

General introduction to the Examination of DUS



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1. Purpose of DUS test

2. Role of DUS test

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

Plant Variety Protection system

New Variety

Breeding: needs a lot of time and money

Propagation: very quick and easy

- ✓ *breeders may lose the chance to recover the cost of the breeding*

Needs an effective system of PVP

- ✓ *gives the breeder a chance to obtain a financial return*
- ✓ *encourage the development of new varieties more, then*
- ✓ *leads to contributing to agricultural development*



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



What is DUS?

Uniformity

U: must be uniform



What is DUS?

Stability

S: must be unchanged after repeated propagation



Next
generation



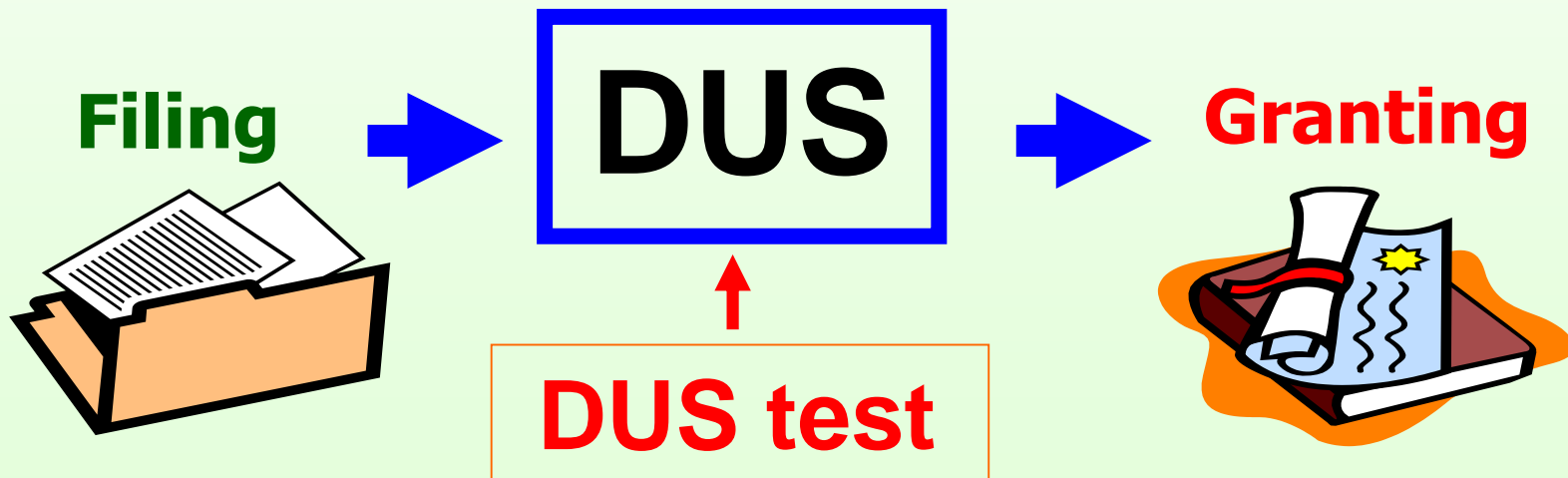
Next
generation

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

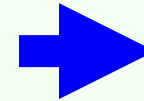
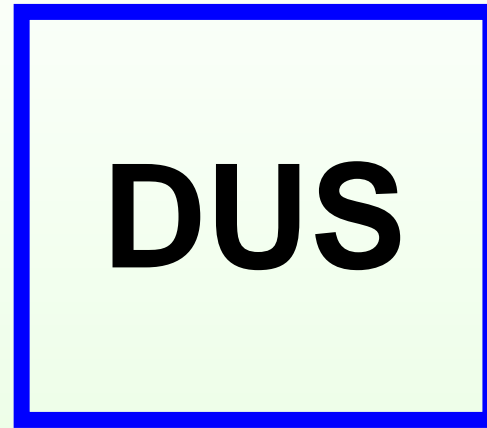
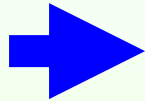
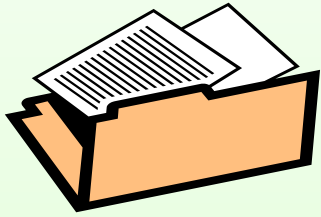


▶ **DUS test**

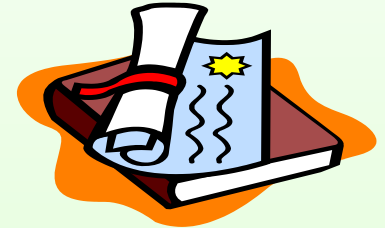
- ✓ to assess whether the variety meets the DUS requirements
- ✓ a test to be conducted before protection is granted for new varieties

What is DUS test?

Filing



Granting



Who?

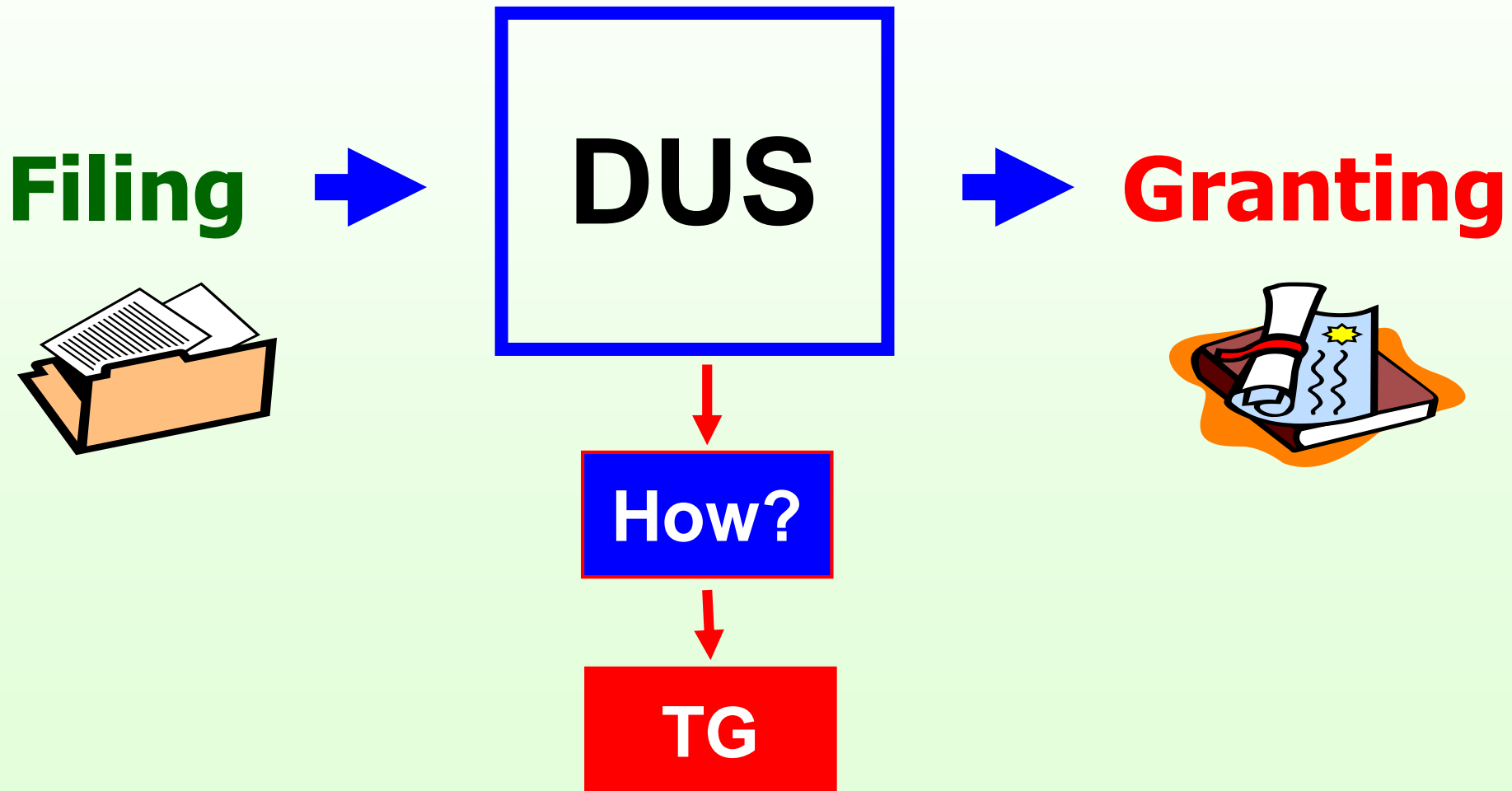
Who does the DUS test?

Article 12; 91 Act of the UPOV

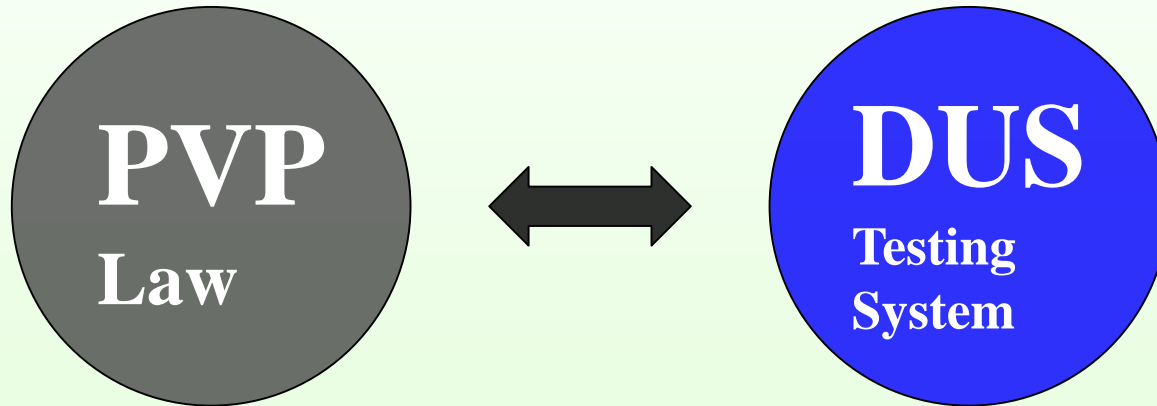
DUS growing test is conducted by

- ✓ Authority offices (Public Institute...)
- ✓ Breeder
- ✓ Purchase the test result from other country

What is DUS test?



PVP System



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.

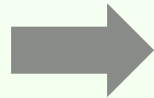
characteristics →
basis for examining DUS of a variety.



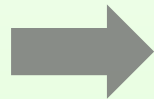
purpose of DUS test

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

Purpose of DUS test



Definition of a variety



Examination of DUS

Role of

DUS test

1. Definition of a variety by the expression of characteristics

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 the¹⁷
DUS criteria required for protection.*

Definition of a variety

To define a variety
by the expression of characteristics



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

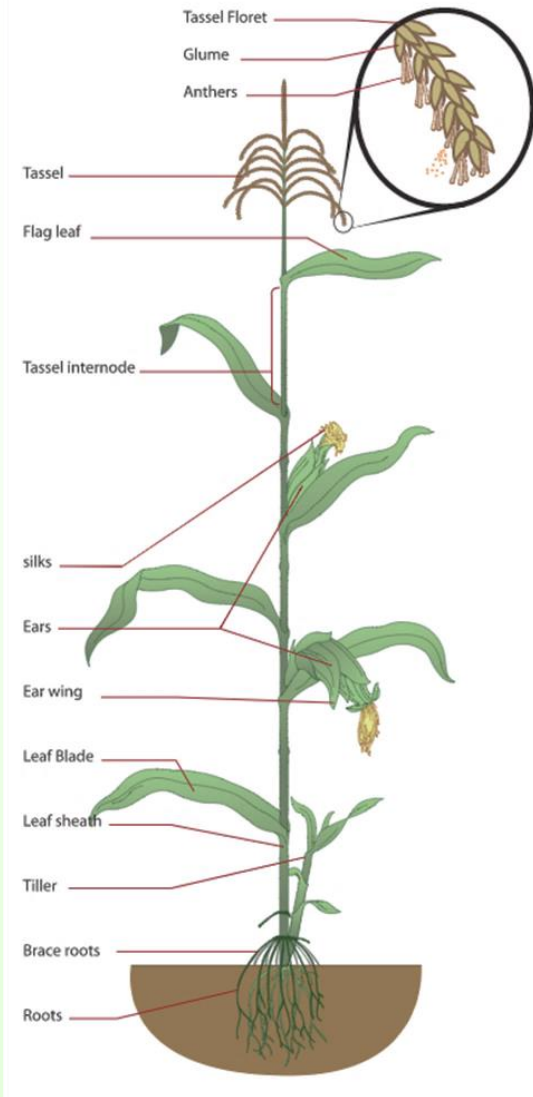
Definition of a variety

■ How to define the variety



UPOV		TG/2/7 ORIGINAL: English DATE: 2009-04-01		
INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS GENEVA				
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> MAIZE UPOV Code: ZEAAA_MAY <i>Zea mays</i> L. </div>				
GUIDELINES FOR THE CONDUCT OF TESTS FOR DISTINCTNESS, UNIFORMITY AND STABILITY				
Alternative Names: [*]				
<i>Botanical name</i>	<i>English</i>	<i>French</i>	<i>German</i>	<i>Spanish</i>
<i>Zea mays</i> L.	Maize, Corn	Mais	Mais	Maiz
The purpose of these guidelines ("Test Guidelines") is to elaborate the principles contained in the General Introduction (document TG/1/3), and its associated TGP documents, into detailed practical guidance for the harmonized examination of distinctness, uniformity and stability (DUS) and, in particular, to identify appropriate characteristics for the examination of DUS and production of harmonized variety descriptions.				
ASSOCIATED DOCUMENTS				
These Test Guidelines should be read in conjunction with the General Introduction and its associated TGP documents.				
medium	moyenne	mittel	claro	W182E 1
dark	foncée	dunkel	medio	Empire (SC), W117 2
			oscuro	GSS 3287 (SC), W401 3

Maize: 42 characteristics



3

7

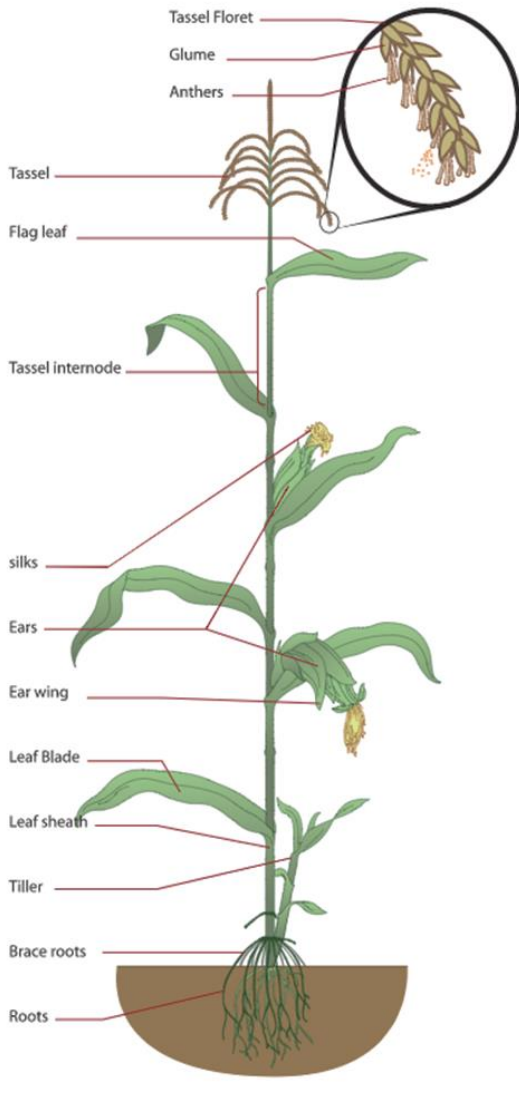


10. (+)	Tassel: anthocyanin coloration of glumes excluding base	Note
QN	absent or very weak	1
	weak	3
	medium	5
	strong	7
	very strong	9

14. (*)	Tassel: number of primary lateral branches	Note
QN	absent or very few	1
	few	3
	medium	5
	many	7
	very many	9

15. (+)	Ear: time of silk emergence	Note
QN	early	3
	medium	5
	late	7

Maize: 42 characteristics



17. (+)	Stem: anthocyanin coloration of brace roots	
QN	absent or very weak	1
	weak	3
	medium	5
	strong	7
	very strong	9

20. (+)	Stem: anthocyanin coloration of internodes	
QN	absent or very weak	1
	weak	3
	medium	5
	strong	7
	very strong	9

28. (* (+)	Ear: length	
QN	very short	1
	short	3
	medium	5
	long	7
	very long	9

Definition of a variety

■ Variety description

total 41 chars.



Char No.	Characteristics	Notes
1	First leaf: anthocyanin coloration of sheath	5
2	First leaf: shape of apex	3
3	Foliage: intensity of green color	2
4	Leaf: undulation of margin of blade	2
5	Leaf: angle between blade and stem	3
6	Leaf: curvature of blade	3
7	Stem: degree of zig-zag	2
8	Tassel: time of anthesis	4
..

The variety description → defined by the states of expression of the 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 states of expression of the characteristics

Definition of a variety

■ Variety description

total 61 chars.



<http://o-e-c.net/syokuzai/tomato>

UP OV No.	Characteristics	States of Expression
1	Seedling: anthocyanin coloration of hypocotyl	9
2	Plant: growth type	1
3	Only determinate growth type varieties: Plant: number of inflorescences on main stem (side shoots to be removed)	5
4	Stem: anthocyanin coloration of upper third	3
5	Only indeterminate growth type varieties: Stem: length of internode (between 1st and 4th inflorescence)	
6	Leaf: attitude (in middle third of plant)	5
7	Leaf: length	5
8
9

The variety description → defined by the states of expression of the characteristics

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

Qualititative

Characteristics

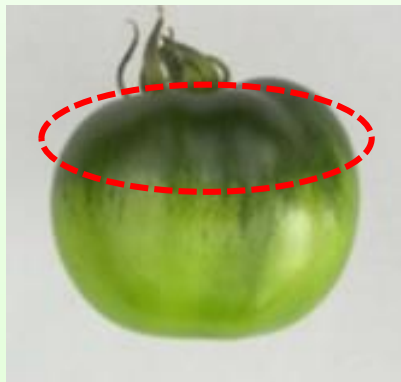
Type of expression of characteristics: QL

- ✓ 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)**



Present 9



Absent 1

**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	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

Example of QL

- Anthocyanin coloration; absent, present
- Ploidy; diploid, triploid, tetraploid
- Sex; male, female
- Leaf margin; entire, serrate, dentate
- Flower type; single, double
- Color of vein; green, red
- Border of eye zone; sharp, diffuse
- Fruit: surface; smooth, bumpy

Type of expression of characteristics: **QN**

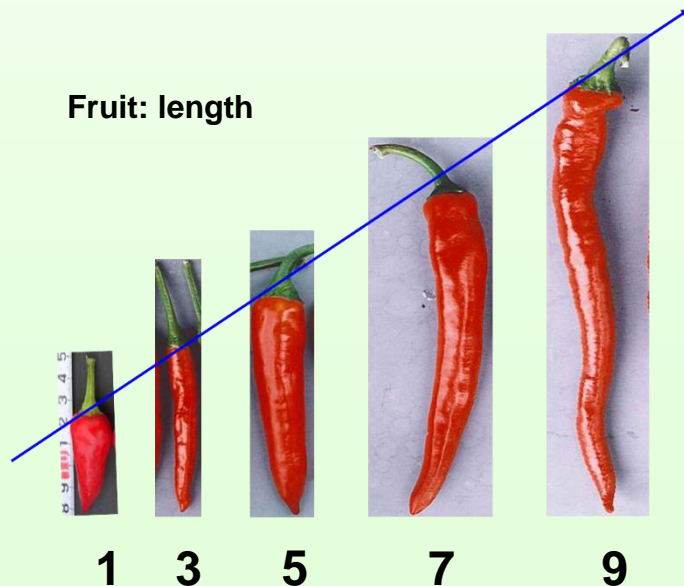
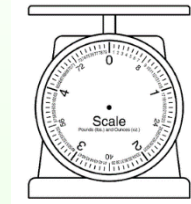
QN

Quantitative

Characteristics

Type of expression of characteristics: QN

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



states of expression

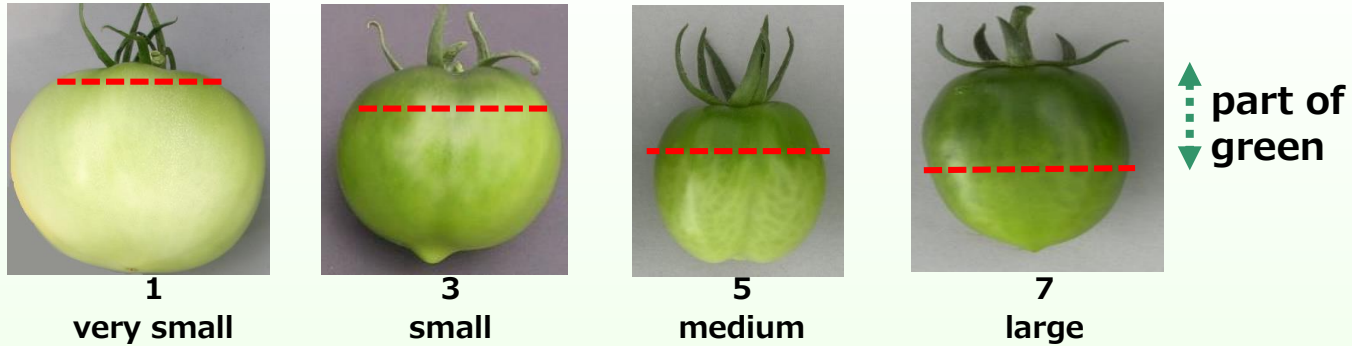
- very short
- very short to short
- short
- short to medium
- medium
- medium to long
- long
- long to very long
- very long

Notes

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

Type of Expression: QN

Fruit: extent of green shoulder (before maturity)



Fruit: ribbing at peduncle end



Type of expression of characteristics: **QN**

Ear: length of peduncle



3



5



7

Stem: anthocyanin coloration of brace roots



1



3



5



7



9

35

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

■ 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



Example of QN

- height, length, width, thickness, diameter, weight, size, number of flowers, firmness, time of flowering(harvest, maturity)
- intensity of green color, anthocyanin coloration, attitude of blade, hairiness, leaf: waxiness, leaf: waviness, leaf: undulation of margin, leaf: angle of apex, fragrance, glossiness, resistance to disease

Type of expression of characteristics: PQ

PQ

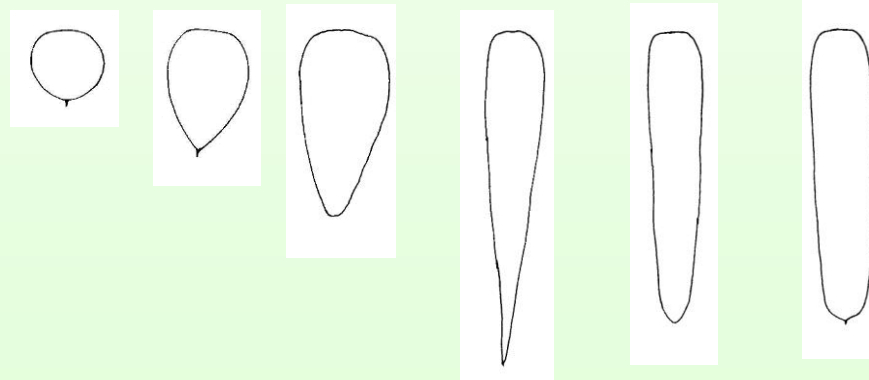
Pseudo Qualitative

Characteristics

Type of expression of characteristics: PQ

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

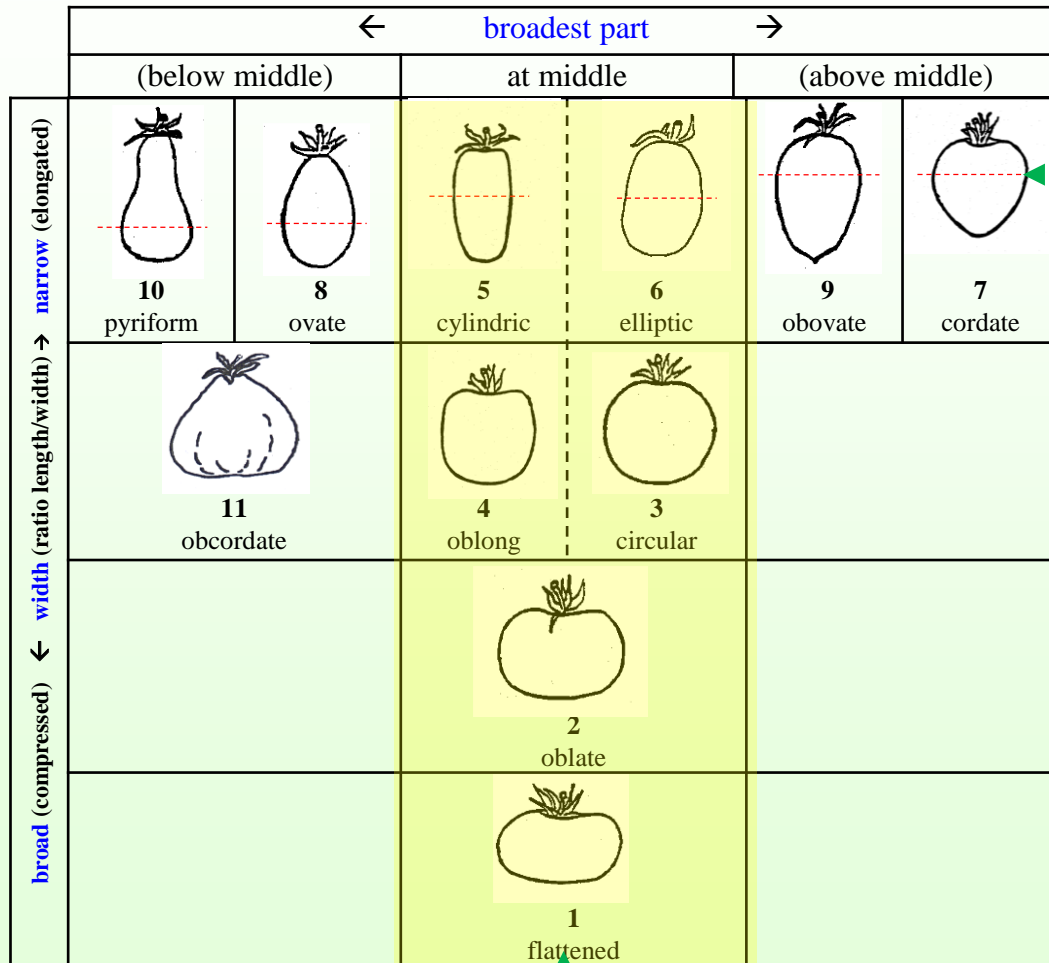
10. (*) (+)	VG	Root: shape in longitudinal section	TG/49/7 Carrot	
PQ	(b)	circular	Parijse Markt 2	1
		obovate		2
		medium obtriangular	Chantenay, De Colmar à	3
		narrow obtriangular	Imperator, De Colmar à	4
		narrow obtriangular to narrow oblong	Maestro	5
		narrow oblong	Amsterdam 2	6



1 circular 2 obovate 3 medium obtriangular 4 narrow obtriangular 5 narrow obtriangular to narrow oblong 6 narrow oblong

Type of expression of characteristics: PQ

(Tomato)
Fruit: shape in
longitudinal
section



← broadest part

width ↑

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

	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

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



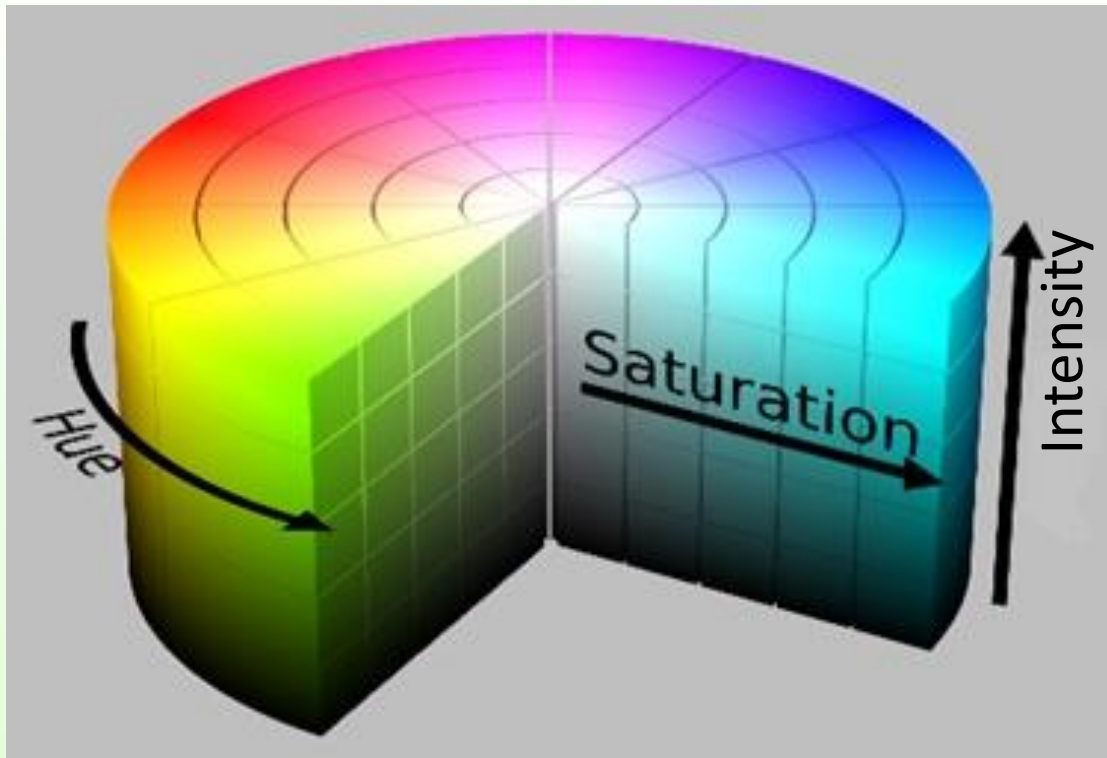
6



44

Kaneda;2005

Type of expression of characteristics: PQ



<https://codewords.recurse.com>

Color: three dimension

Hue



Saturation

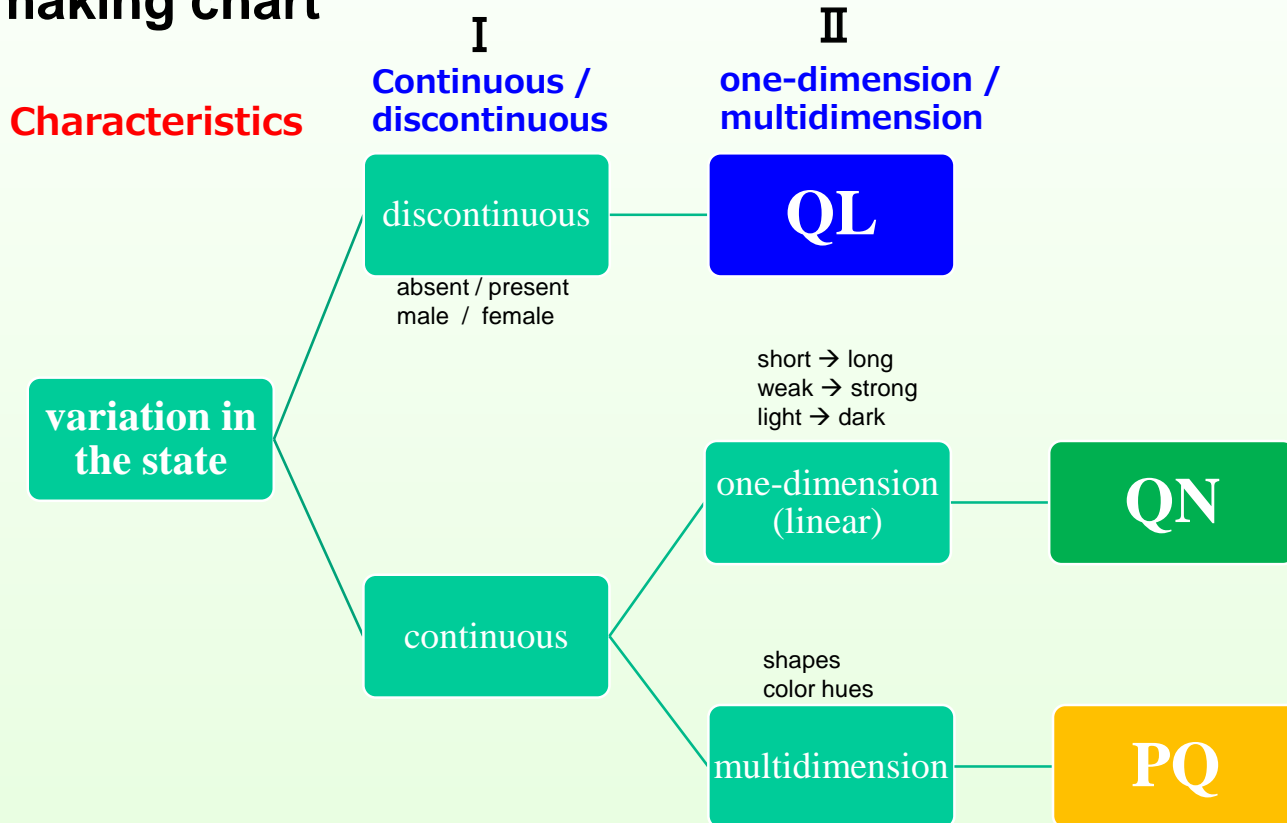


Intensity (Brightness)



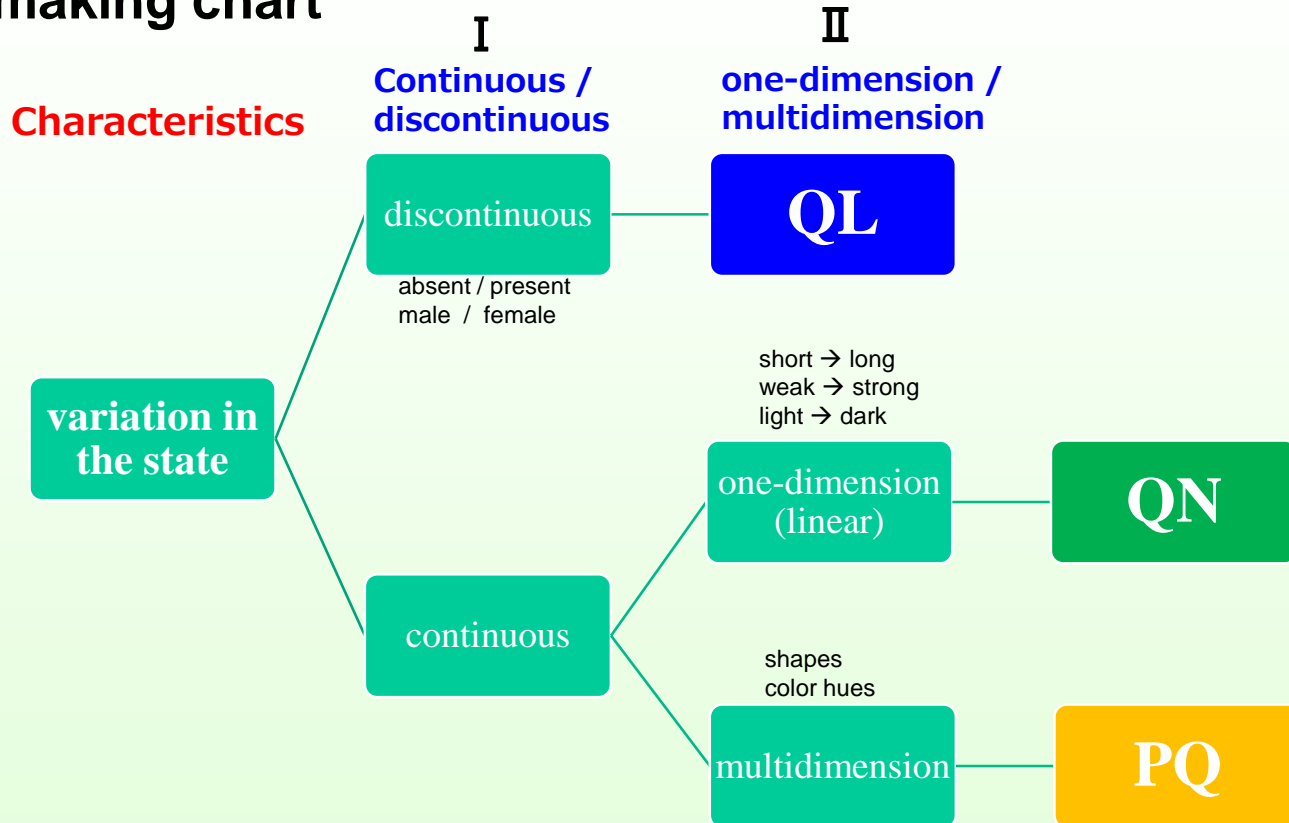
Type of expression of characteristics

Decision making chart



Type of expression of characteristics

Decision making chart



Leaf: intensity of green color **QN**



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

Method of observation

Method of observation

V (visual) : visual observation includes smell, taste and touch
: diagrams, example varieties, color chart

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

QL: in general, observed visually

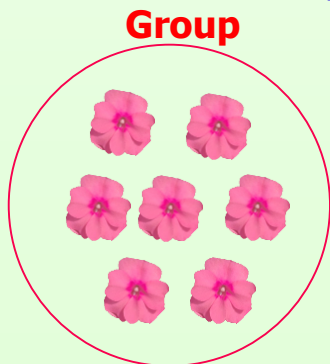
QN: measured or visually observed

PQ: in general, observed visually

Type of record

Type of record

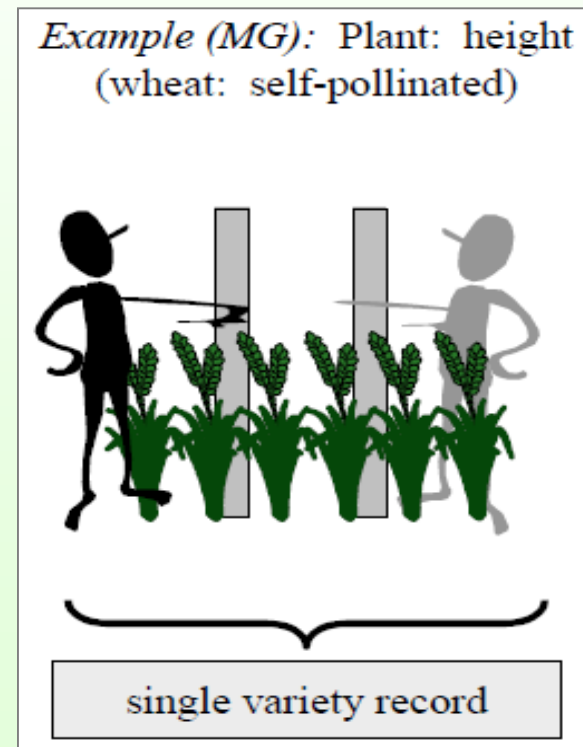
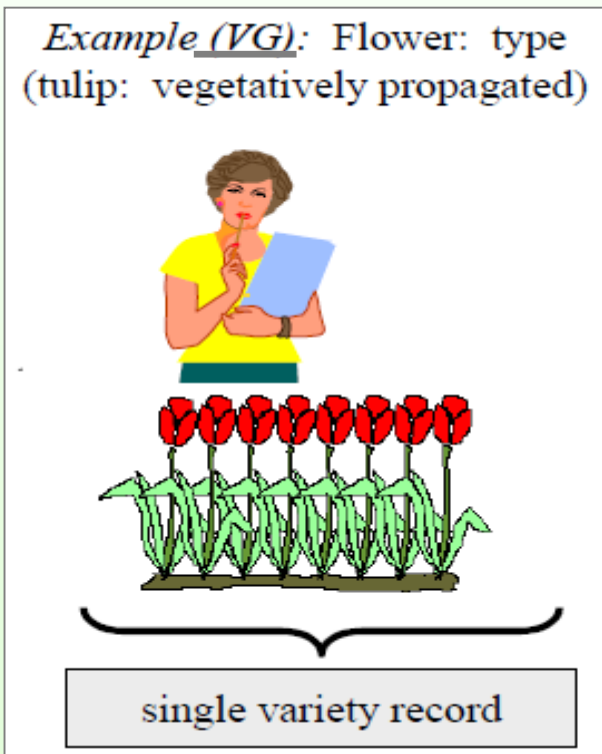
- G (Group)** : single record per variety, or a group of plant or parts of plants
: notes, colour chart Number, measurement (length, count, date etc.)
- S (Single)** : record for a number of single, individual plants or parts of plants
: records are used for calculating a variety mean value etc.



Type of assessment

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

MG : Single measurement of a group of plants or parts of plants



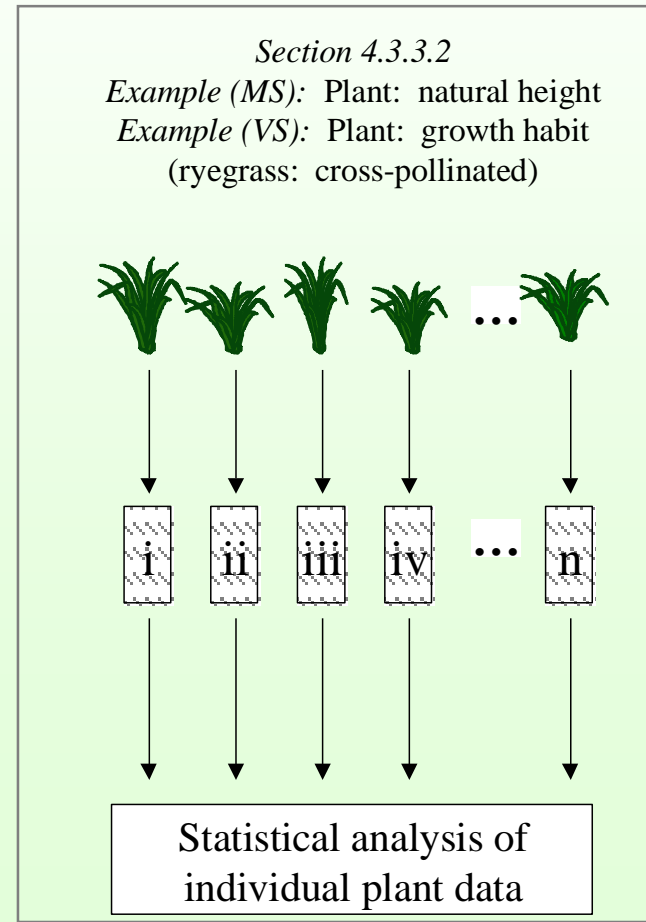
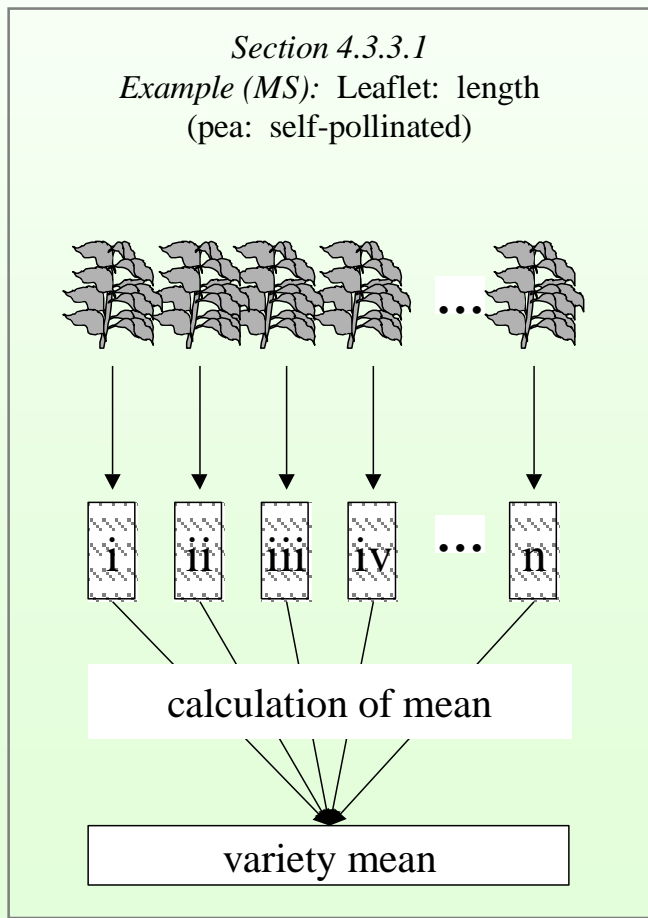
Type of Assessment

16.	VG	Ear: anthocyanin coloration of silks	
(*)			
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		early	Sungold 3
		early to medium	Aichi First 4
		medium	Daniela, Ferline, 5
			Montfavet H 63.5
		medium to late	Ozyrys 6
		late	Green Grape, Green Zebra 7
		late to very late	AM1513 8
		very late	9

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

14.	MS/VG	Tassel: number of primary lateral branches		
(*)				
QN		absent or very weak	F7	1
		few	F252	3
		medium	F244	5
		many	A188	7
		very many	Suregold (SC)	9

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

■ Type of assessment in Maize TGs

	QL	PQ	QN	Total
VS	0	0	0	0
VG	2	3	25	30
VG/MS	0	0	1	1
MS	0	0	8	8
MG	0	0	2	2
	2	3	36	41

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

Role of

DUS test

2. Examination of DUS

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.*

Examining Distinctness : D

Requirement of “D”

TG/1/3; 5.1

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

Candidate
Variety

VS

Common
knowledge

**clearly
distinguishable**



{
✓ consistent
✓ clear differences

Examining Uniformity : U

Requirement of “U”

TG/1/3; 6.1

A variety is 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,”

The level of uniformity required for

- **ruly self-pollinated varieties,**
- **mainly self-pollinated varieties,**
- **inbred lines of hybrid varieties,**
- **vegetatively propagated varieties,**
- **cross-pollinated varieties,**
- **mainly cross-pollinated varieties,**
- **syntnetic varieties**
- **and hybrid varieties**

will, in general, be different.

Examining Stability : S

Requirement of “S”

TG/1/3; 7.1

A 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, test of stability is not performed.

- ✓ **when a variety has shown to be uniform, it can be considered to be stable.**
- ✓ **where appropriate, stability may be tested by growing a further generation**

Summary

General Introduction to DUS

DUS test

- Object:** to assess whether the variety meets the DUS requirement
- Definition of the variety** ---> To generate a description of the candidate variety, using its relevant characteristics (e.g. plant height, leaf shape, time of flowering)
- Assessing DUS**

Observation of characteristics

- type of expression ⊖ QL, QN, PQ
- Method of observation ⊖ V, M
- type of record ⊖ G, S

D Examination

- reference varieties selection** ⊕
- examining D ⊕

U Examination

⊕

S Examination

⊕



Thank you for your attention

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