties	Note
		oblate	Liebesapfel	1
PQ	(b)	circular	Cherry Sweet	2
		cordate	Daniel	3
		square	Delphin, Yolo Wonder	4
		rectangular	Clovis, Nocera rosso	5
		trapezoidal	Delta, Marconi	6

Type of Expression: PQ

1	VG	Root: shape	TG/218/2
(*)			Parsnip
(+)			
PQ		narrow obtriangular	Fist 1
		medium obtriangular	Countess 2
		broad obtriangular	Tenor 3
		medium obovate	Merlin 4
		broad obovate	White King 5
		napiform	Kral, Rotund 6

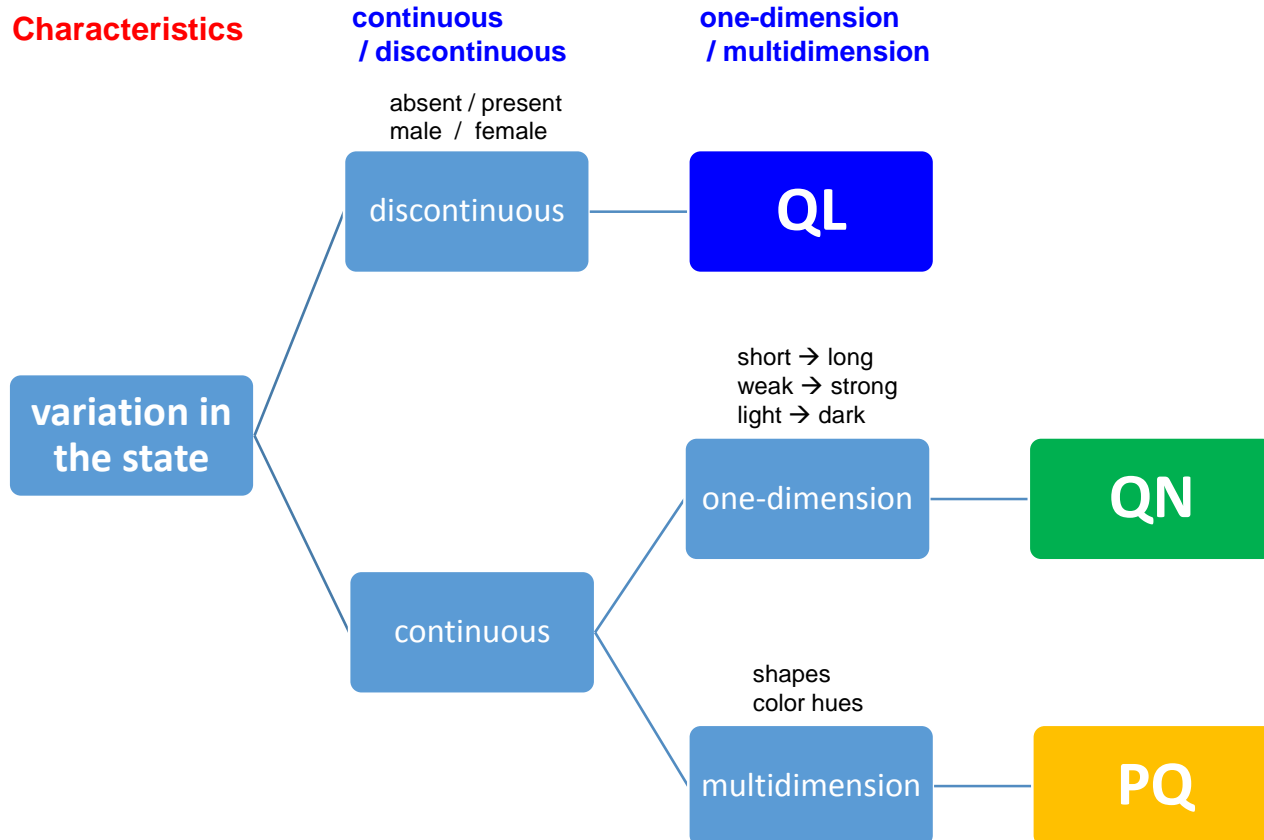


37	VG	Fruit: color (at	TG/44
(Tomato
(
I			
		brown	Jazon, White Mirabell 1
		green	Goldene Königin, 2
			Yellow Pear
			Sungold 3
			Aichi First 4
			Daniela, Ferline, 5
			Montfave H 63.5
			Ozyrys 6
			Green Grape, 7
			Green Zebra



Types of expression of characteristics

Decision making chart



Method of observation & Type of record

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:

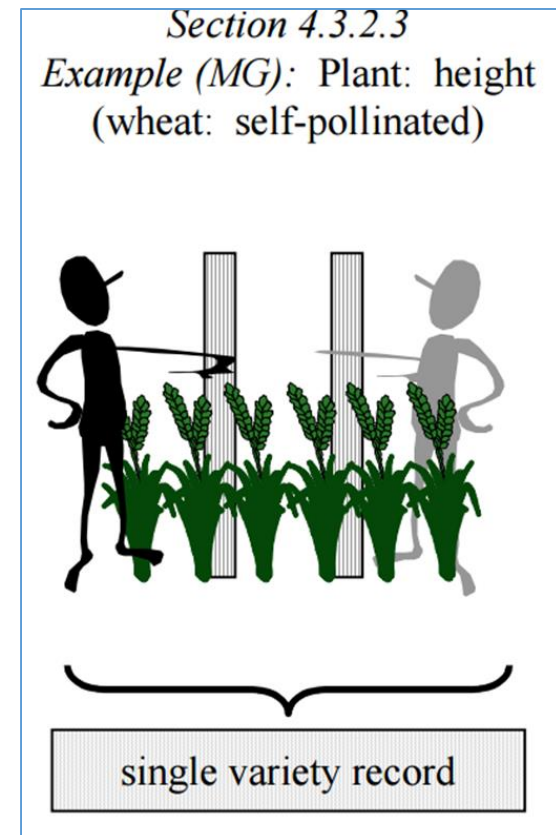
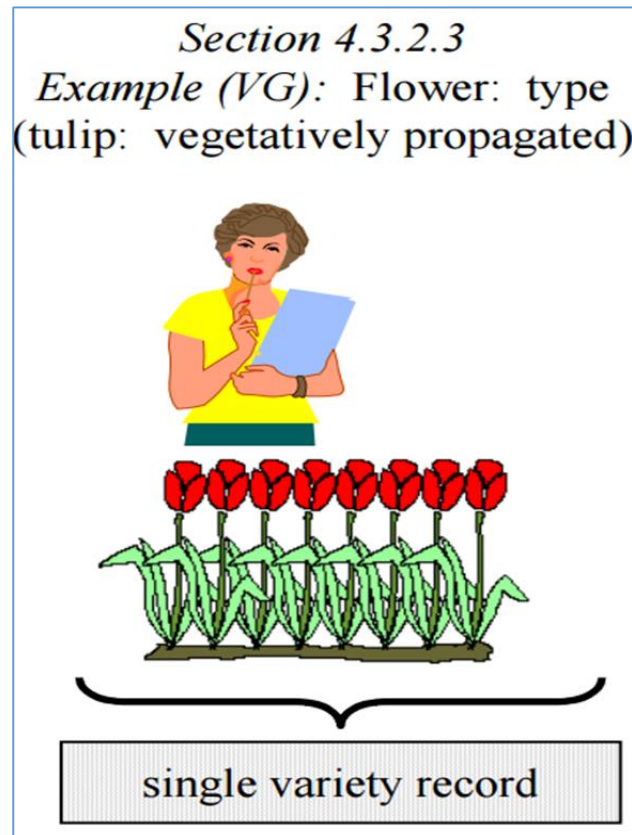
G (Group) : single record for a variety, or a group of plants or parts of plants

S (Single) : records for a number of single 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.



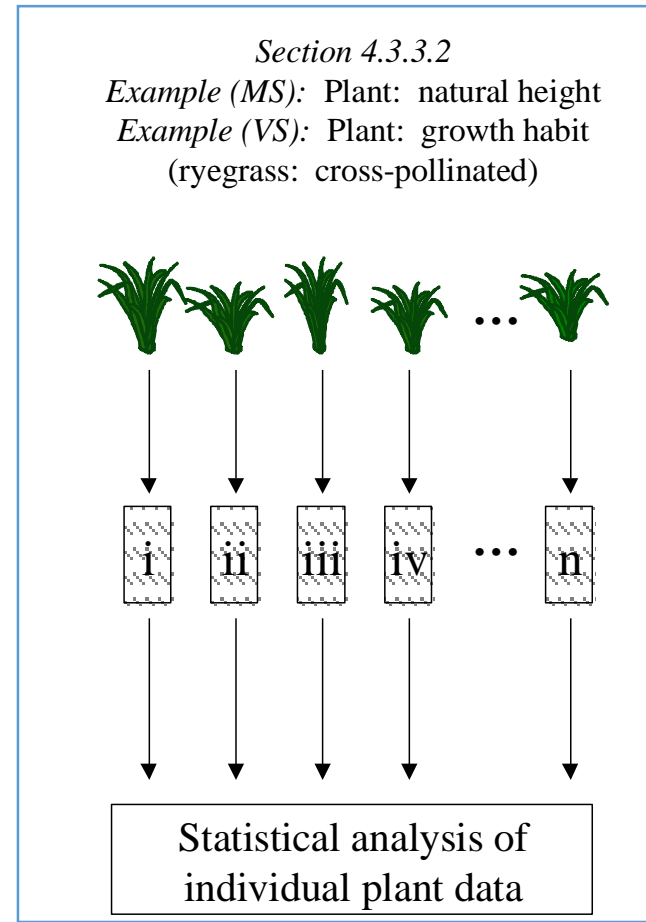
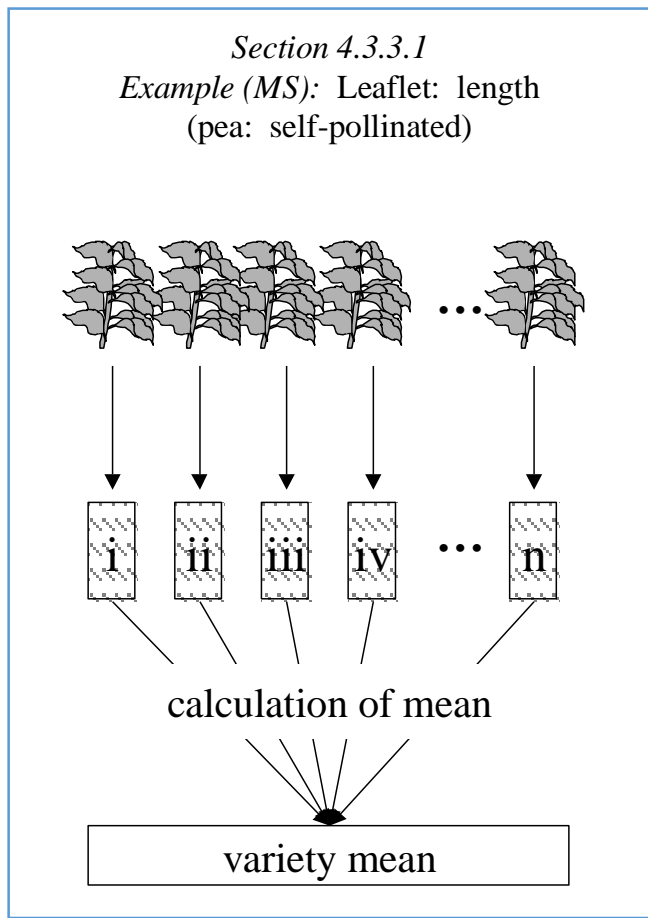
Type of Assessment

19 (*)	55 VG	Time of heading (50% of plants with heads)	Example varieties	Notes
QN		very early	Loto	1
		early	Albada, Cripto	3
		medium	Ariete, Bahia	5
		late	Bomba, Puntal	7
65(*)	92 MG	Decorticated grain: aroma	Example varieties	
QN		absent or very weak		1
		weak		2
		strong	Arome, Gange	3

Type of Assessment

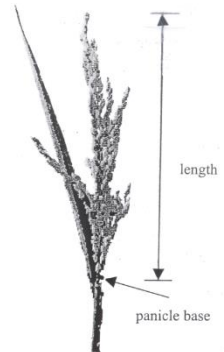
MS : Measurement of a number of individual plants or parts of plants.

VS : Visual assessment by observation of a number of individual plants or parts of plants.



Types of assessment

9	40 VS	Leaf: anthocyanin coloration of auricles	Example varieties	
QL		absent		1
		present		9
30 (*)	72-90 MS	Panicle: length of main axis		Notes
QN		short	Ariete, Lido	3
		medium	Thaibonnet, Thainato	5
		long	Carnaroli, Lemont	7



Type of Assessment

■ Type of assessment in Rice TGs

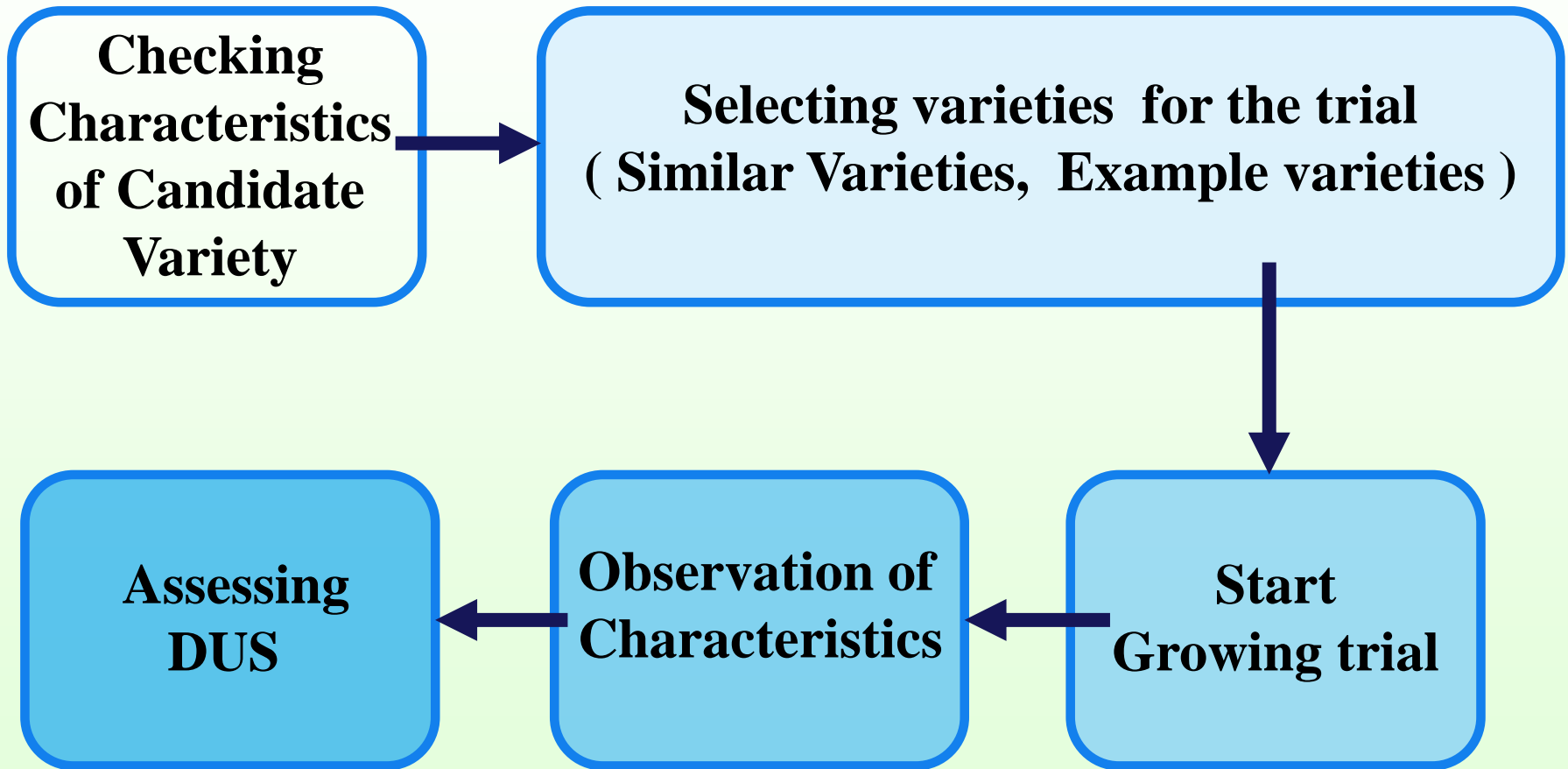
	QL	PQ	QN	Total
VS	7	16	15	38
VG	3	2	8	13
MS	0	1	10	11
MG	0	1	2	3
	10	20	35	65

- **QL,PQ**; mainly Visual
- **QN**; Visual, Measurement

DUS

Examination

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

D

Distinctness examination

Distinctness

Requirement:

Article 7; 91 Act of the UPOV

- a variety must be **clearly distinguishable** from any other variety whose existence is a matter of common knowledge.

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

Clearly Distinguishable from any other varieties ?

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



VS



Compare **Candidate variety** **VS** **Existing varieties**

Selection of Similar Varieties

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



VS



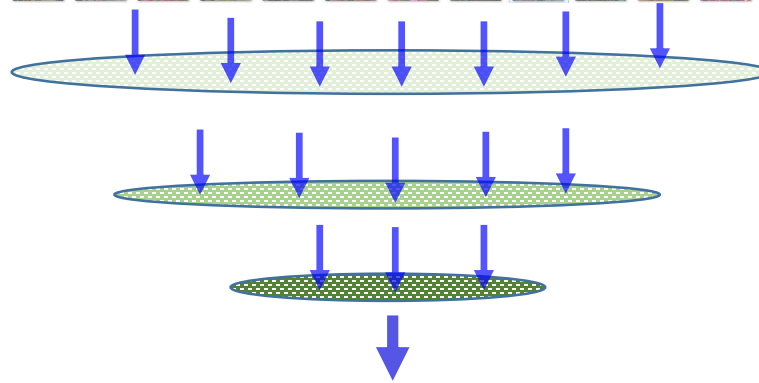
No need to compare the candidate variety with different group of varieties

Selection of Similar Varieties

Selecting the similar varieties



Candidate varieties



Grouping characteristics



Similar varieties

Selection of Similar Varieties

Not be necessary for comparing with all varieties, where a candidate variety is different from a particular group of varieties



VS

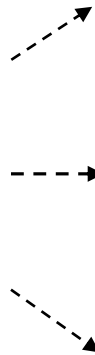


Compare *Candidate variety* **VS** *Similar varieties*

Selection of Similar Varieties



Candidate varieties



≠



≠



≠





Similar varieties

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

Grouping characteristics

■ Grouping characteristics: Rice

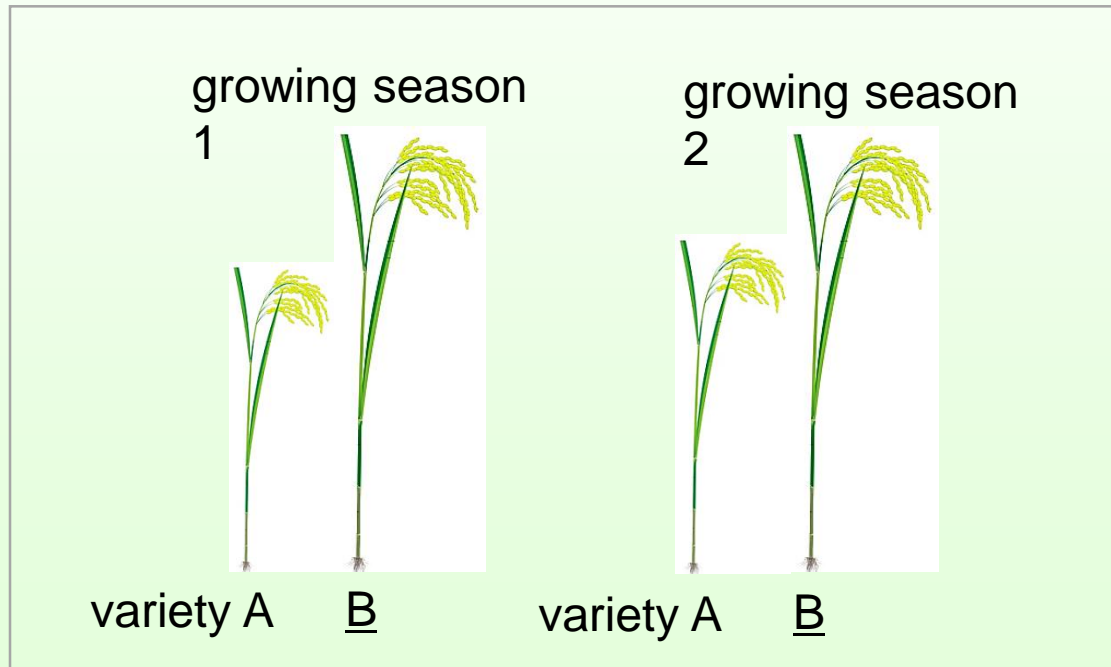
			Characteristics	notes
9	QL	VS	Leaf: anthocyanin coloration of auricles	 1, 9
19	QN	VG	Time of heading	1-9
26	QN	VS	Stem: length	1-9
58	QN	MS	Decorticated grain: length	1-9
61	PQ	VS	Decorticated grain: color	 1-9
65	QN	MG	Decorticated grain: aroma	1-3

Distinctness

Consistent difference

1. Consistent difference:

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



Each time, variety B is taller than variety A

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

Requires:

- 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**

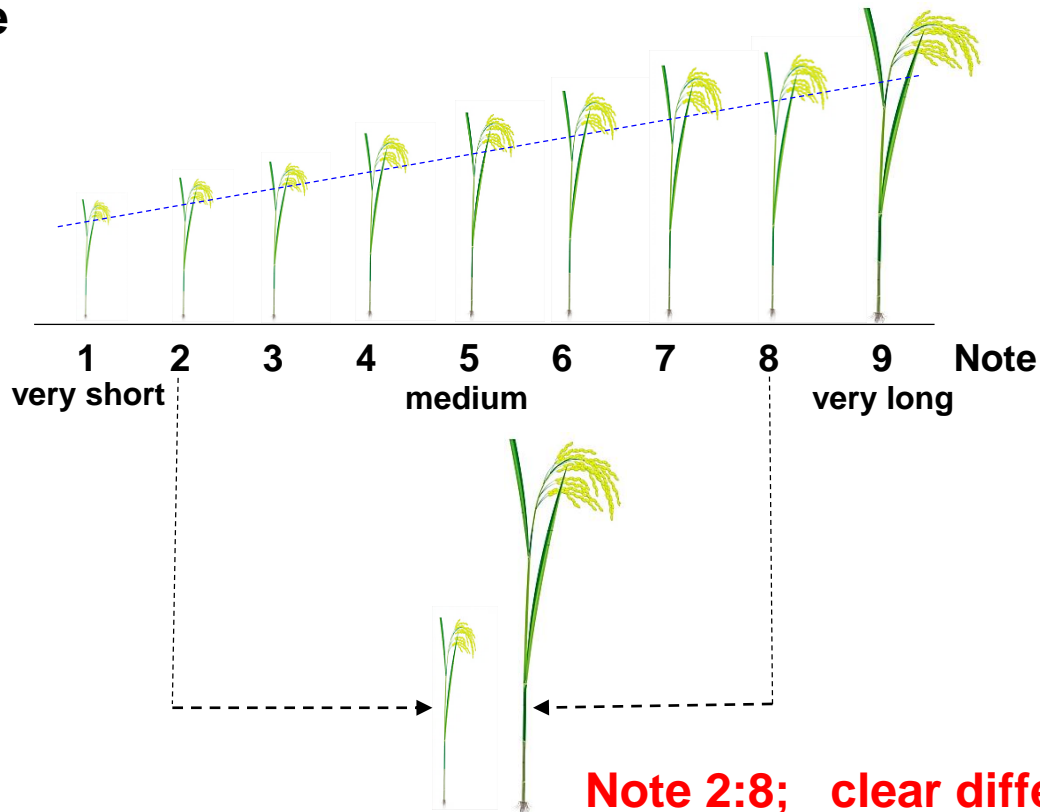
Distinctness

Clear difference

QN characteristics:

clear difference

(stem: Length)

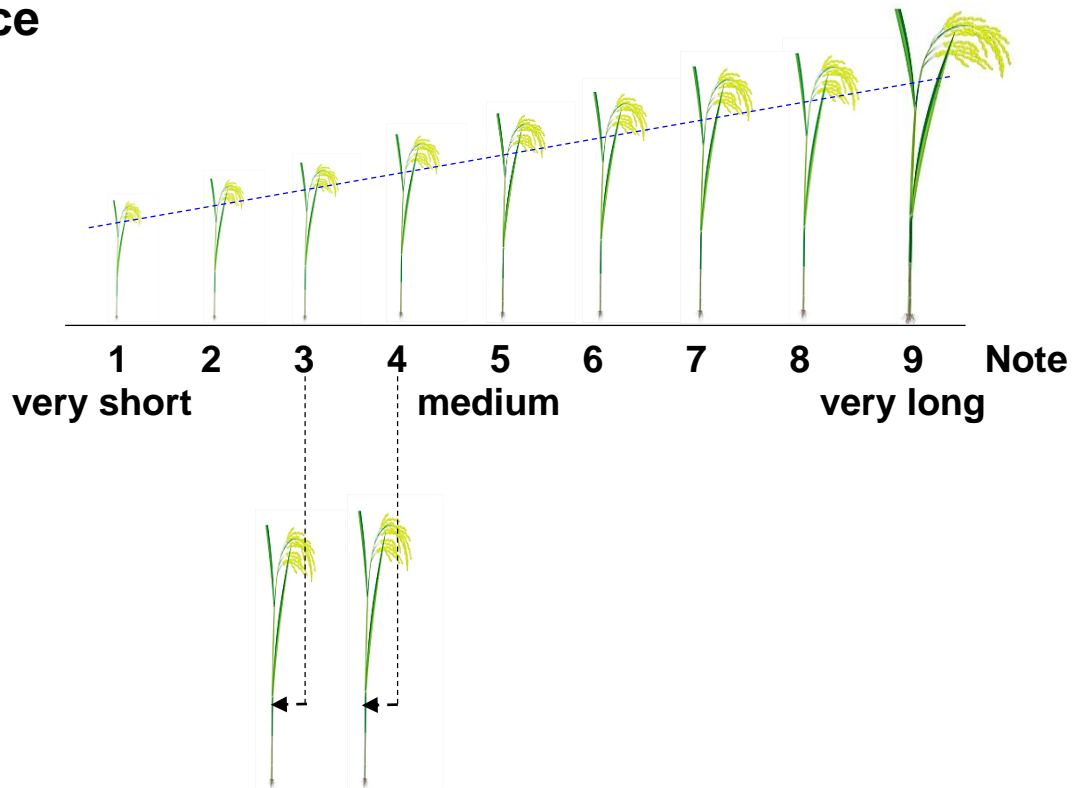


Distinctness

QN characteristics:

clear difference

(stem: Length)

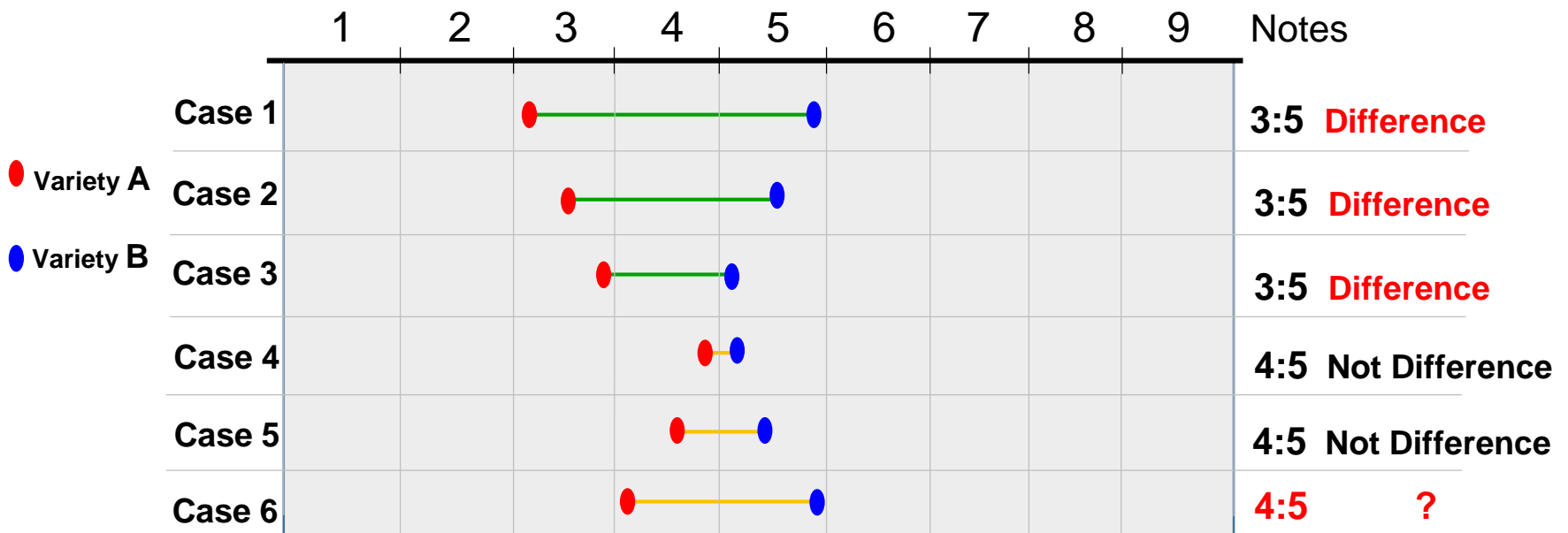


Note 3:4; may not be a clear difference

Distinctness

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

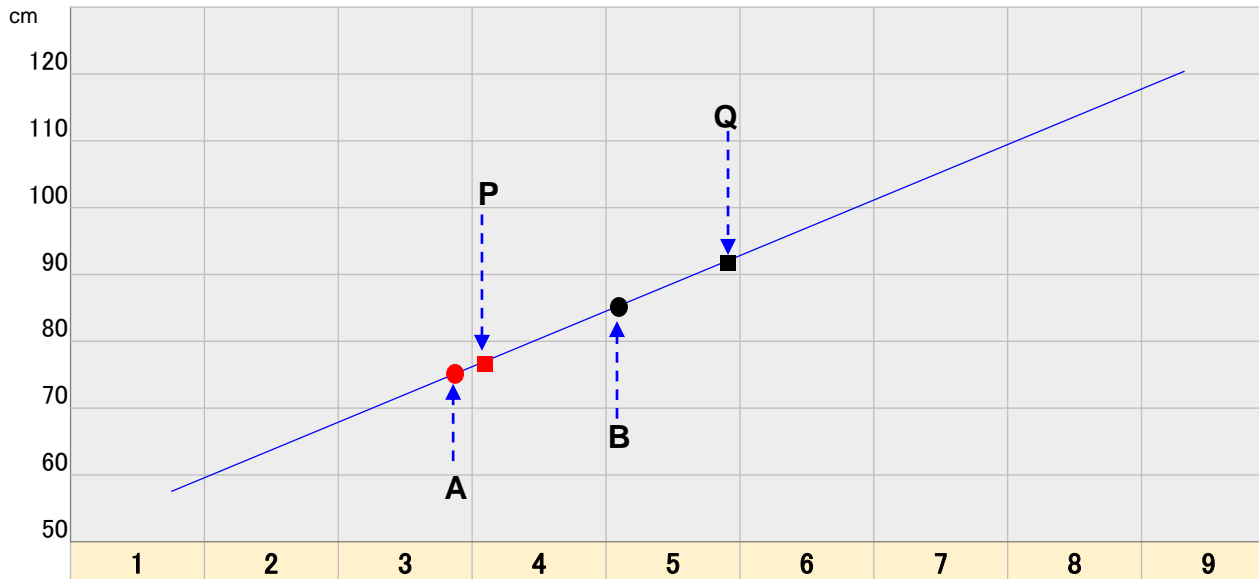
“Two Note” rule



Distinctness

Clear difference

QN: Stem: Length



	length: cm	Notes
A	75.0	3
B	85.0	5
A - B	10.0	2
P	77.0	4
Q	92.0	5
P - Q	15.0	1

Note

two note 3:5 |A-B|  10 cm

one note 4:5 |P-Q|  15 cm

$$4:5 |P-Q| > 3:5 |A-B|$$

“Two Notes” rule means at least One note difference

Distinctness

Clear difference

PQ characteristics:

TG/1/3: 5.3.3.2.3

Requires:

- **A different state in the Test Guidelines may not be sufficient to establish distinctness.**

However, in certain circumstances, varieties described by the same state of expression may be clearly distinguishable.

- ✓ It is difficult to define a general rule on the difference in Notes to establish Distinctness.
- ✓ **should be assessed on a Case by case basis**

Examining Distinctness



Distinctness

Clear difference

	Characteristics	Assessment
QL	<ul style="list-style-type: none">- discontinuous states- absent / present	one or more characteristics have expressions that fall into two different states
QN	<ul style="list-style-type: none">- continuous states- length, width	A difference of two notes represents a clear difference
PQ	<ul style="list-style-type: none">- more than one dimension- shape, color	A different state in the TGs may not be sufficient

Distinctness

Test Report

16. Similar Varieties and Differences from These Varieties

Example

Denomination of similar variety	Characteristic in which the similar variety is different	State of expression of similar variety	State of expression of candidate variety
Similar A	6. Leaf sheath: anthocyanin coloration	absent 1	present 9
Similar B	26. Stem length	short 3	medium 5
Similar B	40. Leaf sheath: intensity of anthocyanin coloration	medium 5	strong 7



Uniformity examination

Uniformity

Requirement:

Article 8; 91 Act of the UPOV

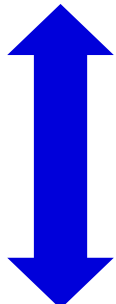

- A variety must be sufficiently uniform in its relevant characteristics, subject to the variation that may be expected from the **particular features of its propagation**

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

How many off-types should we accept?

Uniformity

■ Acceptable number of off-types

features of propagation	Genetic variation	Acceptable Number of off-types
•Vegetatively propagated	Low	Low
•Self-pollinated		
•Hybrid (single-cross)		
•Cross-pollinated		
•Hybrid (Multiple-cross)		
	High	High

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

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



Uniformity

Off-type

- 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

S

Stability examination

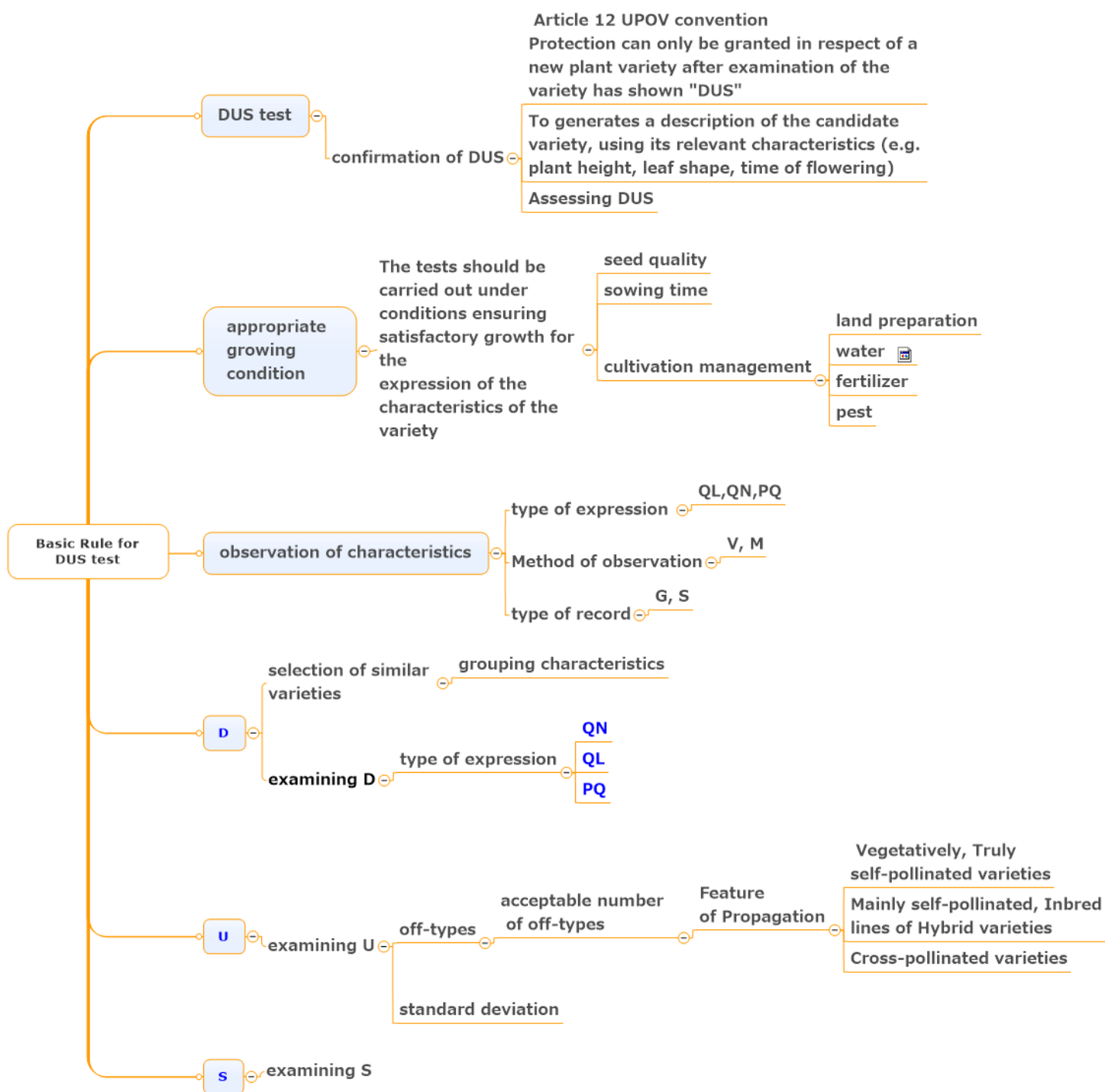
Stability

Requirement:

Article 9; 91 Act of the UPOV

- Relevant characteristics must remain unchanged after repeated propagation
 - 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
 - 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.

Making a Test Report



Thank you for your attention

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