TEMPERATE AND WARM TEMPERATE FRUIT VARIETY DESCRIPTORS BOOK

(Apple, Walnut, Pecan, Almond, Pear, Persimmon, Kiwi)

Collection of IBPGR, UPOV, IBPGR, and ECPGR Publications

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ECPGR Characterization and Evaluation Descriptors for Apple Genetic Resources

Apple (*Malus x domestica*)

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The Programme, which is entirely financed by the member countries, is overseen by a Steering Committee composed of National Coordinators nominated by the participating countries. The Coordinating Secretariat is hosted by the Alliance of Bioversity International and CIAT.

The Programme operates through Working Groups composed of pools of experts nominated by the National Coordinators. The ECPGR Working Groups deal with either crops or general themes related to plant genetic resources (documentation and information, *in situ* and on-farm conservation, and cryopreservation). Members of the Working Groups carry out activities based on specific ECPGR objectives, using ECPGR funds and/or their own resources.

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Introduction

Developing standards to collect and share information about plant genetic resources is vital for their conservation and use by farmers, gardeners, scientists, conservationists and breeders.

In recent years, the ECPGR *Malus/Pyrus* Working Group highlighted the need to synthesize, harmonize and prioritize an agreed set of characterization and evaluation descriptors for *Malus/Pyrus* cultivated species (Lateur et al., 2006; Lateur et al., 2013), and committed to filling this need. Common protocols and descriptors were consequently adapted, initially by a task force formed by representatives of the *Malus/Pyrus* Working Group (M. Lateur, D. Szalatnay, E. Dapena, M. Kellerhals). Further on, in the framework of an ECPGR Grant Scheme Activity named 'Common ECPGR protocols and tools available for Characterization & Evaluation of *Malus/Pyrus* genetic resources',and supported by the Federal Ministry of Food and Agriculture, Germany, it was planned to finalize a new updated version of the former Descriptor List for Apple (*Malus*) published 40 years ago.

This publication brings all the above efforts together and includes enhanced descriptions of methods/protocols and technical practical information.

As far as possible, it was attempted to retain descriptors already in use, and many of the descriptors proposed are the same as those previously published by, or adapted from ECPGR, UPOV, CPVO and/*or Obst-Deskriptoren NAP – Descripteurs de Fruits PAN* (Szalatnay 2006). Further descriptors are from protocols already developed and in use by collection curators, and a small number of novel descriptors have been added where no suitable descriptor was available.

Genetic resources, by their nature, contain a wide diversity of traits. Scales must be sufficiently open to include this range. A general rule has been to use 1–9 scales with extreme classes (1 and 9) described as 'Extremely…', which should be taken to mean outside of what is generally known. To maximize the accuracy of a trait description, in many tables, it is recommended to use the intermediate class types referenced in the descriptor tables as 'X'.

Describing colour can be challenging, and illustrations are presented in the document thanks to the work of Szalatnay (2006). It is recommend, when possible, to control the judgement of colour against a standard colour chart such as the Royal Horticultural Society Colour Chart,and reference to this is either included or will be included in due course in line with UPOV (2019).

Even for characterization traits, variability is observed among fruits, among sites and across years. It is therefore ideal to collect data during a sufficiently long period of time to be able to show the variability of the character and to define a 'median' relative value for each trait.

Most descriptors are based on comparison to reference cultivars. However, in some cases, illustrations or absolute values have been added for further clarity. For most descriptors, it is recommended that the list of reference cultivars is extended so that, for each category, at least one is available for comparison.

One very important objective in standardizing descriptors is to be able to compare and analyze data from different collections, and it is crucial to clearly describe the methodology used for each descriptor. To aid with the comparison across different collections, it is important to record experimental methods, numbers of replicates, ages of trees, rootstocks and management scheme (e.g. fungicide application), and to include reference cultivars as far as possible. Climatic data such as mean rainfall for each season can also be important to note.

It is hoped that the descriptors below will allow the potential ranking of accessions through relative classification; ranking will obviously need to be applied within specific contexts.
It is recommended that field observations on descriptions and/or descriptors should be maintained for later reference and/or consideration.

Further information on the concepts of crop descriptors is downloadable from:

- https://cgspace.cgiar.org/handle/10568/56589

Online information on apple descriptors can also be found at:

- https://hdl.handle.net/10568/72794
- http://www.upov.int/edocs/tgdocs/en/tg014.pdf
- https://cpvo.europa.eu/sites/default/files/documents/malus_domestica_2.pdf
- http://www.cpc-skek.ch/fileadmin/pdf/NAP_Beschreibungshandbuecher/deskriptoren-handbuch_nap.pdf

Methods and prioritized descriptors for *Malus*

The aim of the below is to recommend a range of descriptors, which will successfully describe and discriminate between key characters in most accessions. Ideally, characters should meet the criteria of being:

- Highly stable over time with low interaction with environmental factors
- Highly polymorphic
- Easy to score in practice
- Able to combine characterization and agronomic evaluation value where possible.

The proposed list was mostly compiled using:

- Characters suggested by members of the *Malus/Pyrus* Working Group and compiled by a Task Force headed by M. Kellerhals (Lateur et al., 2010)
- Results of a study on selected common cultivars in the UK, France, Belgium and Italy (Janes and Jones, 1998)
- Apple Descriptors (Watkins and Smith, 1982)
- Protocol for distinctness, uniformity and stability tests – *Malus domestica* Borkh. – APPLE, CPVO-TP/14/2 Final (14/03/2006).
- UPOV Guidelines for the conduct of tests for distinctness, uniformity and stability (Apple – Fruit Varieties): TG/14/8 (1995) and TG/14/9 (2005).
- *Obst-Deskriptoren NAP – Descripteurs de Fruits PAN* (Szalatnay, 2006).
- Dapena, E., Fernández, M. (2009). Guía de descriptores de caracteres. In : Dapena, de la Fuente E, Blazquez, Noguero MD. 2009. Description de las variedades de Manzana de la D.O.P Sidra de Asturias. Villaviciosa. 69pp.

A priority ranking of the descriptors is included. It is acknowledged that capability will depend upon time and resources. The primary characterization and evaluation traits are recommended for prioritization. First priority descriptors are indicated in the document with “**Priority 1**”; second and third priority descriptors with a “**Priority 2/3**”. Second and third priority descriptors represent useful tools that can be used by curators who have the capacity to do the further evaluation and/or characterization work.

Since many scores are relative, it is important to have representatives from a minimum set of common reference cultivars (ideally, a minimum of 2/3) in each characterization/evaluation site. Recommended cultivars for general comparison are listed below and are based on a survey of the members of the ECPGR *Malus/Pyrus* Working Group:

- Alkmene
- Åkerö
- Ananas Reinette (syn. Reinette Ananas)
- Discovery
- Golden Delicious
- Ingrid Marie
- James Grieve
- Jonathan
- King of the Pippin (syn. Reine des Reinettes, Winter Goldparmäne)
- Reinette de Champagne
- Winter Banana
- White Transparent (syn. Transparente Blanche)

General notes on methodology for characterization

Data should be recorded on representative trees and ideally, data should be recorded in representative years.

Extreme climatic conditions such as high spring temperature, severe spring frost or hail are known to affect floral phenology and fruit set/quality.

Ideally, data from several **representative** years should be recorded before accessions can be fully classified.

All recorded dates should be transformed into number of days from the first of January. Phenological classifications can then be expressed as '+' or '–' (X) day differences from the reference cultivars classified in the medium period.

It is important to organize training for technicians and field workers who will perform the evaluation. It is recommended to check the reproducibility of data (between data collected on the same object by different observers) and the repeatability (between observations made by the same observer at different times).

1. Flowers

Assessment of trees two to three times per week is generally recommended in order to observe the correct moment when flowers open. The primary stages that need at least to be observed are: E2 (BCCH: 59), F (BCCH: 61), F2 (BCCH: 65) and H (BCCH: 69), (according to Fleckinger and Meier, 2001 – **Figure 1)**. For further detail, it is recommended to follow the BBCH flowering stages codes (Anonym, 1989, Meier, 2001). As a general rule, assessment of flowers should not include those appearing on one-year shoots.

Some cultivars tend to produce a second flowering phase a few months after the spring flowering period. The intensity of this flowering is much less important, but incidence represents a risk of infection by fire blight (*Erwinia amylovora*). Independent descriptors relating to secondary flowering are proposed.

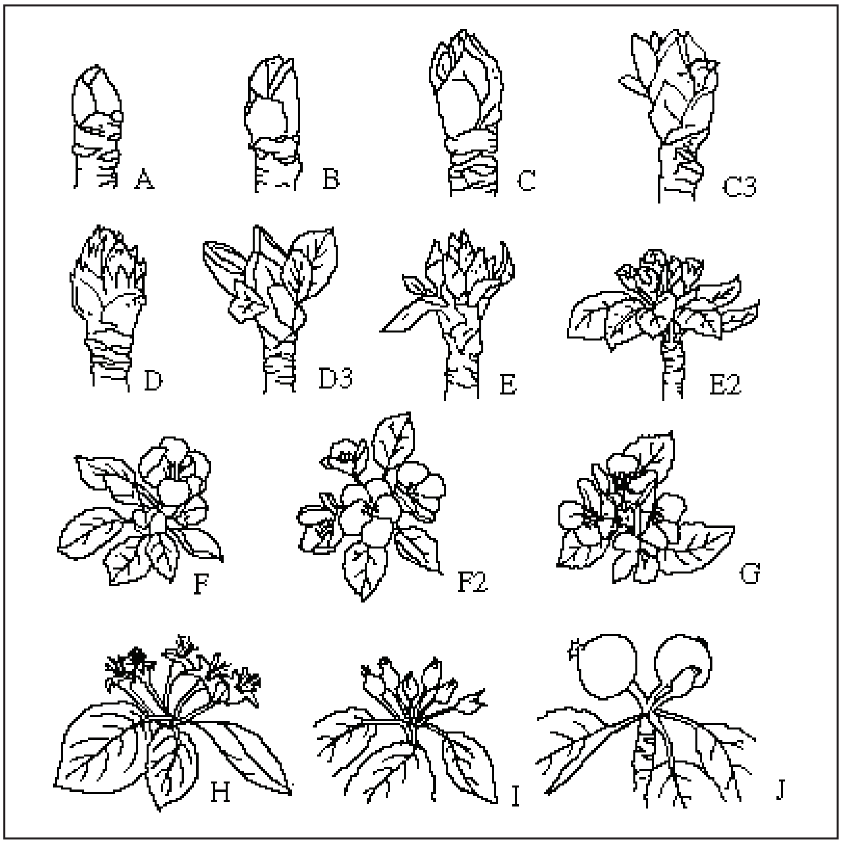


Figure 1. Fleckinger's phenological flower stages for apple.

1.1 Flowering phenology (*Priority 1*)

When flowering intensity is very low (fewer than 5% of the buds are flower buds), it is not representative to evaluate the flowering season. It is useful to note and/or assess the flowering intensity of the trees by using the assessment key defined in **Table 1**. The relative flowering season of a cultivar (**Table 2**) can then be assessed by comparison against the flowering period of reference cultivars. It is recommended that for standardization, Golden Delicious is considered as a central point for all areas. For this comparison; the reference flower stage can be either 'F' (BCCH: 61), or 'F2' (BCCH: 65).

Table 1. Flowering intensity (developed from Lateur and Populer, 1996)

State	Flowering intensity	Field observations
1	No flower	Absence of any flower
2	Extremely low	Flower clusters represent up to 5% of all buds
3	Low	Flower clusters represent approx. 10% of all buds
4	Low to medium	X
5	Medium	Flower clusters represent approx. 30% of all buds
6	Medium to high	X
7	High	Flower clusters represent approx. 50% of all buds
8	High to extremely high	X
9	Extremely high	Over 90% of all buds are floral

'X': Intermediate rating.

Table 2. Relative flowering season (adapted from Lateur and Populer, 1996)

State	Flowering period	Indicative difference in average days	Example of reference cultivars
1	Extremely early		
2	Very early	-9	White Transparent, Gravensteiner, Stark Earliest, Sobena, Princesa
3	Early	-6	Boskoop, Idared, Alkmene, Rosy Glow, James Grieve, Discovery
4	Early/medium	-3	Granny Smith, Tydemans Early Worcester, Jonathan, Cox's Orange Pippin
5	Medium	0	Jacques Lebel, Elstar, Golden Delicious, Glockenapfel, Jonagold, King of the Pippin, Ingrid Marie
6	Medium/late	+3	Reinette Etoilée (syn. Rote Sternreinette), Belle-Fleur de France, Gala, Golden Orange
7	Late	+6	Court-Pendu Rouge (syn Court-Pendu Plat, Königlicher Kurzstiel), Belle-Fleur de Brabant, Rome Beauty
8	Very late	+9	Reinette de France, Spätblühender Taffetapfel
9	Extremely late		

1.2 Regularity of flowering *(Priority 3)*

Following the assessment of flowering intensity over four to six representative years, accessions can be placed in categories of flowering regularity. It is important that thinning methods are not in place as these will act to mitigate this characteristic.

Table 3. Relative regularity of flowering (adapted from Watkins and Smith, 1982)

State	Regularity of flowering	Example of reference cultivars
1	Very Irregular	
2	X	
3	Irregular	
4	X	
5	Regular	Golden Delicious

‘X’: Intermediate rating.

1.3 Occurrence of secondary flowering during summertime *(Priority 3)*

Secondary flowering should initially be assessed in terms of intensity as per **Table 4**. Following at least 5–6 seasons, accessions can be classified into different levels of frequency of secondary flowering (**Table 5**).

Table 4. Intensity of secondary flowering

State	Secondary flowering intensity	Field observations
1	Low	Absence of any secondary flowering
2	Medium	Flower clusters represent up to 5% of all buds
3	High	Flower clusters represent more than 5% of all buds

Table 5. Frequency of secondary flowering (Watkins and Smith, 1982)

State	Frequency of secondary flowering	Example of reference cultivars
1	Rare	Reinette de France
2	Intermediate	
3	Frequent	Pinova

1.4 Flower colour at balloon stage (BBCH 59, E2) *(Priority 3)*

1 = white

1 = weiss

1 = blanche

(Cox's Pomona)

2 = yellowish and pink

2 = gelb und rosa

2 = jaune et rose

(Herrenhut, Worcester Pearmain)

3 = light pink

3 = hellrosa

3 = rose pâle

(Gravensteiner, Jonathan)

4 = dark pink

4 = dunkelrosa

4 = rose foncé

(Sylvia, Elstar)

5 = red

5 = rot

5 = rouge

(Kidd's Orange Red)

6 = purple

6 = violett

6 = violette

(Rafzubin, Melba)

7 = dark red

7 = dunkelrot

7 = rouge foncé

(Weirouge)
(Dapena et al., 2009)

Figure 2. Colour of flower petals at E2 stage (CPVO, 2006, Szalatnay, Dapena et al., 2009)

2. Fruit

A sample of at least 6 to 12 representative fruits should be evaluated. Having identified the most representative fruits on the tree, the same protocol should be used for each accession, e.g. fruits taken from the sunny side at ¾ of the height of the tree. It is important to avoid the terminal (king) fruits. In general, it is recommended to perform fruit assessments in the orchard, in front of the tree where possible.

As per the CPVO Protocol (2006), it is recommended that all descriptions of fruit quality should be carried out at an optimal stage of ripening for fresh consumption. Unfortunately, there are no simple criteria to define an accession's good state of ripening, and this will remain a subjective judgement based on the expertise of the curators; frequent observation of the trees is recommended. Some factors offer useful indications e.g. first pre-harvest drop of healthy fruit, change in ground- and over-colour of the fruit, and taste of the fruit (acidity, starchiness, sugar level, firmness) but it is noted that these are themselves characterization/evaluation characters. Iodine starch index can be also a good indicator but this is not always the case. It is generally recommended to not pick before reaching the 6–7 starch index score (Vaysse, Landry, 2004). For extremely late-ripening cultivars, it may be necessary to either analyze samples of fruit picked as late as possible or after a period of post-harvest ripening.

Since ripening time is difficult to accurately predict, and it is often not practical to finely monitor each accession, it is recommended that the level of eating maturity at the date of picking is noted against the scale in **Table 6**. It should be noted that the stage of ripening for harvest and consumption would differ for many cultivars, apart from the 'summer-ripening' apples. Scores of 1 or 5 should indicate that fruits are not suitable for assessment. However, except for those stated as to be measured at eating maturity, many of the characters below would be able to be assessed at harvest maturity.

Table 6. Assessment of the ripening stage (for consumption) of the fruits when picked

State	Optimal ripening stage (eating maturity) assessment
1	Much before optimal ripening stage
2	Just before optimal ripening stage
3	Optimal ripening stage
4	Just after optimal ripening stage
5	Much after the optimal ripening stage

2.1 Time of fruit ripening for harvest (harvest maturity) (*Priority 1*)

It is recommended that the optimal date of picking be recorded during at least four to six representative seasons. It should be possible to estimate the average optimal harvest date and classify accessions as per **Table 7**.

It is noted that the range below may not be wide enough to represent the full range of ripening times across Europe and this descriptor should be optimized further accordingly in the future.

Table 7. Relative harvest maturity

State	**Harvest maturity**	**Examples of reference cultivars**	**Approximate and indicative periods of picking for north-western Europe** (Lateur)	**Approximate difference to south-western Europe** (days, based on cv. Golden Delicious)
1	Extremely early	Earlier than White Transparent	July–August	More than -55
2	Very early	White Transparent	Early August	-55 to -40
3	Early	Jerseymac, Discovery, Tydeman's Early Worcester, Melba	End August	-39 to -26
4	X	James Grieve, Gravenstein, Alkmene, Transparente de Croncels, Auksis	Early September	-25 to -11
5	Medium	Gala, Elstar, Cox's Orange Pippin	Mid-September	± 10
6	X	Golden Delicious, Jonagold	End Sept–Early October	+11 to +25
7	Late	Idared, Melrose	Early October	+26 to +39
8	Very late	Fuji, Glockenapfel, Granny Smith	Mid-October	+40 to +55
9	Extremely late	Later than Fuji, Glockenapfel, Granny Smith	End October–November	> +55

'X': Intermediate rating.

2.2 Tendency to drop fruit at harvest time (*Priority 2*)

Assessment should be specific to healthy fruits (i.e. avoiding those that drop due to damage or factors other than ripening) and should be carried out at the judged time of optimal harvest as above.

Table 8. Tendency to drop fruit at harvest period.

State	Drop observed	Proportion of fruit drop at harvest (%)
1	No drop observed	0
2	Very low drop	1–10
3	Low	approx. 25–30%
4	Low to medium	X
5	Medium	approx. 50%
6	Medium to high	X
7	High	approx. 75%
8	High to very high	X
9	Very high	> 90

‘X’: Intermediate rating.

2.3 Precocity of fruit bearing (*Priority 2*)

Precocious trees of a given cultivar are defined as those that start to crop at an early age relative to other cultivars in a comparable situation.

Assessment should be carried out on the same rootstock, place, type of tree and year of planting. If planting was made in autumn, a score of 5 'in season of planting' should be applied for the following year. The age of the tree at planting, rootstock and other relevant factors should be noted for wider comparison.

Table 9. Relative precocity of fruit bearing

State	Precocity of fruit bearing	Observation
1	Extremely low	4 or more seasons after planting
2	Low	3 seasons after planting
3	Intermediate	2 seasons after planting
4	High	1 season after planting
5	Extremely high	In season of planting

2.4 Productivity (*Priority 2*)

Productivity can be assessed as the relative yield per tree. It is recommended that assessment be carried out over a minimum of four to six years before an average score can be allocated as per **Table 10**.

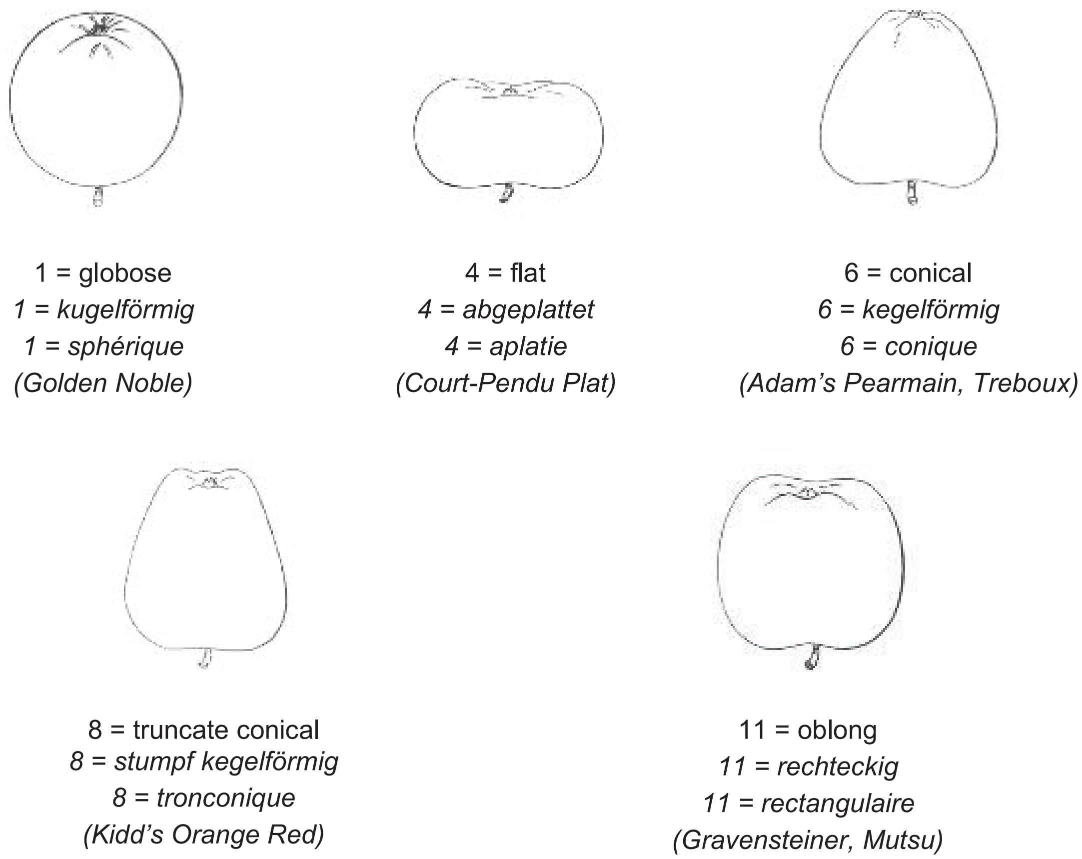
Table 10. Productivity (adapted from Watkins and Smith, 1982)

State	Productivity	Example of reference cultivars
1	Extremely low	
2	X	
3	Low	Discovery
4	X	
5	Medium	Cox's Orange Pippin, Auksis
6	X	
7	High	Golden Delicious
8	X	Greensleeves
9	Extremely high	

'X': Intermediate rating

2.5 Fruit shape (*Priority 1/2*)

We recommend, as a first characterization step, estimating to which of the main groups in **Figure 3** an accession belongs. The ratios between the fruit's height and width, and between the width of the eye basin and stalk cavity can then be estimated, or preferentially measured (further details in **Annexes 1 & 2**) and accessions can be scored using the scale given in **Table 11**.



Images from: Studium der Pomologie (1877), E. Lucas (adapted by Szalatnay)

Figure 3. Global mean fruit shapes with illustration of the main fruit shapes (Szalatnay 2006).

Table 11. Fruit height/width mean ratio (adapted from Dapena et al., 2009) (***Priority 2***)

State	Ratio	Representative average estimated fruit shape	Example of reference cultivars
1	< 0.75	Flat	Court-Pendu Plat (syn. Court-Pendu Rose)
2	0.76–0.85	Slightly flat	Bramley's Seedling, Idared, Grenadier, Auksis
3	0.86–0,99	Intermediate	Cox's Orange Pippin, Golden Noble, Gravensteiner
4	1–1.1	Slightly elongated	Adams's Pearmain, Kidd's Orange Red, Jonagold, Treboux (syn. Paernu Tuvioun)
5	> 1.1	Elongated	Kent, Kandil Sinap, Melon (syn. Prinzenapfel)

Table 12. Fruit eye basin/stalk cavity width mean ratio (See Annexes 1, 2 and 3) (adapted from Dapena et al., 2009) (***Priority 3***)

State	Ratio	Representative average estimated fruit shape	Example of reference cultivars
1	< 0.715	Conical	Adams's Pearmain, Kent, Norfolk Royal
2	0.715–0.815	Truncate conical	Kidd's Orange Red
3	> 0.815	Cylindrical	Gravensteiner, Mutsu

2.6 Regularity of shape in profile (*Priority 2*)

Table 13. Fruit shape variability

State	Fruit shape variability	Example of reference cultivars
1	Regular shape	Blenheim Orange, Ingrid Marie
2	Slightly variable shape	Cox's Orange Pippin, Auksis
3	Highly variable shape	Belle-Fleur de France, Åkerö

2.7 Presence of ribs in top view (*Priority 2*) (Szalatnay, 2006).

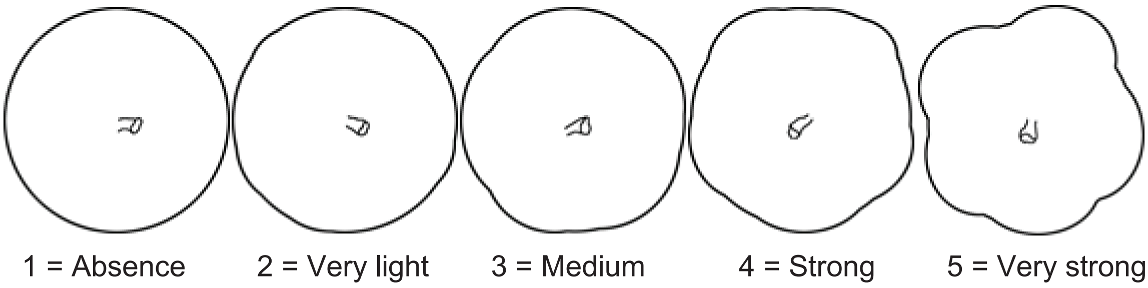


Figure 4. Presence of ribs

2.8 Fruit size (*Priority 1*)

At least 12 representative fruits should ideally be evaluated over a minimum of four to six years. An average score can then be assigned according to **Table 14**. The most straightforward measure of fruit size is based on weight, but since average fruit diameter is more common in commercial classification, indicative values for both are included. It should be noted that these indicative values will differ across locations and growing systems.

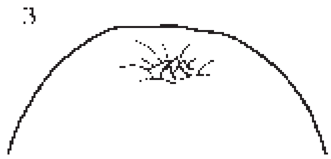
Table 14. Fruit size (adapted by Szalatnay and Lateur).

State	Fruit size	Average diameter (mm)	Average weight (g)	Example of reference cultivars
1	Extremely small	< 45mm	< 40	
2	Very small	46–50	41–60	Golden Harvey, Api Etoilé
3	Small	51–55	61–80	Akane, Miller’s Seedling
4	Small to medium	56–60	81–100	
5	Medium	61–70	101–150	Cox’s Orange Pippin
6	Medium to large	71–80	151–200	Holsteiner Cox
7	Large	81–90	201–250	Mutsu, Boskoop
8	Very large	91–100	251–320	Bramley’s Seedling
9	Extremely large	> 100	> 320	Jumbo, Howgate Wonder

2.9 Fruit crowning at apex (*Priority 2*)

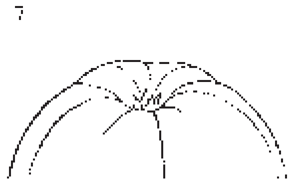
Crowning should be scored relative to the images in **Figure 5** and classifications in **Table 15**. It should be noted that this character is sensitive to fruit size.

1 = absent or very weak
1 = fehlend oder sehr schwach
1 = nulle ou très faible
(Blenheim Orange, Court-Pendu Rose, Discovery)

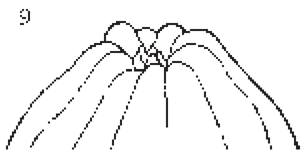


3 = weak
3 = schwach
3 = faible
(Cox's Orange Pippin, Beauty of Bath, Treboux)

5 = medium
5 = mittel
5 = moyenne
(Mutsu, Golden Delicious)



7 = strong
7 = stark
7 = forte
(Red Delicious)



9 = very strong
9 = sehr stark
9 = très forte
(Cox's Pomona, Calville Blanche d'Hiver, Talvenauding)

Figure 5. Illustration of different types of crowning at apex of fruit (**Table 15**).

Table 15. Fruit crowning at apex

State	Crowning at apex	Example of reference cultivars
1	Absent or very weak	Charles Ross, Blenheim Orange, Court-Pendu Rose, Discovery
2	X	
3	Weak	Cox's Orange Pippin, Beauty of Bath, Treboux (syn. Paernu Tuvioun)
4	X	
5	Medium	Mutsu, Golden Delicious
6	X	
7	Strong	Red Delicious
8	X	
9	Very strong	Cox's Pomona, Calville Blanche d'Hiver, Caville Rouge d'Automne (Röd Höst Kalvil)

'X': Intermediate rating.

2.10 Colour of fruit skin - ground colour at eating maturity (*Priority 1*)

It is recommended when possible to control the judgement of colour against a standard colour chart such as the Royal Horticultural Society Colour Chart and reference to this is either included or needs to be in due course in line with UPOV (2019).

Ground colour should be scored relative to the images in **Figure 6** and classifications in **Table 16**.

1 = yellow
1 = gelb
1 = jaune

(Golden Delicious)

2 = whitish yellow
2 = weisslich-gelb
2 = jaune blanchâtre

(Transparent de Croncels, Treboux, Kaja)

3 = green yellow
3 = grüngelb
3 = jaune vert

(Cox's Orange Pippin)

4 = whitish green
4 = weisslich-grün
4 = vert blanchâtre

(Grenadier)

5 = green
5 = grün
5 = verte

(Granny Smith)

6 = orange
6=orange
6=orange

Figure 6. Illustration for fruit skin ground colours (Images: Szalatnay, 2006)

Table 16. Ground colour

State	Ground colour	**Example reference cultivars** (IBPGR, CPVO)
1	Yellow	Golden Delicious
2	Whitish yellow	
3	Green yellow	Cox's Orange Pippin
4	Whitish green	
5	Green	Granny Smith
6	(Yellow) - Orange	

2.11 Amount of over colour on fruit skin at eating maturity (*Priority 1*)

Table 17. Over colour coverage

State	Over colour coverage	Estimated percentage of coverage (%)	Example reference cultivars (UPOV)
1	Absent	0	Granny Smith, Treboux (syn. Paernu Tuvioun), Kaja,
2	Very low	1–10	
3	Low	11–25	Cox's Orange Pippin
4	Low to medium	X	
5	Medium	± 50	(Gala), Aroma, Auksis
6	Medium to high	X	Cortland
7	High	± 75	Spartan
8	High to very high	X	
9	Very high	> 90	

'X': Intermediate rating.

2.12 Over colour of the fully mature fruit skin at eating maturity (*Priority 1*)

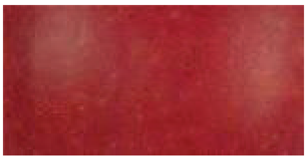
Again, it is recommended, when possible, to control the judgement of colour against a standard colour chart such as the Royal Horticultural Society Colour Chart and reference to this is either included or needs to be in due course in line with UPOV (2019).

Over colour should be scored relative to the images in **Figure 7** and classifications in **Table 18**.

1 = orange
1 = orange
1 = orange
(Egremont Russet, Alice)

2 = pink
2 = rosa
2 = rose
(Cripps Pink, Åkerö, Aroma)

3 = red
3 = rot
3 = rouge
(Jonathan, Auksis)



4 = dark red
4 = dunkelrot
4 = rouge foncé
(Starking Delicious, Ingrid Marie)

5 = purple
5 = violett
5 = violette
(Spartan, Lobo)

6 = brownish red
6 = braunrot
6 = brun-rouge
(Lord Burghley, Ilga)

Figure 7. Illustration for fruit skin over colour assessment (adapted from Szalatnay, 2006)

Table 18. Over colour

State	**Over colour**	**Reference cultivars** (e.g. UPOV)
0	Absent	
1	Orange	Egremont Russet, Alice
2	Pink	Cripps Pink, Åkerö, Aroma
3	Red	Jonathan, Auksis
4	Dark red	Starking Delicious, Ingrid Marie
5	Purple	Spartan, Lobo
6	Brownish Red	Lord Burghley, Ilga

2.13 Pattern of over colour on fruit skin at eating maturity (*Priority 2*)

The predominant pattern of over colour should be scored relative to the images in **Figure 8** and classifications in **Table 19**.

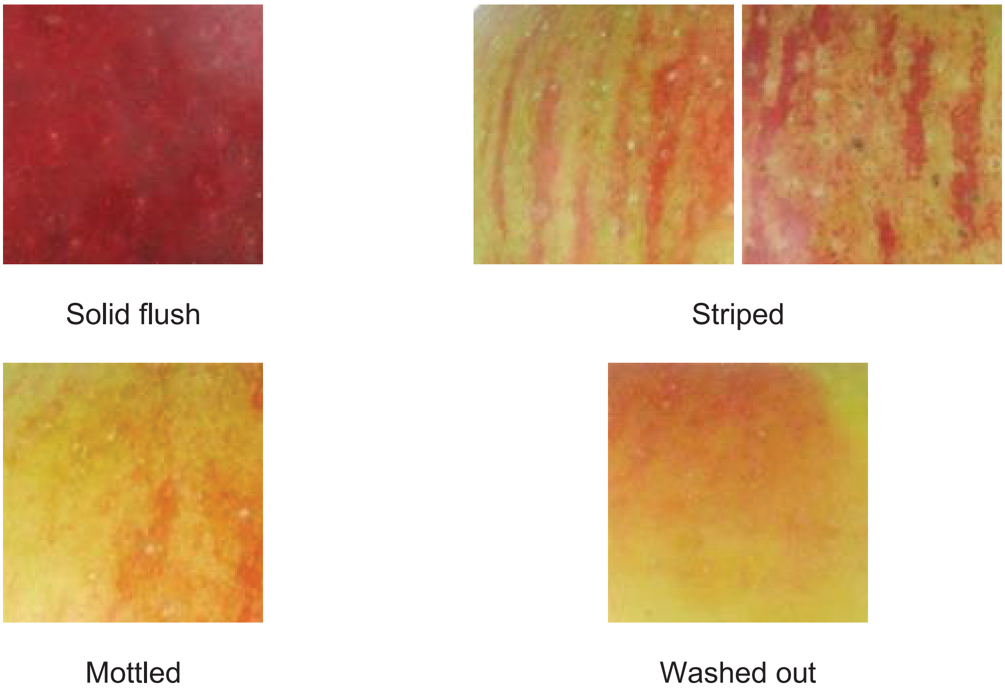


Figure 8. Illustration for fruit skin over-colour pattern assessment (adapted from Szalatnay, 2006)

Table 19. Over-colour pattern

State	**Over-colour pattern**	**Example of reference cultivars** (UPOV 2005)
1	Only solid flush	Richard Delicious
2	Flush with stripes	Gravensteiner
3	Only stripes	
4	Mottled	
5	Washed out	

2.14 Russet on fruit skin (*Priority 1/3*)

2.14.1 Overall amount of russet on fruit skin (*Priority 1*)

For fruit russet coverage, at least 12 representative fruits should be evaluated. An average score, including russet on cheeks, around eyes and in stalk basin is recorded at harvest, at full fruit ripeness (**Table 20**).

Table 20. Overall russet coverage

State	Russet coverage	Estimated percentage of coverage (%)	Examples of reference cultivars (CPVO-UPOV 2006)
1	Absent	0	Lobo
2	Very low	1–10	Golden Noble, Åkerö
3	Low	11–25	Cox's Orange Pippin
4	Low to medium	X	
5	Medium	± 50	Karmijn de Sonnaville, Coulon Reinette, Boskoop
6	Medium to high	X	
7	High	± 75	Zabergäu Renette
8	High to very high	X	
9	Very high	> 90	Egremont Russet, Canada Gris, Gris Braibant, Brownlee's Russet

'X': Intermediate rating.

2.14.2 Russet area around stalk cavity (adapted from Szalatnay, 2006) (*Priority 3*)

Table 21. Russet around stalk cavity

State	Russet coverage	Estimated percentage of coverage (%)
1	Absent	0
2	Very low	X
3	Low	± 25
4	Low to medium	X
5	Medium	± 50
6	Medium to high	X
7	High	± 75
8	High to very high	X
9	Very high	> 90

'X': Intermediate rating.

2.14.3 Russet area around eye basin (adapted from Szalatnay, 2006) (***Priority 3***)

Table 22. Russet around eye basin

State	Russet coverage	Estimated percentage of coverage (%)
1	Absent	0
2	Very low	X
3	Low	± 25
4	Low to medium	X
5	Medium	± 50
6	Medium to high	X
7	High	± 75
8	High to very high	X
9	Very high	> 90

'X': Intermediate rating.

2.15 Tendency for greasiness on fruit skin during storage (***Priority 3***)

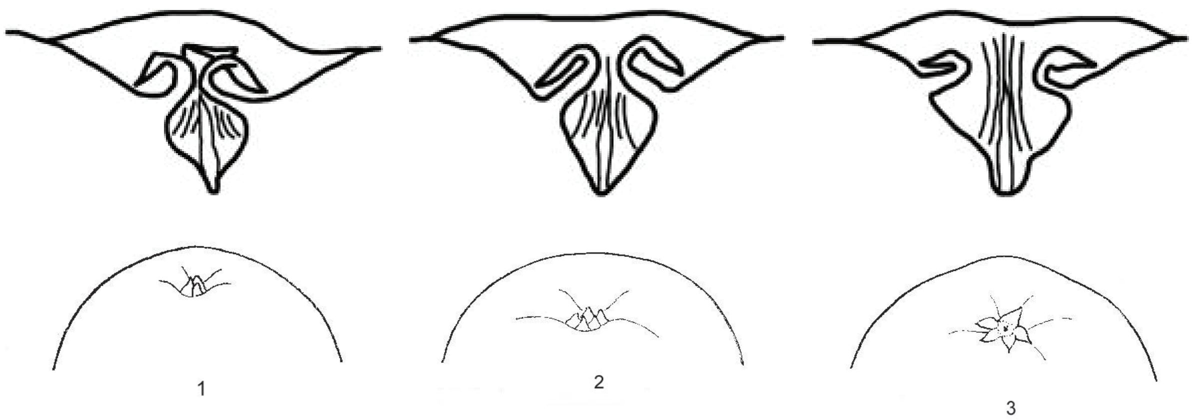
The tendency of the fruit to develop greasiness (wax) on fruit skin should be evaluated on fruits picked when fully ripe, subsequent to open storage at room temperature for at least three to four weeks (**Table 23**).

Table 23. Tendency to fruit skin greasiness (waxy skin)

State	Greasiness intensity	Example of reference cultivars
1	Absent or very low	Canada Gris, Dronning Louise
2	Medium	Boskoop, Auksis
3	Strong	Rubinola, Lord Lambourne, Jacques Lebel, Président Roulin, Lobo, Treboux (syn. Paernu Tuvioun)

2.16 Aperture of eye (*Priority 2*)

For aperture of eye, at least 6–12 representative fruits should be evaluated at full ripeness (**Figure 9**).



1 = closed	2 = partly open	3 = fully open
1 = geschlossen	*2 = halboffen*	*3 = offen*
1 = fermé	*2 = partiellement ouvert*	*3 = complètement ouvert*
(Gris Braibant, Jonathan, Worcester Pearmain, Åkerö)	*(Cox's Orange Pippin)*	*(Court Pendu Rose, Auksis)*

Figure 9. Aperture of eye (reproduced and adapted from Szalatnay, 2006)

2.17 Length of stalk (*Priority 2*)

For length of stalk, at least 6–12 representative fruits will be evaluated at harvest (**Table 24**).

Table 24. Stalk length

State	Stalk length	Average length (mm)	Example of reference cultivars
1	Very short	0–5	Court-Pendu Rose
2	Short	6–15	Cox's Orange Pippin
3	Medium	16–25	Worcester Pearmain, Melba
4	Long	26–30	Golden Delicious
5	Very long	> 30	Rubinette, Pinova, Paide Taliõun

2.18 Flesh colour at eating maturity (*Priority 3*)

Flesh colour should be assessed at full maturity based on a transversal cut through the middle of the fruit (**Table 25** and **Figure 10**).

Table 25. Flesh colour (CPVO, 2006)

State	Flesh colour	Example of reference cultivars
1	White	Akane, Radoux, Lobo, Cortland
2	Cream	Jonagold, Auksis
3	Yellowish	Topaz
4	Greenish	Gloster, Granny Smith
5	Pinkish	Pink Pearl, Pomfit
6	Red	Geneva, Weirouge

Figure 10. Illustration for flesh colour assessment at full maturity. 1 = White, 2 = Cream, 3 = Yellowish, 4 = Greenish, 5 = Pinkish, 6 = Red (reproduced from Dapena and Fernández, 2009).

2.19 Average number of seeds (*Priority 2*)

An average of fully formed seeds from approximately ten fruits should be calculated (**Table 26**). An average lower than three indicates a likelihood that a cultivar is triploid. A complete lack of seeds can be taken as an indicator of parthenocarpy (Lateur, 1996). Note that this characteristic can be highly influenced by environmental conditions and the availability of pollen.

Table 26. Number of seeds (Adapted from Gantar, 2016)

State	Average number of well-formed seeds	Example of reference cultivars
1	0	
2	1–3	Boskoop, Jacques Lebel, Blenheim Orange
3	4–5	
5	6–10	
7	11–15	
9	> 15	

2.20 Photographs of picked fruit samples (adapted from Szalatnay, 2006) (*Priority 1*)

Samples must be representative and very young; old, high- and low-yielding trees should be avoided, along with seasons with uncharacteristic conditions. Labels should include, as a minimum: accession name, accession number, tree position and date. Photographs may be taken under natural light (avoiding early morning or late afternoon) or artificial light (including flash light in studio conditions). A standard size reference (ideally a grid) should be included and a minimum set of views (as shown in **Figure 11**) should be included. All accessions for entry into ECPGR databases should have photographs available.

Further advisory details on photography can be found in **Annex 4**.

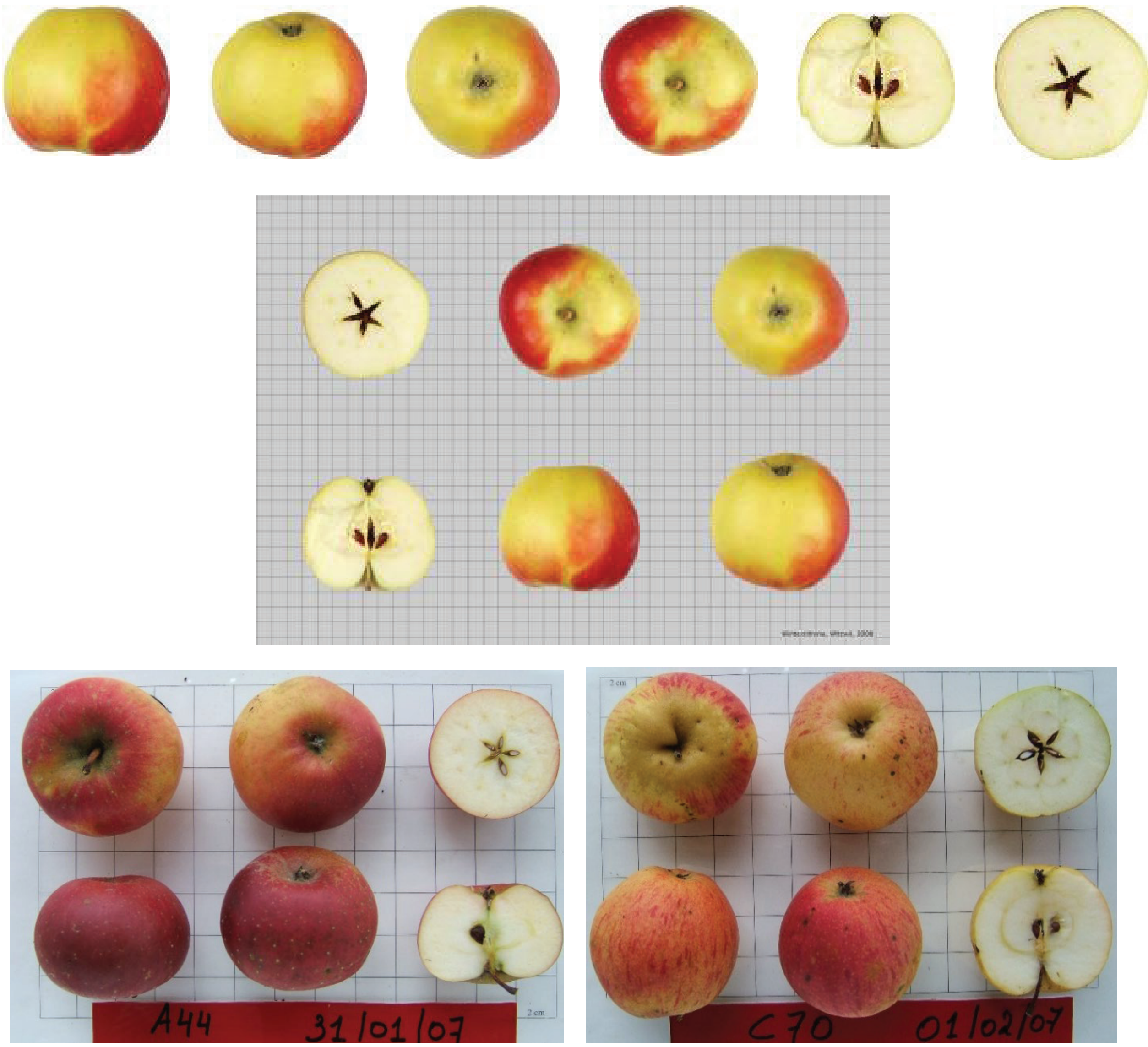


Figure 11. Examples of fruit pictures (Top photos: Courtesy of Szalatnay, 2006. Bottom photos: Courtesy of CRA-W).

2.21 Photographs of fruit hanging on the tree (*Priority 1*)

A representative fruit, or group of fruits well placed on the tree, should be selected. It is often practical to take a picture firstly of the tree label and/or the name on a list in order to trace the name of the accession. It is very important to get a clear view of the fruit eye (**Figure 12**). It is recommended to use a white panel as a natural light reflector as this can improve the precision of the fruit image.

Figure 12. Examples of apple fruit cultivars photographed on the tree (Photos: Courtesy of CRA-W).

3. Tree

3.1 Tree global architecture (*Priority 2*)

Tree architecture should be characterized when trees are at least 7–10 years old and should be scored using the UPOV classifications (**Table 27** and **Figure 13**).

Table 27. Tree architecture

State	Tree form	Example of reference cultivars (UPOV)
0	Columnar type	
1	Very upright or fastigiate	Firiki, Laine
2	X	
3	Upright	Gloster 69, Åkerö
4	X	
5	Spreading	Bramley Seedling's, Idared, Boskoop
6	X	Elstar
7	Drooping	Jonathan, Treboux, Cortland
8	X	
9	Weeping	Elisa Rathke, Kuku, Ritika

'X': Intermediate rating.

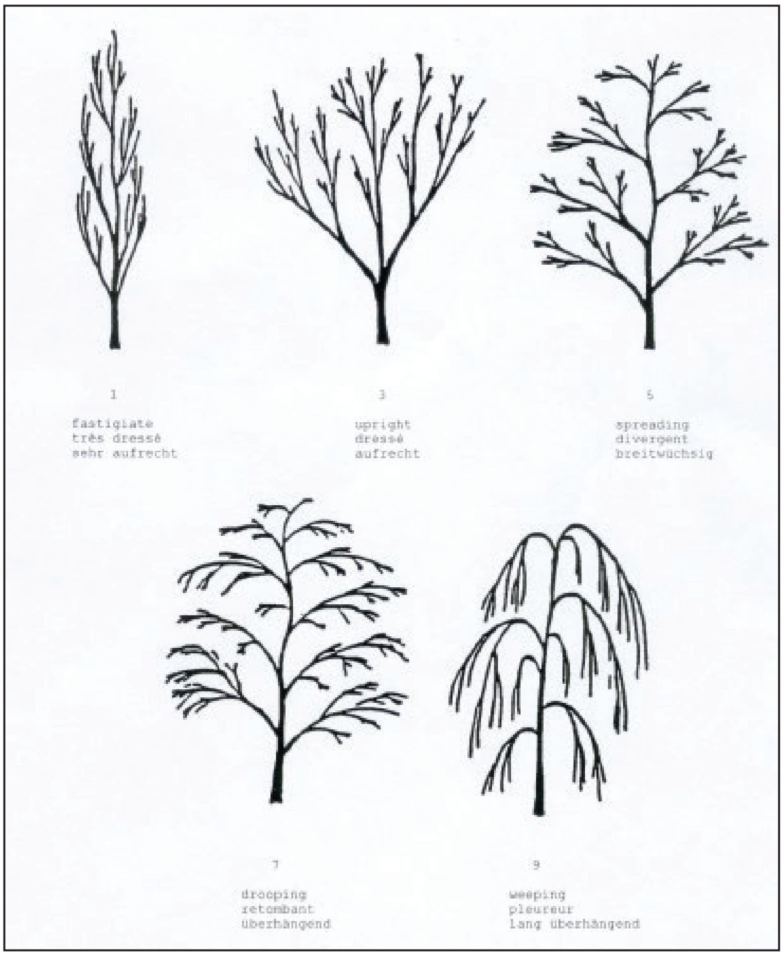


Figure 13. Global tree shape (CPVO, 2006).

3.2 Fruit-bearing habits (*Priority 2)*

Overall fruit-bearing habits can be assessed in a single year (**Table 28**). Ideally, they should be assessed on trees that have not been overly pruned and generally on established trees of 5–10 years old. For further detail of descriptions, see **Figure 14**.

Table 28. Fruit-bearing habits (Watkins and Smith, 1982)

State	Fruit-bearing type	Main fruit position	Indicative tree form	Reference cultivars
1	Columnar	On spurs only	Very few branches	Wijcik, Bolero, Waltz
2	Type I	Numerous short spurs that are long-lived. Fruit zone close to the trunk.	Upright with sparse branching and narrow crotches.	Starkrimson
3	Type II	On spurs mainly, with fruit zone moving slightly away from the trunk.	More frequent branching (than type I) resulting in tree spreading with age.	King of the Pippin (Reine des Reinettes), Cox's Orange Pippin, Blenheim Orange, Schone van Boskoop, White Transparent
4	Type III	On spurs and shoots that are 1–3 years of age. Tendency for the fruit zone to move towards the outside of the tree.	Spreading with frequent branching and wide crotches.	Golden Delicious, Jonagold, Pinova, Auksis
5	Type IV	Mostly at the end of 1-year-old shoots. Strong tendency for fruiting at the extremities of branches.	Upright main scaffold with frequent branching and narrow crotches. Tendency to droop and for the lower part of shoots to be without fruit or leaves.	Granny Smith, Tydeman's Early, Idared, Cortland

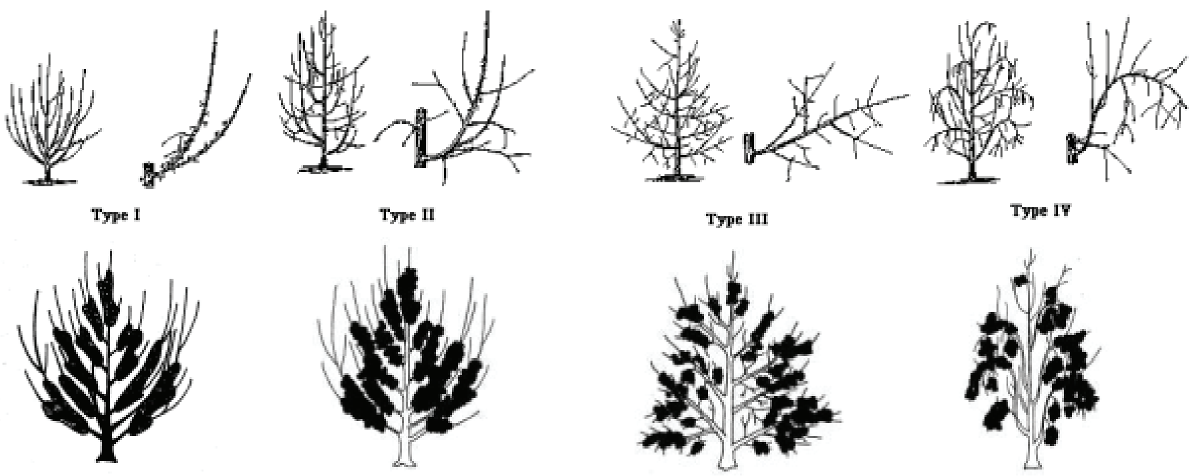


Figure 14. Types of global fruit-bearing habits (reproduced from Lespinasse, 1977).

3.3 Tree vigour (*Priority 3*)

Vigour can be assessed in a single year and should involve the assessment of height, and spread trees more than 5 years old. Comparisons to reference cultivars should be in the same place and use the same rootstock (**Table 29**).

Table 29. Tree vigour (adapted from Watkins, Smith, 1982)

State	Tree form	Example of reference cultivars
1	Extremely weak	
2	X	Discovery
3	Weak	Beauty of Bath, Grenadier, James Grieve
4	X	
5	Intermediate	Cox’s Orange Pippin, Golden Delicious, Auksis
6	X	
7	Vigorous	Boskoop, Blenheim Orange
8	X	Bramley’s Seedling, Åkerö
9	Extremely vigorous	

‘X’: Intermediate rating.

4. Disease and pest susceptibility

For pest and disease susceptibility assessment, it is particularly important to note details of the management scheme for fungicide and insecticide application for at least five years preceding the first evaluation. It is strongly recommended to not spray evaluation orchards for several seasons before the evaluation process (ideally, at least five years).

It is also important to carefully check that the pest/disease is homogeneously distributed inside the plot and useful to plant sufficient susceptible control cultivars throughout the field to help identify the occurrence of localized infections.

The most widely used assessment keys are based on a global approach for the assessment of the intensity of the pest/disease. Intensity forms the sum of two components: incidence and severity. Incidence is the qualitative 'presence' and 'absence' of symptoms (generally defined by the proportion of organs affected by at least one symptom); severity is the quantitative proportion of a surface, length or volume of an organ infected by the disease. In some instances, when more precision is needed on the type of resistance, it can be necessary to evaluate incidence and severity independently.

4.1 Scab (*Venturia inaequalis*) (*Priority 2*)

At least one observation should be made per year at the end of the growing season. If possible, though, it is recommended to assess leaf scab two or three times in the season to be able to evaluate the primary and secondary infections. It is much easier to make the assessment when leaves are dry.

The most common and easiest way for assessing the intensity of symptoms on leaves, fruits and twigs is based on the use of **global assessment** scales that take into account and integrate into one global score the incidence and severity status (**Tables 30** and **31**).

Incidence is defined as the estimated percentage of organs that express at least one clear symptom of the disease and severity refers to the estimated mean area of the majority of organs covered by clear symptoms.

Table 30. Global assessment scale for Scab infection on **leaves** (adapted from Lateur and Populer, 1996)

State	Field observations	Visual rating estimation	
		Incidence (%)	Severity (%)
1	No visible symptom	0	
2	A few small scab spots are detectable on close scrutiny of the tree	≤ 1	
3	Scab immediately apparent, with lesions very thinly scattered over the tree	> 1–5	-
4	X	X	-
5	Infection widespread over the tree, majority of leaves with at least one lesion	≥ 50	≤ 5
6	X	≥ 50	X
7	Heavy infection; multiple lesions or more large surfaces covered by scab on most leaves. Partial leaf fall	≥ 50	± 25
8	X	≥ 50	X
9	Maximum infection; leaves black with scab often fallen	≥ 50	> 75

'X': Intermediate rating.

Table 31. Global assessment scale for Scab infection on **<u>fruits</u>** (adapted from Lateur and Populer, 1996)

State	Field observations	Visual rating estimation	
		Incidence (%)	**Severity (%)**
1	No visible symptom	0	-
2	A few small scab spots are detectable on close scrutiny of the tree	≤ 1	-
3	Scab immediately apparent, with lesions very thinly scattered over the tree	> 1–5	-
4	X	X	-
5	Infection widespread over the tree, majority of fruits with at least one lesion	≥ 50	≤ 5
6	X	≥ 50	X
7	Heavy infection; multiple lesions or more large surfaces covered by scab on most fruits, some fruits with skin cracks in scabbed lesions	≥ 50	± 25
8	X	≥ 50	X
9	Maximum infection; fruits black with scab	≥ 50	> 75

'X': Intermediate rating.

Alternatively, and at a lower priority level, when a more precise approach is justified, it is recommended to separate the assessment of the two complementary components of disease intensity by making an assessment for incidence and another for severity.

The key for incidence assessment is given in **Table 32** and the key for severity assessment is given in **Table 33**.

Table 32. Incidence assessment key for apple scab, either on leaves or fruits (***Priority 4***)

State	Mean proportion of infected <u>organs</u> with at least one visible symptom on leaves or fruits (%)
1	0
2	]0–1]
3	]1–5]
4	X
5	± 25
6	X
7	± 50
8	X
9	> 90

'X': Intermediate rating.

Table 33. Severity assessment key for apple scab, either on leaves or fruits **(Priority 4).**

State	Mean proportion of scab-infected surface of leaves or fruits – on the most infected organs (%)
1	0
2	]0–1]
3	]1–5]
4	X
5	± 25
6	X
7	± 50
8	X
9	> 90

'X': Intermediate rating.

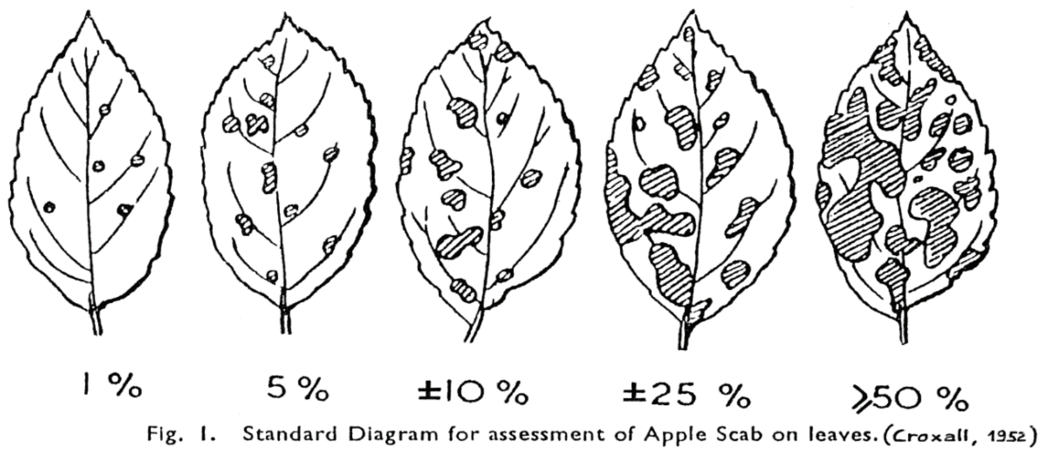


Figure 15. Assessment of scab severity on leaves (reproduced from Croxall et al, 1952)

4.2 Powdery mildew (*Podosphaera leucotricha*) (*Priority 2*)

It is possible to carry out a single assessment during late summer to take into account both primary infections, which are the most damaging, and secondary infections (**Table 34**). If possible, two assessments would be recommended: one in spring for the primary symptoms on shoot tips and flower clusters (**Table 35**) and one during summer.

Table 34. Global assessment scale for powdery mildew infection (primary and secondary infections) on apple leaves, shoot tips and flower clusters (adapted from Lateur, 1999).

State	Field observation	Visual rating estimation Incidence of primary infection symptoms (%)
1	No visible macroscopic symptoms	-
2	Very few (0–5%) leaves with secondary infection	0
3	Secondary infections on leaves immediately apparent. Infected leaves thinly scattered over the tree (5–25%). No primary infection	0
4	Same as 3 but with a few primary infections visible	0–5
5	Widespread secondary infection over the tree. Majority of leaves with secondary infections. More twigs or flower clusters with primary infection	5–10
6	X	X
7	Heavy infection, with about half of the shoots showing primary infection	± 50
8	X	X
9	Extremely heavy infection, with nearly all twigs showing primary infection	> 90

'X': Intermediate rating.

Table 35. Primary powdery mildew infection assessment scale at end of shoots and in flower clusters

State	Field observation	Visual rating estimation Incidence of primary infection symptoms (%)
1	No visible symptom	0
2	One or very few organs affected, detectable on close scrutiny of the tree	0–1
3	Infected organs readily apparent but without important consequences for the tree	1–5
4	X	X
5	Primary mildew widespread over the branches, inducing the infection of a substantial part of the crown	± 25
6	X	X
7	Heavy infection; half of the organs are badly affected	± 50
8	X	X
9	Crown completely affected, nearly all top of the organs are infected	> 90

'X': Intermediate rating.

4.3 Neonectria canker (*Neonectria ditissima*) (*Priority 2*)

Accurate evaluation needs to take into account the homogeny distribution of the disease across the orchard; it is normally achieved when more than 50% of the trees are at least moderately infected. **Table 36** shows an assessment scale that is normally used just after leaves are fallen in autumn.

Table 36. Assessment scale for infection of *Neonectria* cankers on branches (adapted from Lateur, 1999)

State	Observation in the orchard	Visual rating estimation Incidence – Proportion of twigs and branches infected (%)
1	No visible symptoms	0
2	One or very few small cankers, detectable only on close scrutiny of the tree	0–1
3	Directly apparent cankers without important consequences for the tree	1–5
4	X	X
5	Cankers widespread over the branches, inducing the death or the ablation of a large part of the crown	± 25
6	X	X
7	Heavy infection; about half of the crown is badly affected with risk of ablation or death	± 50
8	X	X
9	Maximum infection, tree completely affected, nearly dead	> 90

‘X’: Intermediate rating.

4.4 Fire blight (*Erwinia amylovora*) (*Priority 2*)

Even if the EU recently (2020) classified it as a “regulated non-quarantine pest” organism (Commission Implementing Directive (EU) 2020/177), fire blight (*Erwinia amylovora)* is still a major threat to apple orchards and can have a major impact in the safe management of repository and evaluation orchards. Monitoring of the disease is needed in terms of prophylactic measures, and needs to start during the flowering period. **Table 37** shows a global assessment scale.

Table 37. Global assessment scale for the evaluation of fire blight infection (Lateur, 1999)

State	Observation in the orchard	Visual rating estimation Incidence (%)
1	No visible symptom	0
2	One or very few small infections, detectable only on close scrutiny of the tree	]0–1
3	Directly apparent infections without important consequences for the tree	]1–5
4	X	X
5	Disease widespread over the branches, inducing the death or the ablation of a large part of the crown	± 25
6	X	X
7	Heavy infection; about half of the crown is badly affected with risk of ablation or death	± 50
8	X	X
9	Maximum infection, tree completely affected, nearly dead	> 90

‘X’: Intermediate rating.

4.5 Blossom wilt – Infection through flowers caused by *Monilinia laxa (Priority 2)*

With climate change, Blossom wilt (formerly defined as ‘*Sclerotinia laxa*’) could become an emergent disease with severe impact in some regions. Heavy infections have already been observed on many cultivars, especially ‘Cox’s Orange Pippin’, ‘Lord Lambourne’, ‘Alkmene’, ‘James Grieve’ and ‘Ingrid Marie’, which were highly susceptible.

The first symptoms are detectable approximately a week after full bloom by a wilting of the blossom trusses. The infected spurs are killed and often the fungus extends into the leaves, and the extremities of branches are killed, which may look like fire blight symptoms (Wormald, 1945).

Table 38. Blossom wilt assessment scale

State	Blossom wilt	Visual rating estimation Incidence – Proportion of blossom and ends of one-year twigs infected (%)
1	No symptom visible	0
2	Very low	0–1
3	Low	1–5
4	Low to medium	X
5	Medium	± 25
6	Medium to high	X
7	High	± 50
8	High to very high	X
9	Very high	> 90

‘X’: Intermediate rating.

4.6 Fruit brown rot (*Monilinia fructigena*) *(Priority 2)*

Table 39 Fruit brown rot at harvest period.

State	Brown rot	Visual rating estimation Incidence – Proportion of rotted fruits on trees (%)
1	No symptom visible	0
2	Very low	0–1
3	Low	1–5
4	Low to medium	X
5	Medium	± 25
6	Medium to high	X
7	High	± 50
8	High to very high	X
9	Very high	> 90

'X': Intermediate rating.

4.7 Anthracnose of leaves and fruits (*Elsinoë piri*) *(Priority 2)*

In recent years, anthracnose symptoms (**Figure 16**) were more often observed in a range of cultivars (Chandelier et al., 2022). Symptoms and damages could be serious. Therefore, evaluating a large diversity of apple genetic resources becomes opportune. A similar global assessment scale approach as for scab is in use. (**Tables 40** and **41**). Observation of leaves and fruits is best performed during late summer up to early autumn.

Table 40. Global assessment scale for anthracnose *(Elsinoë piri)* on **leaves** (adapted from Lateur and Populer, 1996)

State	Field observations	Visual rating estimation	
		Incidence (%)	Severity (%)
1	No visible symptom	0	
2	A few small anthracnose spots are detectable on close scrutiny of the leaves	≤ 1	
3	Anthracnose spots immediately apparent, with lesions very thinly scattered over the tree	>1–5	-
4	X	X	-
5	Infection widespread over the tree, majority of leaves with at least one anthracnose spot	≥ 50	≤ 5
6	X	≥ 50	X
7	Heavy infection; multiple anthracnose spots covering large surfaces on most leaves. Partial leaf fall.	≥ 50	± 25
8	X	≥ 50	X
9	Maximum infection; leaves surfaces covered by more than 75% with anthracnose spots	≥ 50	> 75

'X': Intermediate rating.

Table 41. Global assessment scale for anthracnose (*Elsinoë piri*) **on fruits** (adapted from Lateur and Populer, 1996)

State	Field observations	Visual rating estimation	
		Incidence (%)	**Severity (%)**
1	No visible symptom	0	-
2	A few small anthracnose spots are detectable on close scrutiny of the fruits	≤ 1	-
3	Anthracnose spots immediately apparent, with lesions very thinly scattered over the fruits on the tree	>1–5	-
4	X	X	-
5	Infection widespread over the tree, majority of fruits with at least one anthracnose spot	≥ 50	≤ 5
6	X	≥ 50	X
7	Heavy infection; multiple anthracnose spots of larger importance covering a quarter up to a third of the surfaces on most fruits, some fruits with skin cracks in anthracnose spots	≥ 50	± 25
8	X	≥ 50	X
9	Maximum infection; more than 75% of fruit surfaces covered with anthracnose spots; many fruits with skin cracks and/or sunken anthracnose spots	≥ 50	> 75

'X': Intermediate rating.

Figure 16. Photos of a diversity of intensity of anthracnose symptoms (*Elsinoë piri*) on fruits and leaves (Photos: Courtesy of CRA-W).

4.8 Rosy aphid (*Dysaphis plantagina*) (*Priority 3*)

Rosy aphids symptoms should be evaluated (**Table 42**) during the late spring period; after this critical period, it becomes difficult to properly assess the degree of infection. Infection can be initially identified by the curling of leaves.

Table 42. Rosy aphid on leaves and fruits (adapted from Lateur, 1999)

State	Observation in the orchard	Visual rating estimation Incidence (%)
1	No visible symptom	0
2	One or very few foci, detectable only on close scrutiny of the tree	]0–1
3	Directly apparent foci without important consequences for the tree	]1–5
4	X	X
5	Number of foci widespread over the branches, inducing the curling of leaves	± 25
6	X	X
7	Heavy infection; about half of the leaves/fruits is badly affected	± 50
8	X	X
9	Maximum infection, tree completely affected, nearly all organs with symptoms	> 90

'X': Intermediate rating.

NB: *Other pests or diseases susceptibility assessments may be developed following the same scoring principle.*

4.9 Global tree foliage health (*Priority 3*)

Assessment should be based on overall appearance, and will represent a combination of disease tolerance, robustness and good nutrient uptake efficiency indicated by healthy green leaves (**Table 43**).

Table 43. Global tree foliage health

State	Appearance
1	**Extremely low** health foliage (> 90% of leaves **suffering** diverse foliar deficiencies)
2	X
3	**Low health** foliage (± 75% of leaves **suffering** diverse foliar deficiencies)
4	X
5	**Medium** health foliage (± 50% of leaves **without** foliar deficiency)
6	X
7	**High health** foliage (± 75% of leaves **without** foliar deficiency)
8	X
9	**Extremely high health** foliage (> 90% of leaves **without any** foliar deficiency)

'X': Intermediate rating.

5. Fruit quality traits

As an initial evaluation procedure, sensory assessment is simple and efficient; it provides relative values that simulate the consumer habit, but it requires some experience. In principle, a first sensory analysis can be performed directly in the orchard in front of the tree (depending on the level of ripeness).

When assessing fruit quality by sensorial approach, it is important to select a representative sample of fruit at eating maturity and neutralize the influence of the sample previously tasted, since this could affect the assessment. The sensorial analysis should be ideally performed by two people and the fruit should be tasted with and without the skin.

Accurately predicting ripening times is difficult and it is recommended to use a simple method for defining the optimal picking date and to note the actual level of maturity at the date of picking by using the scale in **Table 6**.

Many apples need to be picked at their correct maturity stage and have to be stored in a cool room, cellar or fridge for a number of days, weeks or even months before they will reach their optimal ripeness for eating. Some cultivars are not suitable for fresh consumption before having matured. Periodically, fruits should be inspected and the change in ground colour can be used as an indication of the maturity stage. The greenish ground colour starting to turn yellow is a useful indication. This can be cultivar specific, and for some cultivars, the assessment must be carried out earlier; for others, it is necessary to wait until the ground colour becomes fully yellow.

The use of instrumental measurements can be more precise but much more time-consuming although recommendations for these are also provided. General rules and methods recommended for the instrumental fruit trait analysis are defined in the CTIFL reference publication (Vaysse and Landry, 2004).

In general, the sample of fruit should be taken from the upper part of the fruit, on the sunny side.

Ideally, each trait linked with fruit-eating quality needs to be performed at the optimal fruit ripening stage.

Many old apple cultivars were only used for cooking, baking (compotes, cakes, pies,…) or other simple processing methods (drying, juice, cider, syrup, etc.). These specific quality traits are not taken into account in the present document.

5.1 Fruit firmness

5.1.1 Using a penetrometer (*Priority 2*)

Following the protocol described by Watkins and Smith (1982), assessments should be done, as a minimum, at picking time, on a sample of at least six fruits, making two opposite measurements at the widest part of the fruit. Measurements should be taken on both sides of the fruits (for bi-coloured fruit, at the borders between the over-coloured zone and ground colour).

Ideally, a second set of measurements should be taken at eating maturity (if this differs from harvest maturity). In all cases, an 11mm probe should be used and skin should be removed.

The data are expressed as kg/cm^2. Approximate values are included within the scale in **Table 44**.

5.1.2 Sensory analysis (*Priority 1*)

Firmness should be assessed at eating maturity by evaluating the relative force needed for masticating a bit of fruit (**Table 44**).

Table 44. Fruit firmness sensory assessment scale and measured with a penetrometer

State	Fruit firmness	Example reference cultivars	Mean value firmness (kg/cm^2)
1	Extremely soft		< 2
2	Very soft	White Transparent	2–3
3	Soft		3–4
4	X	Elstar, Cox's Orange Pippin	4–5
5	Intermediate	Jonagold, Golden Delicious, Topaz, Auksis	5–6
6	X		6–7
7	Firm	Pinova, Pilot	7–8
8	Very firm	Goldrush	8–9
9	Extremely firm		> 9

'X': Intermediate rating.

5.2 Skin thickness (*Priority 3*)

Skin thickness should be scored by sensory assessment based on the resistance to masticating the skin. (**Table 45**).

Table 45. Sensory evaluation of relative fruit skin thickness

State	Skin thickness	**Example reference cultivars** (UPOV, Szalatnay)
1	Extremely thin	
2	Very thin	White Transparent
3	Thin	
4	X	
5	Medium	
6	X	
7	Thick	Cortland, Delicious
8	Very thick	Jonathan
9	Extremely thick	

'X': Intermediate rating.

5.3 Flesh sweetness *(Priority 1/2)*

5.3.1 Sensory analysis (*Priority 2*)

Table 46. Flesh sweetness sensory assessment scale at optimal eating maturity

State	Sweetness	Refractometer (°Brix)
1	Extremely low	< 10
2	Very low	10–12.5
3	Low	12.5–13,5
4	X	
5	Intermediate	13.5–15
6	X	
7	High	15–17
8	Very high	17–20
9	Extremely high	> 20

'X': Intermediate rating.

5.3.2 Refractometer method (*Priority 2*)

In a laboratory: this should be carried out at optimal eating time on a sample of at least six representative fruits. Juice should be extracted using standard protocols with either a press or extractor, and measurements should be taken at room temperature. Standard protocols extract juice from two slices/fruit – with a press or an extractor – and then make the measurement on the obtained juice with a refractometer at room temperature.

In the field: the simplest method is to place on the refractometer a mix of at least six droplets of juice extracted by pressure between the thumb and index finger from pieces of different representative fruits. Alternatively, a glass stick can be inserted into the fruit at two opposite sites situated at the widest part of the fruit in order to extract droplets.

Scores should be expressed as °Brix and can be compared to **Table 46**.

5.4 Flesh acidity

5.4.1 Sensory analysis (*Priority 2*)

Table 47. Flesh acidity sensory assessment scale

State	Flesh intensity of acidity
1	Extremely low acidity
2	Very low acidity
3	Low acidity
4	X
5	Intermediate acidity
6	X
7	High acidity
8	Very high acidity
9	Extremely high acidity

'X': Intermediate rating.

5.4.2 Measurement with a pH meter (*Priority 3*)

Measurements should be taken on juice from a sample of at least six representative fruits using juice extraction techniques as for flesh sugar measurement.

5.4.3 Measurement by titration (*Priority 3*)

Standard methods (Vaysse, Landry, 2004) should be used, with titration using NaOH. Data should be expressed in g Malic acid/l, g Sulphuric acid/l or meq/l (milliequivalents/litre).

Table 48. Acidity by pH measurement or titration

State	Flesh Acidity	pH	g/l of Malic acid	g/l of sulphuric acid	meq/l
1	Extremely low				
2	Very low				
3	Low	> 3,8	≤ 4,0	≤ 2,94	≤ 60
4	X				
5	Intermediate	3,5–3,4	4,0–6,0	2,94–4,41	60–90
6	X				
7	High	3,3–3,1	6,0–8,0	4,41–5,88	90–120
8	Very high	< 3,0	> 8,0	> 5,88	> 120
9	Extremely high				

'X': Intermediate rating.

5.5 Ratio between acidity and sweetness (*Priority 1*)

When tasting a sample of fruit at eating maturity, a general impression of the balance between acidity and sweetness should be scored (**Table 49**).

Table 49. Ratio acidity/sweetness of flesh sensory assessment scale

State	Acidity/sweetness	Example of reference cultivars
1	Extremely more acid than sweet	
2	Much more acid than sweet	Bramley's Seedling, Antonovka
3	More acid than sweet	Boskoop
4	X	Elstar
5	Good balance acid/sugar	Cox's Orange Pippin, Auksis
6	X	Jonagold
7	More sweet than acid	Golden Delicious, Pinova
8	Much more sweet than acid	Fuji, Starkrimson, Gala
9	Extremely more sweet than acid	

'X': Intermediate rating.

5.6 Flesh juiciness (*Priority 1*)

Sensory assessment should be made of the quantity of juice extracted from a sample of fruit when it is masticated (**Table 50**).

Table 50. Sensory assessment scale for flesh juiciness in apple

State	Flesh juiciness	Example of reference cultivars
1	Extremely low	
2	Very low	Cripps Pink
3	Low	Pinova, Revaler Birnapfel
4	X	
5	Intermediate	
6	X	
7	High	Gravensteiner Scifresh, Delcorf (Delbarestivale)
8	Very high	
9	Extremely high	

'X': Intermediate rating.

5.7 Flesh crunchiness (*Priority 2*)

Crunchiness should be assessed as the sustained granular resistance of flesh during mastication. It can be distinguished from crispness, in that crispness is generally associated with brittleness and the shattering of food and is short-lived. Crunchiness can also be identified by the noise made during mastication (**Table 51**).

Table 51. Sensory assessment scale for flesh crunchiness

State	Flesh crunchiness	Example of reference cultivars
1	Extremely low	
2	Very low	
3	Low	
4	X	
5	Intermediate	Pinova, Mutsu, Auksis
6	High	
7	Very high	Gravensteiner, Scifresh, Delcorf (Delbardestivale)
8	X	
9	Extremely high	Honey Crisp

'X': Intermediate rating.

5.8 Flesh bitterness (*Priority 3*)

Should be assessed sensorially based on **Table 52**.

Table 52. Sensory assessment scale for flesh bitterness

State	Bitterness	Example of reference cultivars
1	Extremely low	Gala, Auksis
2	Very low	
3	Low	
4	X	Jonagold, Orlik
5	Medium	Starkrimson
6	X	
7	High	
8	Very high	
9	Extremely high	

'X': Intermediate rating.

5.9 Tendency for flesh to become mealy (*Priority 3*)

Mealiness should be assessed as the flesh becoming dryer, softer and often of coarse texture. It should be assessed (**Table 53**) at the end of the eating maturity period, and ideally after a period of storage (it is important to note which).

Table 53. Sensory assessment scale for flesh mealiness

State	Tendency to become mealy	Example of reference cultivars
1	Extremely low	Scifresh, Sinap Orlovski
2	Very low	Pinova
3	Low	Reinette de France, Auksis
4	X	
5	Intermediate	Jonagold
6	X	
7	High	Jacques Lebel, Revaler Birnapfel
8	Very high	White Transparent
9	Extremely high	

'X': Intermediate rating.

5.10 Fruit flesh texture (*Priority 3*)

The fineness or coarseness of flesh texture should be assessed sensorially and scored according to **Table 54**.

Table 54. Sensory assessment scale for fruit flesh texture

State	Flesh texture	Example reference cultivars
1	Extremely fine	
2	Very Fine	
3	Rather fine	
4	X	
5	Intermediate	
6	X	
7	Coarse	
8	Very coarse	
9	Extremely coarse	

'X': Intermediate rating.

5.11 Intensity of fruit aroma (*Priority 1*)

Should be assessed as the aromatic taste of fruit at optimal eating maturity (**Table 55**). Obviously, there are different types of aroma and the assessment should be a quantitative assessment of intensity rather than characterize types of aroma.

Table 55. Sensory assessment scale for intensity of fruit aroma

State	Intensity of aroma	Example of reference cultivars
1	Extremely low	
2	Very low	
3	Low	
4	X	Golden Delicious
5	Medium	Auksis
6	X	Cox's Orange Pippin
7	High	
8	Very high	Aroma, Ellison's Orange
9	Extremely high	

'X': Intermediate rating.

5.12 Overall fruit quality (*Priority 1*)

It is an obvious hedonic and relative global evaluation of the fruit quality based on multi criteria analysis. An assessment should be made of the overall quality of the fruit at eating maturity, taking into account all the individual quality traits. It is important to maintain an objective and comparative approach and to avoid being influenced by personal tastes (**Table 56**).

Table 56. Sensory assessment scale for overall fruit quality

State	Overall fruit quality	Example reference cultivars
1	Extremely poor	
2	Very poor	
3	Poor	
4	Poor to good	
5	Good	Red Delicious
6	Good to very good	Golden Delicious
7	Very good	McIntosh
8	X	Cox's Orange Pippin
9	Extremely good	

'X': Intermediate rating.

5.13 Fruit storage capacity

5.13.1 Storage life in natural cellar conditions (*Priority 2*)

Assessment should be made on a sample of 20–40 fruits by monitoring the increase in the percentage of decayed fruits and classifying them according to **Table 57**. The limit of storability should be considered to be met when more than 50% of the fruits are no more eatable.

It is important to record the date of harvesting, temperature and humidity, and it is important to note fungicide treatments applied prior to harvest. It is also valuable to note the internal fruit quality in order to define the best period for consumption during storage.

Table 57. Storage life in cellar conditions

State	Storage life	**Example of reference cultivars** (UPOV, Szalatnay)	**Indicative keeping period** in Northwestern Europe (Lateur)
1	Extremely short	Close, Vista Bella	Earlier than mid-August
2	Very short	White Transparent	Mid to end-August
3	Short	Discovery, Tydeman's Early Worcester	September
4	X	Alkmene	October
5	Medium	Gala, Elstar, Cox's Orange Pippin	November
6	X		December
7	Long	Golden Delicious, Jonagold	January
8	Very long	Fuji, Glockenapfel	February–March
9	Extremely long	Granny Smith, Président Van Dievoet ('Cabarette'), Marie Joseph d'Othée, Gueule de Mouton	April and later

'X': Intermediate rating.

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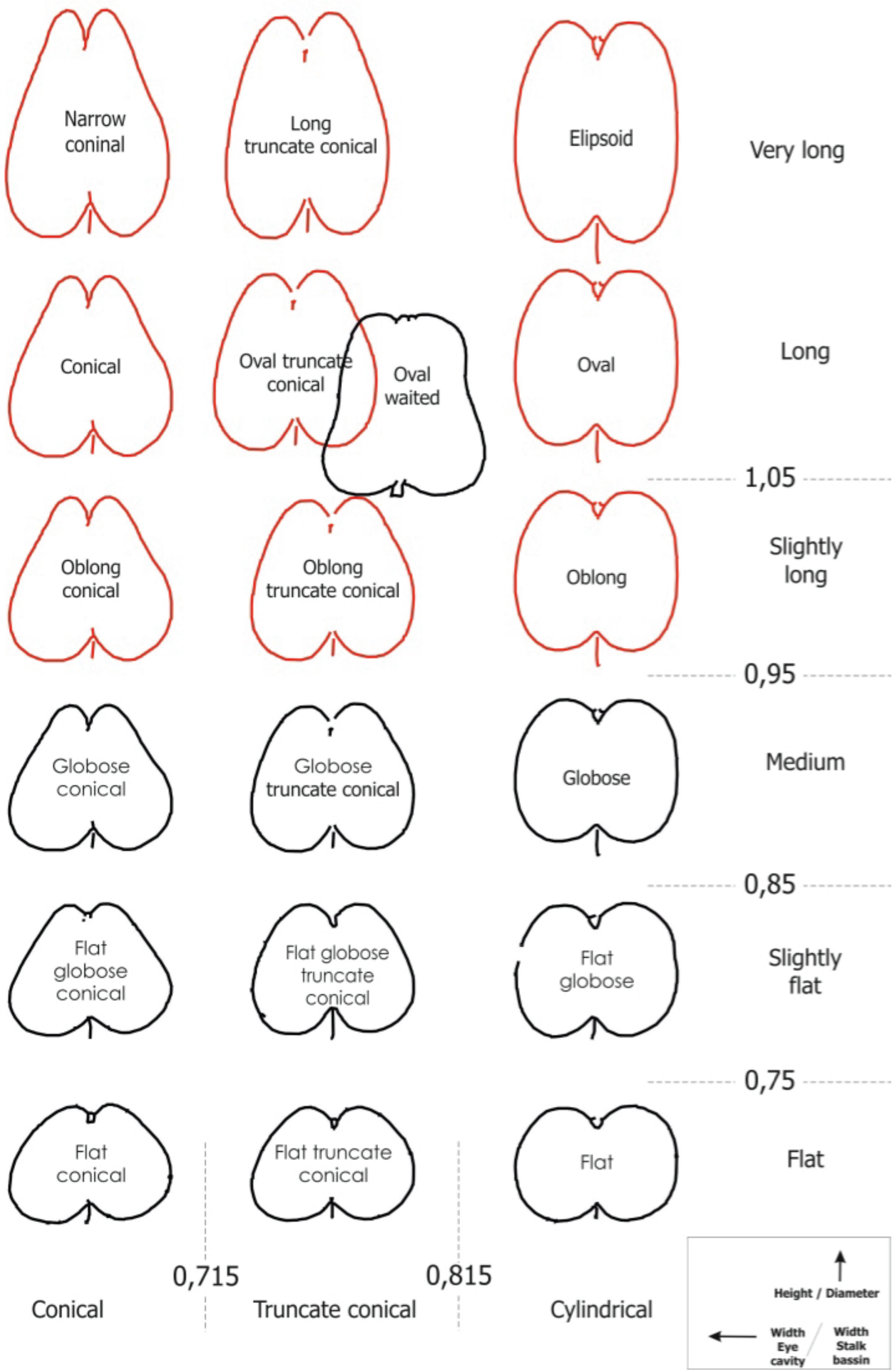
Annex 1. Illustration of fruit general shapes (a)

Illustration of fruit general shapes in function of the relation height/diameter and of the ratio of width of the eye basin/width of the stalk cavity (adapted from Dapena et al., 2009).

Annex 2. Illustration of fruit general shapes (b)

Illustration of fruit general shapes in function of the relation height/diameter and of the ratio of width of the eye basin/width of the stalk cavity (Dapena et al., 2009).



Annex 3. Measuring width and depth of eye basin and stalk fruit cavity

Illustration (**Figure 17**) of how to measure the width and depth of the eye basin and stalk cavity of the fruit (Dapena and Fernández, 2009).

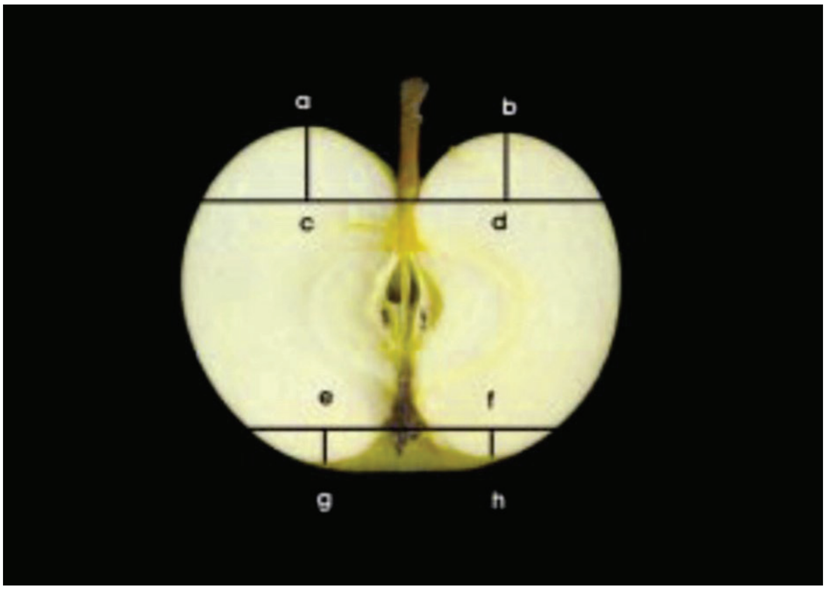


Figure 17. Measurement of width and depth of basin and stalk fruit cavities (Dapena et al., 2009)

Annex 4. Further guidance on photography

Correct camera settings are essential. **Figure 18** shows how to do it correctly.

Camera settings	✓	✗
Focus		
Exposure		
White balance		

Figure 18. Correct camera settings (Szalatnay, 2006)

Suggested camera settings

-F25

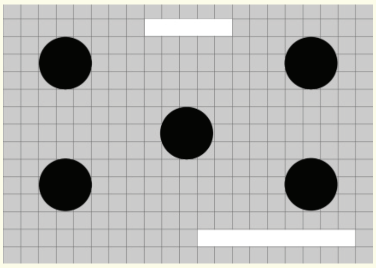
-1/640

-ISO100

Photographs can be taken in two different ways (**Figures 19** and **20**):

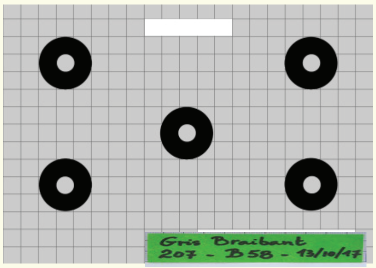
- The first option is appropriate if photographs are needed for a database only
- The second option is appropriate if pictures need to be used for high-quality printing and/or as a reference for identification/verification.

Option 1. Taking all views at once (Szalatnay, 2006)



Print templates available at http://www.clg-champollion-voisins.ac-versailles.fr/IMG/pdf/papiers_millimetres-2.pdf

Attach template on a cardboard box and put holes in cardboard box and template at places where fruits need to be placed



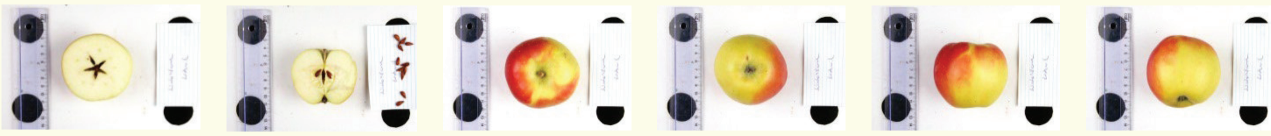
Print templates available at: http://www.clg-champollion-voisins.ac-versailles.fr/IMG/pdf/papiers_millimetres-2.pdf

Use rings (plastic, metal, model clay, …) to place fruits in the right spots

Put label with: Accession name, accession number, Tree ID, date.

Option 2. Taking all views separately, create a picture with photo-editing software

Take a photograph of every view/angle separately



Resize every picture and cut out the fruit with photo-editing software (Adobe Photoshop or other)

Combine photographs into a picture

Main advantage: → much higher quality

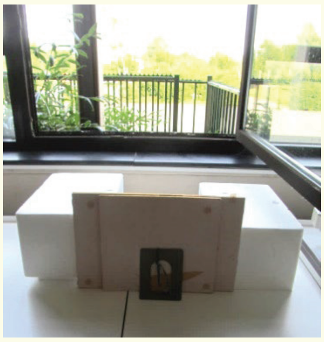
Figure 19. Illustration of the different steps to taking fruit pictures

As an alternative, another less sophisticated option for taking fruit picture is building a simple natural 'light chamber', as illustrated in **Figure 20**.

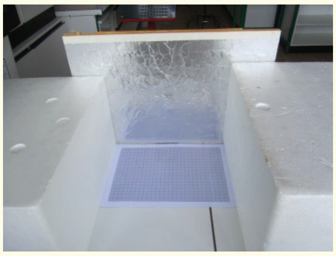
Choose a room with large windows oriented north or north-west, place a table near the window and build a 'light chamber' with sides being either white or covered with aluminium film. Leave an opening in front of the window as illustrated below.

In north-western European countries, the best quality pictures are obtained between around 10:00 am and 15:00 pm.

1. View of the handmade light chamber



Build your light chamber in front of a north/north-east window.

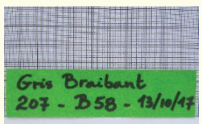


Print grey template available at http://www.clg-champollion-voisins.ac-versailles.fr/IMG/pdf/papiers_millimetres-2.pdf and place it in front of the backplate.

2. Fruit arrangement, label and taking pictures

Use rings (plastic, metal, model clay, etc.) to place fruits at the right spots (here plums as examples).

Put a label with: accession name, accession number, Tree ID, date.



Take the picture in a perpendicular position with adapted camera tuning and having prior to that regulated the 'white balance'.

Figure 20. Illustration of an alternative way to take fruit pictures. Pictures courtesy of M. Lateur.

Descriptors for

Walnut

(*Juglans* spp.)

International Plant Genetic Resources Institute

IPGRI

Descriptors for

Walnut

(*Juglans* spp.)

International Plant Genetic Resources Institute

IPGRI

The International Plant Genetic Resources Institute (IPGRI) is an autonomous international scientific organization operating under the aegis of the Consultative Group on International Agricultural Research (CGIAR). IPGRI's mandate is to advance the conservation and use of plant genetic resources for the benefit of present and future generations. IPGRI works in partnership with other organizations, undertaking research, training, and the provision of scientific and technical advice and information and has a particularly strong programme link with the Food and Agriculture Organization of the United Nations.

The international status of IPGRI is conferred under an Establishment Agreement which, by December 1993 had been signed by the Governments of Belgium, Bolivia, Cameroon, Chile, China, Cyprus, Denmark, Egypt, Greece, Hungary, India, Iran, Italy, Jordan, Kenya, Pakistan, Poland, Portugal, Romania, Russia, Senegal, Switzerland, Syria, Turkey and Uganda. IPGRI, the legal successor to the International Board for Plant Genetic Resources (IBPGR), became operational when its Headquarters Agreement with the Italian Republic was ratified by Italian Parliament in December 1993.

Financial support for the core programme of IPGRI is provided by the Governments of Australia, Austria, Belgium, Canada, China, Denmark, France, Germany, India, Italy, Japan, the Republic of Korea, the Netherlands, Norway, Spain, Sweden, Switzerland, the UK, the USA, and the World Bank

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PREFACE

*Descriptors for walnut (*Juglans *spp.)* was developed by G.H. McGranahan, E. Germain, D.E. Ramos and K. Rigert with assistance from C.A. Leslie, C. Ingels and R. Gulcan and prepared in the IPGRI standard format. A draft version was subsequently sent to a number of experts for their comments and amendments. A full list of the names and addresses of those involved is given in 'Contributors'.

IPGRI encourages the collection of data for descriptors on the first four categories of this list: *Passport*, *Management*, *Environment and site*, and *Characterization*; and endorses data in these categories as those that should be available for any one accession. However, the number of each of the site and environment descriptor types used will depend on the crop and their importance to the crop's description. Descriptors listed under *Evaluation* allow for a more detailed description of the accession's characters, but generally require replicated site and time trials.

Although the suggested coding should not be regarded as the definitive scheme, this format has the full backing of IPGRI and is promoted worldwide. This descriptor list is intended to be comprehensive for the descriptors that it contains. This approach assists with the standardization of descriptor definitions. IPGRI does not, however assume that each curator will characterize accessions of their collection utilizing all descriptors given. Those descriptors known to be highly discriminating descriptors are given in bold and marked with and asterisk. Descriptors should be used when they are useful to the curator for the management and maintenance of the collection and/or to the users of the plant genetic resources.

This descriptor list provides an international format and thereby produces a universally understood 'language' for plant genetic resources data. The adoption of this scheme for data encoding, or at least the production of a transformation method to convert other schemes to the IPGRI format, will produce a rapid, reliable, and efficient means for information storage, retrieval, and communication, and will assist with the utilization of germplasm. It is recommended, therefore, that information should be produced by closely following the descriptor list with regard to: ordering and numbering descriptors; using the descriptors specified; and using the descriptor states recommended.

Any suggestions on this descriptor list will be appreciated by IPGRI.

DEFINITIONS AND USE OF THE DESCRIPTORS

IPGRI now uses the following definitions for genetic resources data management:

(i) **Passport** descriptors: These provide the basic information used for the general management of the accession (including the registration at the genebank and other identification information) and describe parameters that should be observed when the accession is originally collected

(ii) **Management** descriptors: These provide the basis for the management of accessions in the genebank and assist with their multiplication and regeneration

(iii) **Environment and site** descriptors: These describe the environmental and site specific parameters that are important when characterization and evaluation trials are held. They can be important for the interpretation of the results of these trials. Germplasm collecting site descriptors are also included here

(iv) **Characterization** descriptors: These enable an easy and quick discrimination between phenotypes. They are generally highly heritable, can be easily seen by the eye and are equally expressed in all environments. In addition, these may include a limited number of additional traits thought desirable by a consensus of users of the particular crop

(v) **Evaluation** descriptors: Many descriptors in this category are susceptible to environmental differences but are generally useful in crop improvement. In addition, others may involve biochemical or molecular characterization. They include yield, agronomic performance, stress susceptibilities and biochemical and cytological traits

Characterization will normally be the responsibility of genebank curators, while evaluation will typically be carried out elsewhere (possibly by a multidisciplinary team of scientists). The evaluation data should be fed back to the genebank which will maintain a data file.

Minimum descriptors highly discriminating are in bold and marked with an asterisk.

The following internationally accepted norms for the scoring, coding, and recording of descriptor states should be followed as indicated below:

(a) the Système International d'Unités (SI system) is used. The units to be applied are given in square brackets following the descriptor name;

(b) standard colour charts, e.g. Royal Horticultural Society Colour Chart, Methuen Handbook of Colour, or Munsell Color Chart for Plant Tissues, are strongly recommended for all ungraded colour characters (the precise chart used should be specified in the section where it is used);

(c) many quantitative characters which are continuously variable are recorded on a 1-9 scale, where:

1	Very low
2	Very low to low
3	Low
4	Low to intermediate
5	Intermediate
6	Intermediate to high
7	High
8	High to very high
9	Very high

is the expression of a character. The authors of this list have sometimes described only a selection of the states, e.g. 3, 5, and 7 for such descriptors. Where this has occurred, the full range of codes is available for use by extension of the codes given or by interpolation between them - e.g. in Section 10 (Biotic stress susceptibility) 1 = very low susceptibility and 9 = very high susceptibility;

(d) (i) when a descriptor is scored using a 1-9 scale, such as in (c), '0' would be scored when the character is not expressed; and (ii) when a descriptor is inapplicable. In the following example, '0' will be recorded if an accession does not have a central leaf lobe:

Shape of central leaf lobe

3	Toothed
5	Elliptic
7	Linear

(e) absence/presence of characters are scored as in the following example:

Presence/absence of terminal leaflet

0	Absent
1 (or +)	Present

(f) blanks are used for information not yet available;

(g) for accessions which are not generally uniform for a descriptor (e.g. mixed collection, genetic segregation), the mean and standard deviation could be reported where the descriptor is continuous, or where the descriptor is discontinuous up to three codes in the order of frequency could be recorded; or other publicized methods can be utilized, such as van Hintum (1993), that clearly states a method for scoring heterogeneous accessions;

(h) dates should be expressed numerically in the format DDMMYYYY, where

DD	-	2 digits to represent the day
MM	-	2 digits to represent the month
YYYY	-	4 digits to represent the year

PASSPORT

1. ACCESSION DESCRIPTORS

1.1 ACCESSION NUMBER

This number serves as a unique identifier for accessions and is assigned when an accession is entered into the collection. Once assigned this number should never be reassigned to another accession in the collection. Even if an accession is lost, its assigned number is still not available for re-use. Letters should be used before the number to identify the genebank or national system (e.g. IDG indicates an accession comes from the genebank at Bari, Italy; CGN indicates one accession comes from the genebank at Wageningen, The Netherlands; PI indicates an accession within the USA system)

1.1.1 Local plant number

This identifies a single plant within a population of plants having the same accession number. It may be any combination of plot identity, row number, or tree position within the row

1.2 DONOR NAME

Name of institution or individual responsible for donating the germplasm

1.3 DONOR NUMBER

Number assigned to accession by the donor

1.4 COUNTRY WHERE MAINTAINED

Use the three letter abbreviations from the *International Standard (ISO) Codes for the representation of names of countries*, No. 3166, 1988. Copies of these are available from Beuth Verlag GmbH, Burggrafenstrasse 6, D-10772 Berlin 30, Germany; Tel. 30-2601-2320; Fax 30-2601-1231, Tlx. 1-84-273-din-d

1.5 SITE WHERE MAINTAINED

Name of institution in which collection is maintained

1.6 CURATOR'S NAME

Name of officer responsible for maintaining the genetic resources material held at the site specified in the descriptor SITE WHERE MAINTAINED, 1.10

1.7 OTHER NUMBER(S) ASSOCIATED WITH THE ACCESSION

Any other identification number known to exist in other collections for this accession, e.g. USDA Plant Inventory number (not COLLECTING NUMBER, see 2.3). Other numbers can be added as 1.7.3, etc.

1.7.1 Other number 1

1.7.2 Other number 2

1.8 SCIENTIFIC NAME

1.8.1 Genus

1.8.2 Species

For interspecific hybrids, the species should be designated as 'hybrid' and the parentage indicated in the descriptor PEDIGREE, 1.9

1.8.3 Subspecies

1.9 PEDIGREE

Parentage or nomenclature and designations assigned to breeders' material

1.9.1 Female parent

1.9.2 Male parent

1.10 CULTIVAR NAME

Either a registered or other formal cultivar designation given to the accession

1.10.1 Cultivar name

1.10.2 Year of release of the cultivar/year of registration

1.10.3 Other designations assigned to breeder's material

1.10.4 Literature citations

1.11 ACQUISITION DATE

Date on which the accession entered the collection (in the format DDMMYYYY)

1.12 TYPE OF MAINTENANCE

1 Vegetative in the field
2 Vegetative in tissue culture
3 Pollen
4 Seed
5 More than one type, specify in the descriptor NOTES, 1.14

1.13 ACCESSION SIZE

Number of trees of an accession or approximate number of seeds of an accession in the genebank

1.14 NOTES

Specify here any additional information

2. COLLECTING DESCRIPTORS

2.1 COLLECTING INSTITUTE(S)

Institute(s) and people collecting/sponsoring the sample collection

2.2 SITE NUMBER

Number assigned to the physical site by the collector

2.3 COLLECTING NUMBER

Original number assigned by the collector(s) of the sample, normally composed of the name or initials of the collector(s) followed by a number. This item is essential for identifying duplicates held in different collections and should be unique and always accompany subsamples wherever they are sent

2.4 COLLECTING DATE OF ORIGINAL SAMPLE

(in the format DDMMYYYY)

2.5 COUNTRY OF COLLECTING

(See instructions in the descriptor COUNTRY WHERE MAINTAINED, 1.4)

2.6 PROVINCE/STATE

Name of the primary administrative subdivision of the country in which the sample was collected

2.7 DEPARTMENT/COUNTY

Name of the secondary administrative subdivision (within a Province/State) of the country in which the sample was collected

2.8 LOCATION OF COLLECTING SITE

Distance in kilometers and direction from the nearest town, village or map grid reference point (e.g. CURITIBA 7S means 7 km south of Curitiba) and the name of the farm or other location and the farmer or other individual on whose land the sample was collected

2.9 LATITUDE OF COLLECTING SITE

Degrees and minutes followed by N (North) or S (South) (e.g. 01030S)

2.10 LONGITUDE OF COLLECTING SITE

Degrees and minutes followed by E (East) or W (West) (e.g. 07625W)

2.11 ELEVATION OF COLLECTING SITE [m]

Altitude above sea level

2.12 COLLECTING SOURCE

1 Wild habitat
2 Farmer's field or orchard
3 Farm store (road-side stand)
4 Backyard
5 Village market
6 Commercial market
7 Research organization
8 Other (specify in the descriptor COLLECTOR'S NOTES, 2.25)

2.13 TYPE OF SAMPLE

Form of sample collected. If different types of material were collected from the same source, each sample type should be designated with a unique collecting number and a corresponding unique accession number

1 Vegetative
2 Seed
3 Pollen
4 Tissue culture

2.14 STATUS OF SAMPLE

1 Wild
2 Weedy
3 Landrace/primitive cultivar
4 Advanced cultivar
5 Breeding line/genetic stock
6 Other (specify in the descriptor COLLECTOR'S NOTES, 2.25)

2.15 USES OF THE ACCESSION

1 Edible nut
2 Edible nut for the in-shell market
3 Edible nut for the shelled market
4 Medicinal
5 Ornamental
6 Forage
7 Wood/timber
8 Other (specify in the descriptor COLLECTOR'S NOTES, 2.25)

2.16 ETHNIC GROUP

Name of the tribe of the farmer donating the sample or of the people living in the area of collecting

2.17 LOCAL/VERNACULAR NAME

Name given by farmer to crop and cultivar/landrace. State language and dialect if the ethnic group is not provided

2.18 COLLECTING SITE POPULATION STRUCTURE

2.18.1 Number of trees sampled

2.18.2 Frequency of accession at collecting site

1 Rare
3 Occasional
5 Frequent
7 Abundant
9 Very abundant

2.18.3 Associated flora

Other dominant species, found at and around the collecting site

2.19 HERBARIUM SPECIMEN

Was a herbarium specimen collected? If so, provide an identification number in the descriptor COLLECTOR'S NOTES, 2.25

0 No
+ Yes

2.20 PHOTOGRAPH

Were photograph(s) taken of the accession or habitat at the time of collecting? If so, provide an identification number(s) in the descriptor COLLECTOR'S NOTES, 2.25

0 No
+ Yes

2.21 COLLECTING SOURCE ENVIRONMENT

Descriptors for Collecting Source Environment (2.21.1 - 2.21.26) are given in Section 5. These are numbered in Section 5 in the following manner 5.1.1 - 5.1.26, but should be used for this section. This has been done in order to reduce the repetition of descriptors in Sections 2 and 4

2.22 CULTURAL METHODS

2.22.1 Cropping system

1 Monoculture
2 Mixed with cereals (specify crop)
3 Mixed with legumes (specify crop)
4 Mixed with fruits or nuts (specify crop)
5 Mixed with other (specify crop)

2.22.2 Propagation method

Method used to produce trees

1 Seed
2 Grafted (note species and/or cultivar used as rootstock)
3 Rooted cutting
4 Tissue culture

2.22.3 Irrigation

1 Rainfed
2 Irrigated
3 Flooded
4 River banks
5 Other (specify in the descriptor COLLECTOR'S NOTES, 2.25)

2.23 PLANT POPULATION DENSITY

3 Low
5 Intermediate
7 High

2.24 PREVAILING STRESSES

Information on associated biotic and abiotic stresses. Indicate if disease indexing was done at the time of collecting

2.25 COLLECTOR'S NOTES

Additional information recorded by the collector or any specific information on any state in any of the above descriptors

MANAGEMENT

3. ORCHARD MANAGEMENT DESCRIPTORS

3.1 ACCESSION NUMBER (Passport 1.1)

3.1.1 Local plant number (Passport 1.1.1)

This identifies a single plant within a population of plants having the same accession number. It may be any combination of plot identity, row number, or tree position within the row

3.2 ACCESSION ORCHARD LOCATION

Enter separate block designations, row numbers, and tree numbers within the row for each duplicate tree of each accession if each tree is not identified with a unique LOCAL PLANT NUMBER, 3.1.1

3.2.1 Block designation

3.2.2 Row number

3.2.3 Tree number within the row

3.3 PROPAGATION METHOD

Method used to produce trees

1 Seed
2 Grafted
3 Rooted cutting
4 Tissue culture

3.4 ROOTSTOCK

Note rootstock used for grafted trees. All *J. regia*, including seedling trees, should be grafted onto a Blackline hypersensitive rootstock prior to establishment in the field to prevent the introduction of new strains of Cherry leafroll virus into the collecting

3.5 PLANTING YEAR

Specify year tree was planted in the orchard

3.6 REGENERATION YEAR

Year (estimate) tree should be repropagated for regeneration

3.7 DATE OF LAST REGENERATION OR MULTIPLICATION

Primary method of regeneration is repropagation of clonal material (in the format DDMMYYYY)

3.8 NUMBER OF TIMES ACCESSION REGENERATED

Since the date of acquisition

ENVIRONMENT AND SITE

4. SITE DESCRIPTORS

4.1 COUNTRY OF CHARACTERIZATION AND/OR EVALUATION

(See instructions in the descriptor COUNTRY WHERE MAINTAINED, 1.4)

4.2 SITE (RESEARCH INSTITUTE)

4.2.1 Latitude

Degrees and minutes followed by N (North) or S (South) (e.g. 01030S)

4.2.2 Longitude

Degrees and minutes followed by E (East) or W (West) (e.g. 07625W)

4.2.3 Elevation [m]

Altitude above sea level

4.2.4 Name of farm or institute

4.3 EVALUATOR'S NAME AND ADDRESS

4.4 SOWING OR GRAFTING DATE

(in the format DDMMYYYY)

4.5 EVALUATION ENVIRONMENT

Environment in which characterization/evaluation was carried out

1 Field
2 Screenhouse
3 Glasshouse
4 Laboratory
5 Other (specify in the descriptor NOTES, 4.15)

4.6 CONDITION OF TREE

Choose the one condition that best fits the accession at the time of characterization/ evaluation

1 Dying
2 Old - declining
3 Mature - diseased
4 Mature - non-vigorous
5 Mature - vigorous
6 Young (not yet bearing)
7 Healthy - cropping poorly
8 Healthy - cropping well

4.7 PERCENTAGE SEED GERMINATION [%]

Specify number of days over which germination is measured

4.8 PERCENTAGE FIELD ESTABLISHMENT [%]

4.9 NUMBER OF DAYS TO 50% FIELD EMERGENCE

4.10 SOWING SITE IN FIELD

Give block, strip and/or row/plot numbers as applicable

4.11 TREE SPACING

4.11.1 Distance between trees in a row [m]

4.11.2 Distance between rows [m]

4.12 FERTILIZER

(Specify names, doses, frequency of each, and method of application)

4.13 PLANT PROTECTION

(Specify pesticides used, doses, frequency of each, and method of application)

4.14 ENVIRONMENTAL CHARACTERISTICS OF SITE

Descriptors for the Environmental characteristics of site (4.14.1 - 4.14.26) are given in Section 5. These are numbered in Section 5 in the following manner 5.1.1 - 5.1.26, but should be used for this section. This has been done in order to reduce the repetition of descriptors in Sections 2 and 4

4.15 NOTES

Note any other site-specific information

5. ENVIRONMENT DESCRIPTORS

5.1 COLLECTING AND/OR CHARACTERIZATION/EVALUATION SITE ENVIRONMENT

5.1.1 Topography

This refers to the differences in elevation of the land surface on a broad scale

The reference is:
FAO, 1990. In: *Guidelines For Soil Profile Description*, 3rd Edition (Revised), Rome, p.70

1	Flat	0	-	0.5%
2	Almost flat	0.6	-	2.9%
3	Gently undulating	3	-	5.9%
4	Undulating	6	-	10.9%
5	Rolling	11	-	15.9%
6	Hilly	16	-	30%
7	Steeply dissected	>30%, moderate range of elevation		
8	Mountainous	>30%, great range of elevation (>300 m)		
9	Other (specify in the appropriate Section's NOTES)			

5.1.2 Higher level landform (General physiographic features)

The landform refers to the shape of the land surface in the area in which the collecting site is located (Adapted from *FAO, 1990*)

1 Plain
2 Basin
3 Valley
4 Plateau
5 Upland
6 Hill
7 Mountain

5.1.3 Second level landform (Adapted from *FAO, 1990*)

1	Alluvial plain	(A plain formed from the deposition of alluvium usually adjacent to a river that periodically overflows (aggraded valley plain, river plain, wash plain, waste plain))
2	Coastal plain	
3	Lacustrine plain	
4	Glacial plain	
5	Peneplain	(Base-leveled plain) (Any land surface changed almost to a plain by subaerial erosion)
6	Pediment	(A piedmont slope formed from a combination of processes which are mainly erosional; the surface is chiefly bare rock but may have a covering veneer of alluvium or gravel (conoplain, piedmont interstream flat))
7	Volcano	
8	Dunefield	
9	Delta	
10	Tidal flat	(A marshy, sandy, or muddy nearly horizontal coastal flatland which is alternately covered and exposed as the tide rises and falls)
11	Playa	(A small, generally sandy land area at the mouth of a stream or along the shore of a bay)
12	Cay	(A flat coral island)
13	Other	(Specify in the appropriate Section's NOTES)

5.1.4 Land element and position

Description of the geomorphology of the immediate surroundings of the collecting site (Adapted from *FAO, 1990*). See Fig. 1

1 Plain level
2 Escarpment
3 Interfluve
4 Valley
5 Valley floor
6 Channel
7 Levee
8 Terrace
9 Floodplain
10 Lagoon
11 Pan
12 Caldera
13 Open depression
14 Closed depression
15 Dune
16 Longitudinal dune
17 Interdunal depression
18 Mangrove
19 Upper slope
20 Mid slope
21 Lower slope
22 Ridge
23 Beach
24 Beachridge
25 Rounded summit
26 Summit
27 Coral atoll
28 Drainage line (bottom position in flat or almost flat terrain)
29 Coral reef
30 Other (specify in the appropriate Section's NOTES)

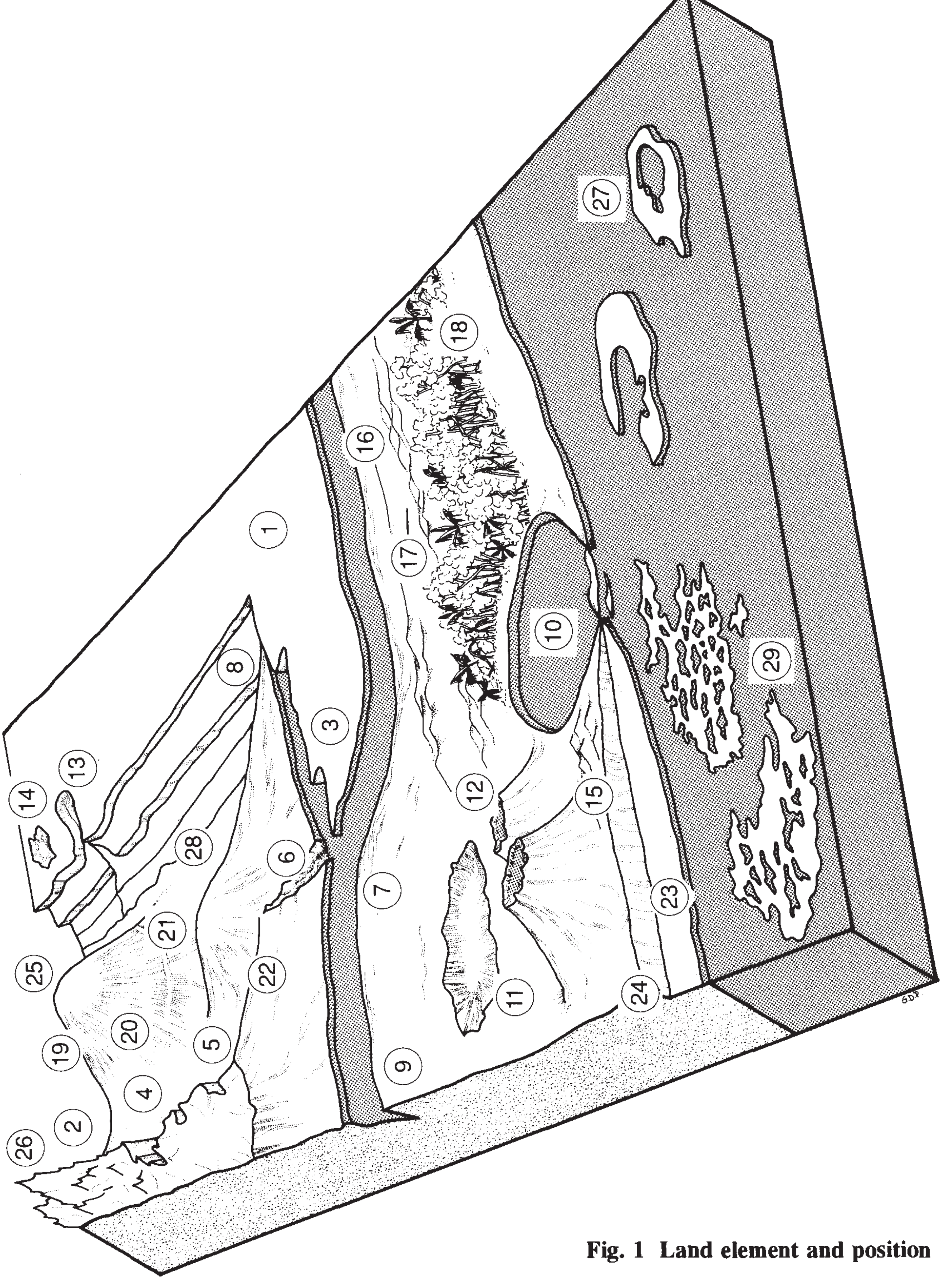

Fig. 1 Land element and position

5.1.5 Slope [°]

Estimated slope of the collecting site

5.1.6 Slope form

It refers to the general shape of the slope in both the vertical and horizontal directions (*FAO, 1990*)

1 Straight
2 Concave
3 Convex
4 Terraced
5 Complex (Irregular)

5.1.7 Slope aspect

The direction that the slope on which the accession was collected faces. Describe the direction with symbols N, S, E, W (e.g. a slope that faces a southwestern direction has an aspect of SW)

5.1.8 Crop agriculture (*FAO, 1990*)

5.1.8.1 Annual field cropping

1 Shifting cultivation
2 Fallow system cultivation
3 Ley system cultivation
4 Rainfed arable cultivation
5 Wet rice cultivation
6 Irrigated cultivation

5.1.8.2 Perennial field cropping

1 Non-irrigated cultivation
2 Irrigated cultivation

5.1.8.3 Tree and shrub cropping

1 Non-irrigated tree crop cultivation
2 Irrigated tree crop cultivation
3 Non-irrigated shrub crop cultivation
4 Irrigated shrub crop cultivation

5.1.9 Overall vegetation surrounding and at collecting site (*FAO, 1990*)

1	Grassland	(grasses, subordinate forbs, no woody species)
2	Forbland	(herbaceous plants predominant)
3	Forest	(continuous tree layer, crowns overlapping, large number of tree and shrub species in distinct layers)
4	Woodland	(continuous tree layer, crowns usually not touching, understorey may be present)
5	Shrubland	(continuous layer of shrubs, crowns touching)
6	Savanna	(grasses with a discontinuous layer of trees or shrubs)

5.1.10 Soil parent material (Adapted from *FAO, 1990*)

Two lists of examples of parent material and rock are given below. The reliability of the geological information and the knowledge of the local lithology will determine whether a general or a specific definition of the parent material can be given. Saprolite is used if the *in situ* weathered material is thoroughly decomposed, clay-rich but still showing rock structure. Alluvial deposits and colluvium derived from a single rock type may be further specified by that rock type

5.1.10.1 Unconsolidated material

1 Aeolian deposits (unspecified)
2 Aeolian sand
3 Littoral deposits
4 Lagoonal deposits
5 Marine deposits
6 Lacustrine deposits
7 Fluvial deposits
8 Alluvial deposits
9 Unconsolidated (unspecified)
10 Volcanic ash
11 Loess
12 Pyroclastic deposits
13 Glacial deposits
14 Organic deposits
15 Colluvial deposits
16 *In situ* weathered
17 Saprolite

5.1.10.2 Rock type

1 Acid igneous/ metamorphic rock
2 Granite
3 Gneiss
4 Granite/Gneiss
5 Quartzite
6 Schist
7 Andesite
8 Diorite
9 Basic igneous/ metamorphic rock
10 Ultra basic rock
11 Gabbro
12 Basalt
13 Dolerite
14 Volcanic rock
15 Sedimentary rock
16 Limestone
17 Dolomite
18 Sandstone
19 Quartzitic sandstone
20 Shale
21 Marl
22 Travertine
23 Conglomerate
24 Siltstone
25 Tuff
26 Pyroclastic rock
27 Evaporite
28 Gypsum rock
29 Not known

5.1.11 Stoniness/rockiness/hardpan/cementation

1 Tillage unaffected
2 Tillage affected
3 Tillage difficult
4 Tillage impossible
5 Essentially paved

5.1.12 Soil drainage (Adapted from *FAO, 1990*)

1 Very poorly drained
3 Poorly drained
5 Moderately drained
7 Well drained
9 Excessively drained

5.1.13 Flooding (*FAO, 1990*)

Flooding or temporary inundation is described according to its estimated frequency, duration and depth. Information may be obtained from records of past flooding or from local enquiry. The frequency and duration classes should give an indication of the average occurrence of inundation

5.1.14 Soil depth to groundwater table
(Adapted from *FAO, 1990*)

The depth to the groundwater table, if present, as well as an estimate of the approximate annual fluctuation, should be given. The maximum rise of the groundwater table can be inferred approximately from changes in profile colour in many, but not all, soils

1 (0 - 25 cm)
2 (25.1 - 50 cm)
3 (50.1 - 100 cm)
4 (100.1 - 150 cm)
5 (>150 cm)

5.1.15 Quality of the groundwater (*FAO, 1990*)

1 Saline
2 Brackish
3 Fresh
4 Polluted
5 Oxygenated
6 Stagnating

5.1.16 Soil salinity

1 (<160 ppm dissolved salts)
2 (160-240 ppm)
3 (241-480 ppm)
4 (>480 ppm)

5.1.17 <u>Soil moisture</u> (*FAO, 1990*)

Moisture conditions prevailing in the soil at the time of collection should be given together with the depth. Attention should be paid to unusual moisture conditions caused by inseasonal weather, prolonged exposure of the profile, flooding, etc.

3 Dry
5 Slightly moist
7 Moist
9 Wet

5.1.18 <u>Soil matrix colour</u> (Adapted from *FAO, 1990*)

The colour of the soil matrix material in the root zone around the accession is recorded in the moist condition (or both dry and moist condition, if possible) using the notation for hue, value and chroma as given in the Munsell Soil Color Charts (Munsell, 1975). If there is no dominant soil matrix colour, the horizon is described as mottled and two or more colours are given and should be registered under uniform conditions. Early morning and late evening readings are not accurate. Provide depth of measurement [cm]. If colour chart is not available, the following categories may be used

1 White
2 Red
3 Reddish
4 Yellowish red
5 Brown
6 Brownish
7 Reddish brown
8 Yellowish brown
9 Yellow
10 Reddish yellow
11 Greenish, green
12 Grey
13 Greyish
14 Blue
15 Bluish-black
16 Black

5.1.19 <u>Soil *p*H</u>

Actual value of the soil within the following root depths around the accession

5.1.19.1 <u>*p*H at 10-15 cm</u>

5.1.19.2 <u>*p*H at 30-60 cm</u>

5.1.19.3 <u>*p*H at 60-90 cm</u>

5.1.20 Soil organic matter content

1 Nil (as on arid zones)
3 Low (as in long-term cultivation in a tropical setting)
5 Medium (as in recently cultivated but not yet much depleted)
7 High (as in never cultivated, and in recently cleared from forest)
9 Peaty

5.1.21 Rock fragments

Large rock and mineral fragments (>2 mm) are described according to abundance (Adapted from *FAO, 1990*)

1 (0 - 2%)
2 (2.1 - 5%)
3 (5.1 - 15%)
4 (15.1 - 40%)
5 (40.1 - 80%)
6 (>80%)

5.1.22 Soil texture classes (Adapted from *FAO, 1990*)

For convenience in determining the texture classes of the following list and the particle size classes are given for each of the fine earth fraction below.
See Fig. 2

1 Clay
2 Loam
3 Clay loam
4 Silt
5 Silty clay
6 Silty clay loam
7 Silt loam
8 Sandy clay
9 Sandy clay loam
10 Sandy loam
11 Fine sandy loam
12 Coarse sandy loam
13 Loamy sand
14 Loamy very fine sand
15 Loamy fine sand
16 Loamy coarse sand
17 Very fine sand
18 Fine sand
19 Medium sand
20 Coarse sand
21 Sand, unsorted
22 Sand, unspecified

Soil particle size classes (Adapted from *FAO, 1990*)

1	Clay		<	2 µm
2	Fine silt	3	-	20 µm
3	Coarse silt	21	-	63 µm
4	Very fine sand	64	-	125 µm
5	Fine sand	126	-	200 µm
6	Medium sand	201	-	630 µm
7	Coarse sand	631	-	1250 µm
8	Very coarse sand	1251	-	2000 µm

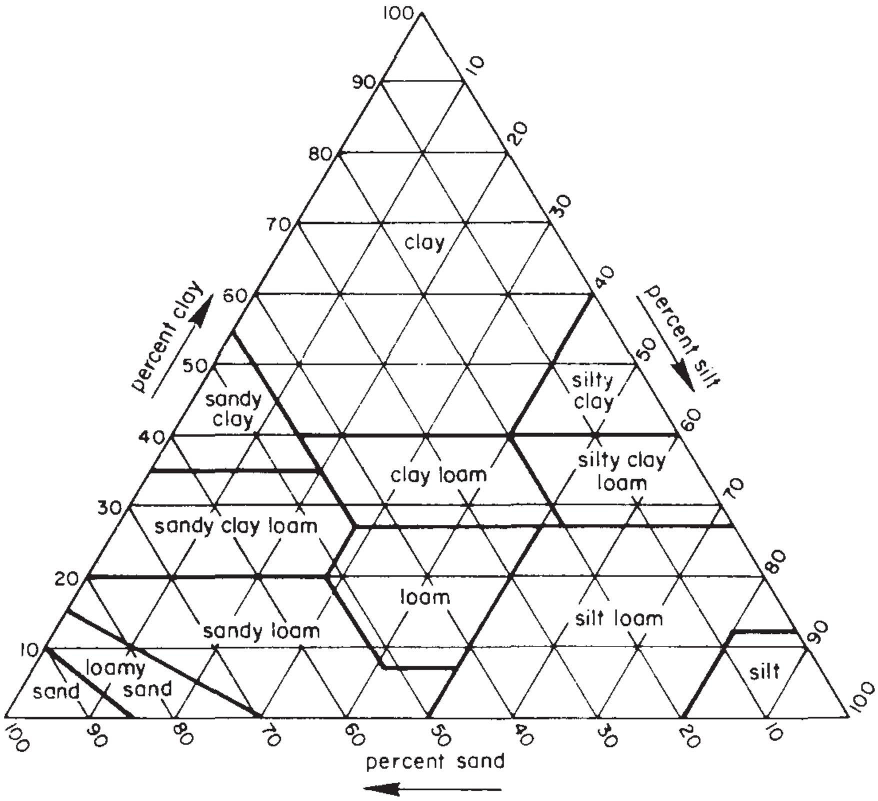

Fig. 2 Soil texture classes

5.1.23 Soil taxonomic classification

As detailed a classification as possible should be given. This may be taken from a soil survey map. State class (e.g., Alfisols, Spodosols, Vertisols etc.)

5.1.24 Water availability

1 Rainfed
2 Irrigated
3 Flooded
4 River banks
5 Sea coast
6 Other (specify in the appropriate Section's NOTES)

5.1.25 Soil fertility

3 Low
5 Moderate
7 High

5.1.26 Climate of collecting site

Should be assessed as close to the collecting site as possible

5.1.26.1 Temperature range [°C]

Provide either the diurnal (mean, maximum, minimum) or the seasonal (mean, maximum, minimum). Specify which one is used

5.1.26.2 Rainfall range [mm]

Annual average (state number of recorded years)

5.1.26.3 Wind [km s^{-1}]

Annual average (state number of years recorded)

5.1.26.3.1 Frequency of typhoons or hurricane force winds

5.1.26.3.2 Date of most recent typhoons or hurricane force winds

(in the format DDMMYYYY)

5.1.26.3.3 Annual maximum wind velocity [km s^{-1}]

5.1.26.4 Frost

5.1.26.4.1 Date of most recent frost

(in the format DDMMYYYY)

5.1.26.4.2 Length of growing season

Number of days from last to first frost

5.1.26.4.3 Lowest temperature

Specify seasonal average and minimum survived

5.1.26.4.4 Number of chill units [h]

Estimated number of hours annually below 7°C

5.1.26.5 Relative humidity

5.1.26.5.1 Relative humidity diurnal range [%]

5.1.26.5.2 Relative humidity seasonal range [%]

5.1.26.6 Light

3 Shady
7 Sunny

5.1.27 Other (specify in the appropriate Section's NOTES)

CHARACTERIZATION

6. PLANT DESCRIPTORS

Average of at least two years data

6.1 PHENOLOGY DESCRIPTORS

* **6.1.1 Reference standard**

Indicate which cultivar has been used for the following descriptors where applicable

1 Payne (generally regarded as phenologically early)
2 Hartley (generally regarded as mid season)
3 Franquette (generally regarded as late season)
4 Other (specify in the NOTES descriptor, 6.6)

* **6.1.2 Date of bud break**[1/]

When over 50% of terminal buds have enlarged and the bud scales have split exposing the green of the leaves inside (in the format DDMMYYYY)

* **6.1.2.1 Days before (-) or after (+) reference standard**

For the flowering phenology, avoid reporting aberrant conditions such as a single, unopened catkin remaining after pollen shedding has ceased or a bloom which is receptive well ahead of the first flush of pistillate flowers. Peak bloom dates are usually when about half the catkins (or blooms) are beyond shedding (or receptivity) and half are not yet opened

[1/] The University of California commonly uses 'leafing date' which is similar except that one leaf must be unfolding, and thus the date is several days later

* **6.1.3 <u>First male bloom date</u>**

When first pollen shedding occurs (in the format DDMMYYYY)

* **6.1.4 <u>Peak male bloom date</u>**

When maximum pollen shedding occurs (in the format DDMMYYYY)

* **6.1.4.1 <u>Days before (-) or after (+) reference standard</u>**

* **6.1.5 <u>Last male bloom date</u>**

When last pollen shedding occurs (in the format DDMMYYYY)

* **6.1.6 <u>First female bloom date</u>**

Date of initial pistillate flower receptivity (in the format DDMMYYYY)

* **6.1.7 <u>Peak female bloom date</u>**

Date of maximum pistillate flower receptivity (in the format DDMMYYYY)

* **6.1.7.1 <u>Days before (-) or after (+) reference standard</u>**

* **6.1.8 <u>Last female bloom date</u>**

Date of last pistillate flower receptivity (in the format DDMMYYYY)

* **6.1.9 <u>Harvest date</u>**

When nuts are harvestable. Take a random sample which is representative of entire tree (in the format DDMMYYYY)

6.1.9.1 <u>Days before (-) or after (+) reference standard</u>

* **6.1.10 <u>Defoliation date</u>**

(in the format DDMMYYYY)

6.1.10.1 <u>Days before (-) or after (+) reference standard</u>

6.2 GROWTH DESCRIPTORS

6.2.1 Seedling vigour

Rate of growth of juvenile seedling tree based on height and stem diameter

3 Low
5 Intermediate
7 High

6.2.2 Tree vigour

3 Low	Howard
5 Intermediate	Franquette, Hartley
7 High	Serr

6.2.3 Growth habit

Uprightness of vigourous current season's shoots (>1 m) of graft trees. See Fig. 3

1 Erect	Corne, Sorrento
2 Semi-erect	Franquette, Hartley, Chico
3 Spreading	Vina, Gustine

6.2.4 Branching

Relative degree of branching

3 Sparse	Corne
5 Intermediate	Franquette
7 Dense	Hartley, Serr, Chandler

6.3 LEAF DESCRIPTORS

For the following descriptors, average of 10 fully expanded representative leaves. Do not select leaves that are out of the ordinary due to pruning and excessive vigour

6.3.1 Leaf length [cm]

Measured from the base of petiole to the tip of terminal leaflet

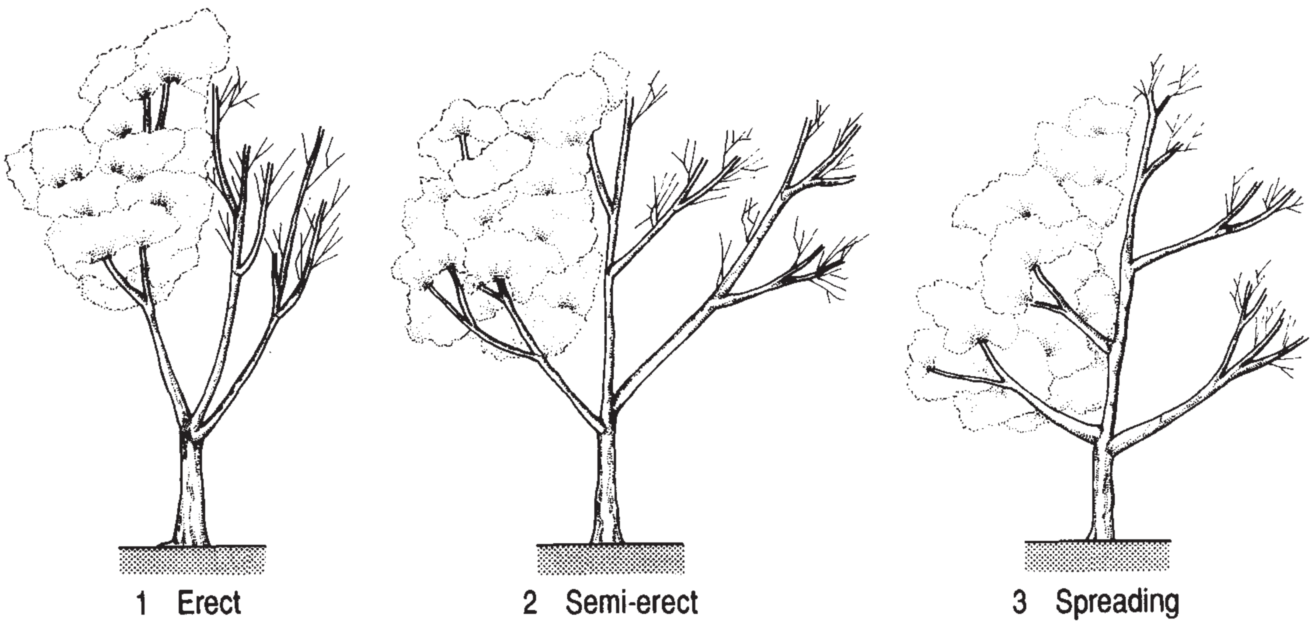

Fig. 3 Growth habit

6.3.2 Leaf width [cm]

Measured at the widest part

6.3.3 Number of leaflets

6.3.4 Leaflet length [cm]

Measured from the point of attachment to the tip. Give range average of shortest/longest leaflets

6.3.5 Leaflet width [cm]

Measured at the widest part. Give range average as above

6.3.6 Leaflet shape

See Fig. 4

1 Narrow elliptic
2 Elliptic
3 Broad elliptic

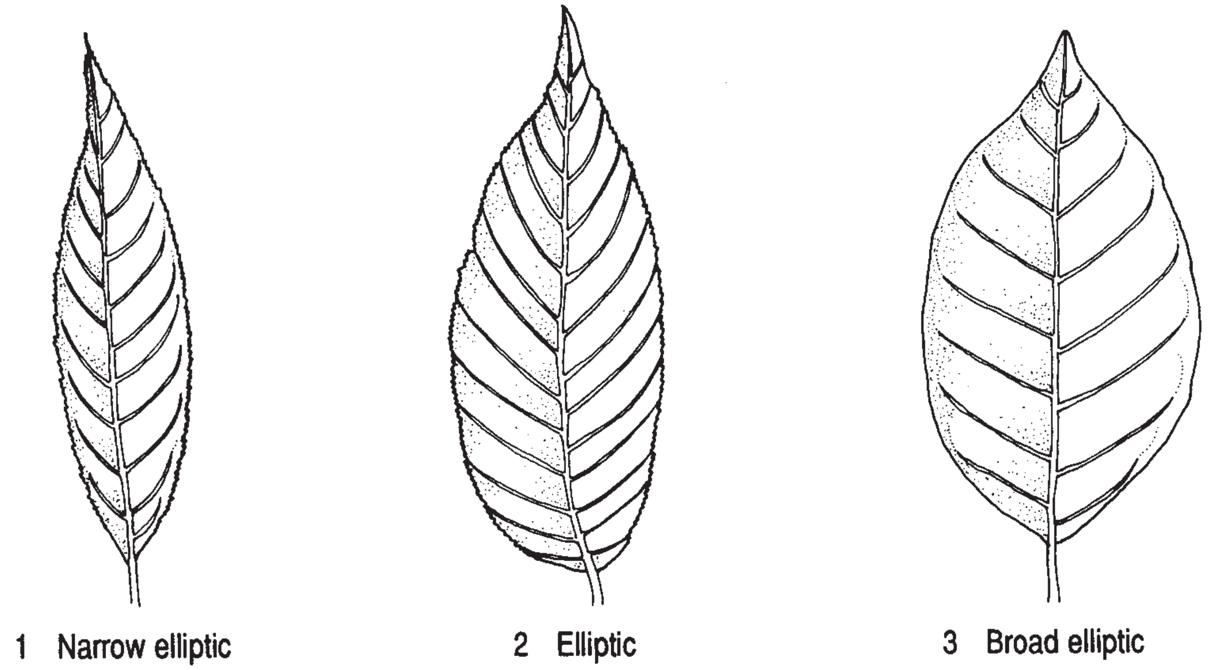

Fig. 4 Leaflet shape

6.3.7 Leaflet margin (See Fig. 5)

1 Entire
2 Serrate
3 Dentate (toothed)

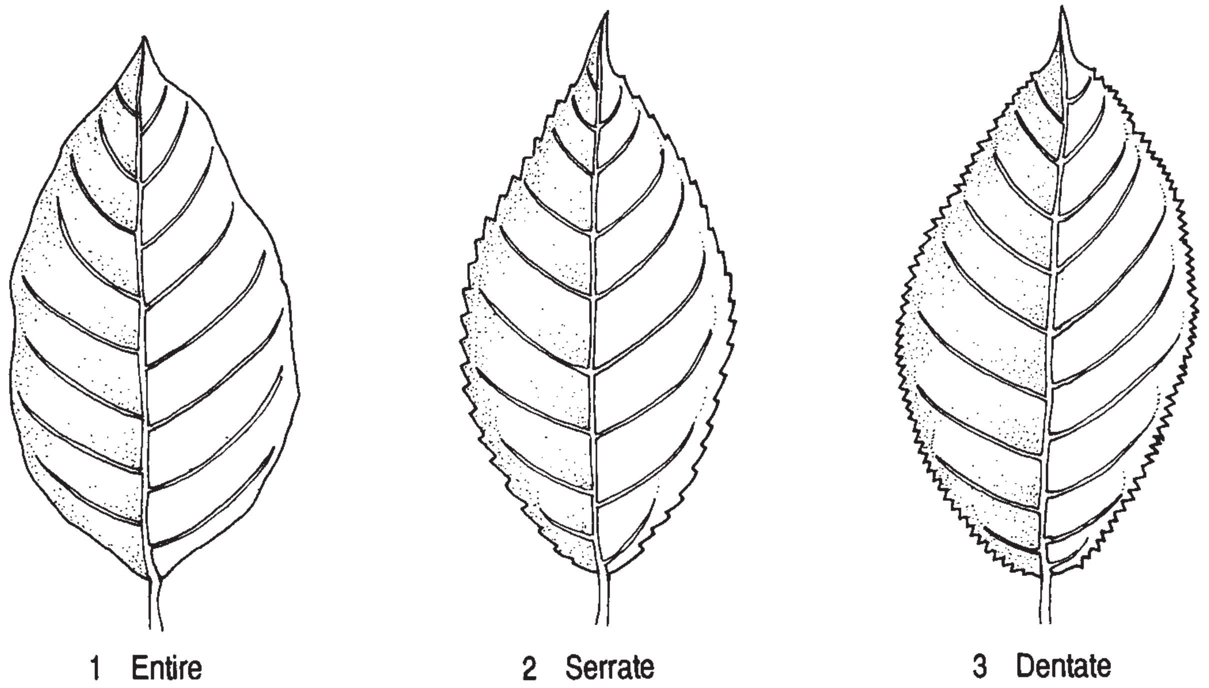

Fig. 5 Leaflet margin

6.3.8 Leaf colour

3 Light green
5 Green
7 Dark green

6.3.9 Rachis colour

3 Green
5 Yellow
7 Red

6.3.10 Shoot pubescence

1 Glabrous
2 Slightly pubescent
3 Pubescent

6.3.11 Shoot colour

3 Green
5 Brown
7 Black

6.3.12 Leaf and rachis pubescence

1 Glabrous
2 Slightly pubescent
3 Pubescent

6.3.13 Leaf and/or rachis persistance

3 Few remain attached to stem
5 Intermediate
7 Many remain attached to stem

6.4 INFLORESCENCE AND FRUITING HABIT

6.4.1 Dichogamy

1 Protandrous
2 Protogynous
3 Unknown

6.4.2 Duration of female bloom overlapped by the staminate bloom [%]

6.4.3 First catkin-bearing year

Number of years from seed or graft to first catkin bearing year, (i.e. 6s indicates that the first catkin was produced six years from seed germination, or seventh leaf)

6.4.4 Catkin abundance

Rate in relation to age and volume of tree

3 Light
5 Intermediate
7 Heavy

6.4.5 Alternate bearing

3 Slight
5 Moderate
7 Significant

6.4.6 Flowering precocity

* **6.4.6.1 Years from seed or graft to first female flower**

Specify number of years (i.e. 3s indicates first flower produced 3 years from seed germination)

6.4.6.2 Years from seed or graft to first yield

Of 300 nuts. Specify number of years as above

* **6.4.7 Lateral bud flowering** [%]

Percentage current season lateral shoots with female flowers in young trees (age 5-7 years) (e.g., Franquette = <10%; Payne = >90%). This trait is not apparent in old trees

6.4.8 Female flower abundance

Rate in relation to age and volume of tree

3 Light
5 Intermediate
7 Heavy

* **6.4.9 Flowers per inflorescence**

Most frequent number of flowers recorded in 10 terminal inflorescences

6.4.10 Pistillate flower abscission

3 Slight
5 Moderate
7 Significant

6.4.11 Stigma colour

3 Green
5 Yellow
7 Red

6.4.12 Hull persistance after nut fall

3 Slight
5 Moderate
7 Significant

* **6.4.13 Hull dehiscence**

1 Non-dehiscent *J. nigra*
2 Slightly dehiscent
3 Dehiscent *J. regia*

6.5 NUT AND KERNEL

Average of 20 sound nuts (except for descriptors 6.5.20 and 6.5.21)

*	6.5.1	**Nut shape**	
		Longitudinal and perpendicular to suture. (See Fig. 6)	
		1 Round	
		2 Triangular	
		3 Broad ovate	
		4 Ovate	
		5 Short trapezoid	
		6 Long trapezoid	
		7 Broad elliptic	
		8 Elliptic	
		9 Cordate	
*	6.5.2	**Nut diameter** [mm]	
		Face to face	
*	6.5.3	**Nut length** [mm]	
*	6.5.4	**Shell texture**	
		1 Very smooth	*J. ailantifolia* var. *cordiformis*
		3 Smooth	
		5 Medium	
		7 Rough	
		9 Very rough	*J. manshurica*, *J. cinerea*
*	6.5.5	**Shell colour**	
		1 Very light	
		3 Light	Hartley
		5 Medium	*J. regia*, Verdot, Grosvert
		7 Dark	*J. hindsii*
		9 Very dark	*J. cinerea*
*	6.5.6	**Shell seal**	
		1 Open or very weak	
		3 Weak	
		5 Intermediate	Hartley
		7 Strong	Franquette
		9 Very strong	Corne

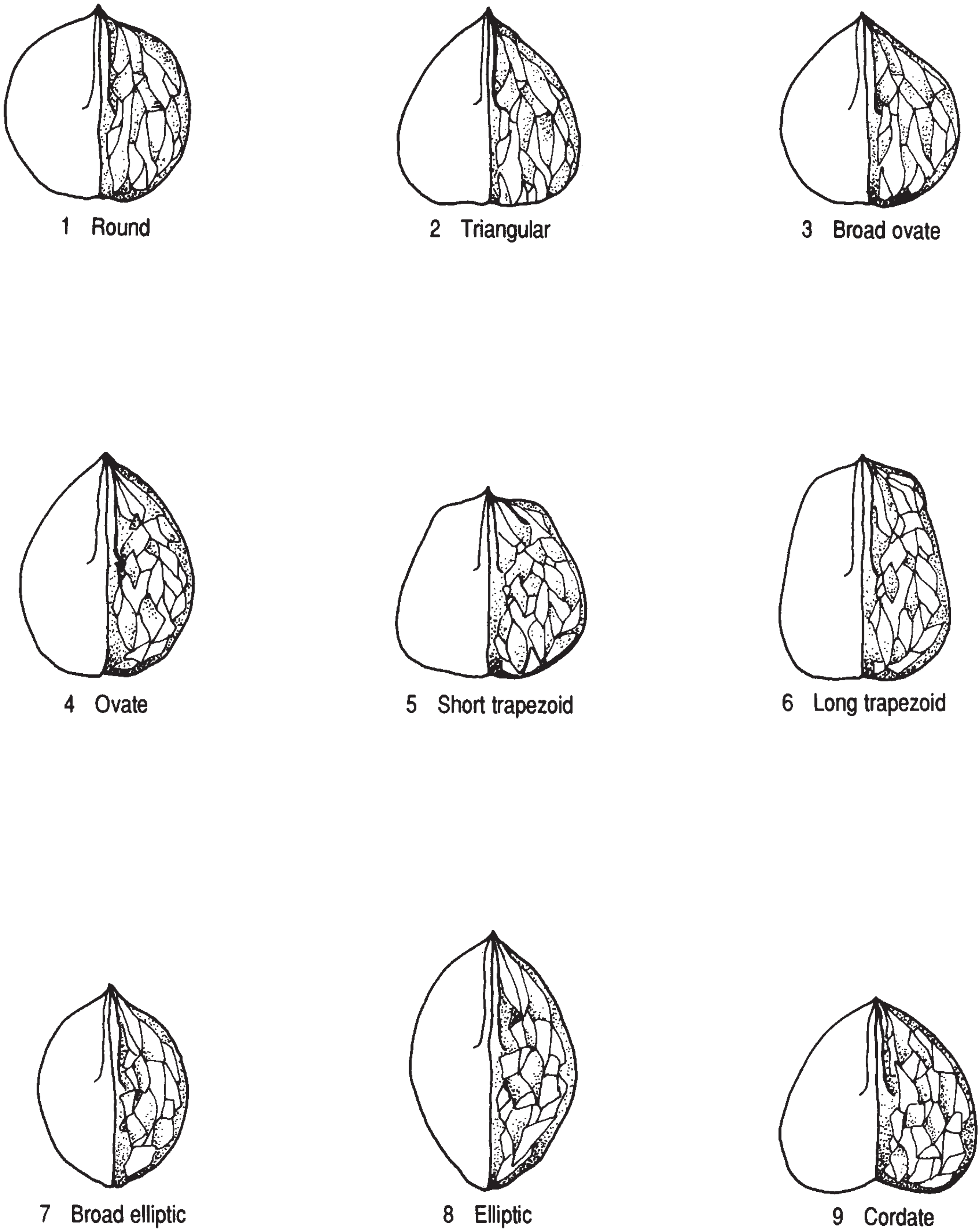

Fig. 6 Nut shape

* **6.5.7 Shell strength**

1 Paper
3 Weak
5 Intermediate
7 Strong

6.5.8 Shell integrity

1 Incomplete shell (>50% missing)
2 Intermediate (≤50% missing)
3 Complete shell, no holes

6.5.9 Shell thickness [mm]

Near center of half shell

6.5.10 Packing tissue brown date

When the packing tissue in 80% of the nuts have completed browning (in the format DDMMYYYY)

6.5.10.1 Days before (-) or after (+) reference standard

* **6.5.11 Packing tissue thickness**

1 Very thin and sparse	
3 Thin	Chandler
5 Medium	Typical *J. regia*
7 Thick	*J. ailantifolia, J. cinerea*
9 Very thick	*J. nigra, J. hindsii*

* **6.5.12 Inshell nut weight** [g]

* **6.5.13 Kernel weight** [g]

Average of 20 sound kernels

* **6.5.14 Kernel percentage**

Kernel weight/nut weight x 100

6.5.15 Kernel veins [%]

Of sample with conspicuous veins

6.5.16 Kernel flavour

1 Satisfactory
2 Unsatisfactory

6.5.17 Kernel fill

3 Poor
5 Moderate
7 Well

6.5.18 Kernel plumpness

3 Thin	
5 Moderate	
7 Plump	Sunland

6.5.19 Ease of removal of kernel halves

1 Very easy	Chandler
3 Easy	Franquette
5 Moderate	Chico, Corne
7 Difficult	*J. ailantifolia*
9 Very difficult	*J. hindsii, J. nigra* and most other species

6.5.20 Kernel shrivel

Based on 20 randomly selected nuts

6.5.20.1 Kernels exhibiting tip shrivel [%]

6.5.20.2 Kernels exhibiting <50% shrivel [%]

6.5.20.3 Kernels exhibiting 50% or more shrivel [%]

6.5.20.4 Kernels blank [%]

* **6.5.21 Kernel colour**

Based on 20 randomly selected nuts. Use 'Walnut Color Chart' to determine classification

The reference is:

Walnut Color Chart. DFA of California (Dried Fruit Association). P.O. Box 270-A, Santa Clara, California 95052

6.5.21.1 Extra light [%]

6.5.21.2 Light [%]

6.5.21.3 Light amber [%]

6.5.21.4 Amber [%}

6.6 NOTES

Any additional information, especially in the category of 'other' under various descriptors above, may be specified here

EVALUATION

7. PLANT DESCRIPTORS

7.1 YIELD

7.1.1 Cropping efficiency [g cm^{-2}]

Yield per unit trunk cross sectional area. Trunk measurement 20 cm above graft union in grafted tree or 40 cm above ground level in seedling tree

* **7.1.2 Estimated yield**

Rate in relation to age and volume of tree

3 Low
5 Intermediate
7 High

7.2 NUT AND KERNEL

7.2.1 Kernel protein [%]

7.2.2 Kernel rancidity potential [%]

Polyunsaturated fatty acids

7.2.3 Kernel oil content [%]

8. ABIOTIC STRESS SUSCEPTIBILITY

Scored under artificial and/or natural conditions, which should be clearly specified. These are coded on a susceptibility scale from 1 to 9 viz.:

1 Very low or no visible sign of susceptibility
3 Low
5 Intermediate
7 High
9 Very high

8.1 LOW TEMPERATURES

8.1.1 Susceptibility to cold in fall

8.1.2 Susceptibility to mid winter cold

8.1.3 Susceptibility to frost damage in spring

8.2 HIGH TEMPERATURES

8.2.1 Sunburn susceptibility of hull

8.2.2 Sunburn susceptibility of kernel

8.2.3 Sunburn susceptibility of trunk

8.3 SALINITY

8.4 MINERAL DEFICIENCIES

8.5 MINERAL TOXICITIES

8.6 WATERLOGGING

8.7 DROUGHT

9. BIOTIC STRESS SUSCEPTIBILITY

In each case, it is important to state the origin of the infestation or infection, i.e., natural, controlled infestation/inoculation, or laboratory. Record such information in the NOTES descriptor, 9.5. These are coded on a susceptibility scale from 0 to 9 viz.:

0 No sign of susceptibility (i.e. non-host response)
1 Very low or almost no visible sign of susceptibility
3 Low
5 Intermediate
7 High
9 Very high

9.1 MAJOR INSECT PESTS

	Causal organism	Pest or common name
9.1.1	*Amyelois transitella* Determine percentage infested nuts at harvest (100 nuts/tree)	Navel orangeworm
9.1.2	*Callaphis juglandis* Determine percentage infested leaflets (20 leaflets/tree)	Dusky-veined aphid
9.1.3	*Cydia pomonella* L. Determine percentage infested nuts at harvest (100 nuts/tree)	Codling moth
9.1.4	*Epidiaspis leperii* Determine percentage infested of major scaffold limb or trunk (10-25 cm length/tree)	Italian pear scale
9.1.5	*Panonychus ulmi* Determine percentage infested leaflets (20 leaflets/tree)	European red mite
9.1.6	*Pseudaulacaspis pentagona* Determine percentage infested of 2 to 3-year-old-wood (10-25 cm length/tree)	White peach scale
9.1.7	*Rhagoletis completa* Determine percentage infested husks just prior to husk split (100 husks/tree)	Walnut husk fly
9.1.8	*Vasates unguiculatus* Determine percentage infested leaves (50 leaves/tree)	Walnut gall mite

9.2 MINOR INSECT PESTS

9.2.1	*Acrobasis demotella* Determine percentage infested shoots in early spring (50 shoots/tree). A pest of *Juglans nigra*	Walnut shoot moth

	Causal organism	Pest or common name
9.2.2	Acrobasis juglandis Determine percentage infested leaves (50 leaves/tree). A pest of *Juglans nigra*	Pecan leaf casebearer
9.2.3	Caloptilia roscepinnella Determine percentage infested leaves (50 leaves/tree)	Walnut tree moth
9.2.4	Chromaphis juglandicola Determine percentage infested leaflets (20 leaflets/tree)	Walnut aphid
9.2.5	Chrysobothris mali Determine percentage infested major scaffold limb and trunk (whole tree)	Pacific flatheaded borer
9.2.6	Conotrachelus retentus Determine percentage infested nuts 2-3 months after bloom before nut drop (50 nuts/tree). A pest of *Juglans nigra*	Walnut curculio
9.2.7	Datana integerrima Determine number infested branches with colonies (whole tree). A pest of *Juglans nigra*	Walnut caterpillar
9.2.8	Eriophyes erineus (Nalepa)	Walnut leaf gall mite
9.2.9	Hyphantria cunea Determine percentage branches with colony (whole tree)	Fall webworm
9.2.10	Lecanium corni Determine percentage infested of 2- to 3-year old wood (10-25 cm length/tree)	European fruit *lecanium*
9.2.11	Lepidosaphes pruinosum Determine percentage infested of 2- to 3-year old wood (10-25 cm length tree)	Frosted scale
9.2.12	Lepidosaphes ulmi Determine percentage infested of major scaffold limb (10-25 cm length/tree)	Oystershell scale
9.2.13	Nysius raphanus Determine percentage infested trees (whole tree)	False chinch bug

	Causal organism	Pest or common name
9.2.14	Panonychus ulmi Determine percentage infested leaflets (20 leaflets/tree)	European red mite
9.2.15	Quadraspidiotus juglansregiae Determine percentage infested of major scaffold limb (10-25 cm length/tree)	Walnut scale
9.2.16	Quadraspidiotus perniciosus Determine percentage infested of 2- to 3-year old wood (10-25 cm length/tree)	San Jose scale
9.2.17	Schizura concinna Determine percentage infested branches (whole tree)	Red-humped caterpillar
9.2.18	Tetranychus pacificus Determine percentage infested leaflets (20 leaflets/tree)	Pacific spider mite
9.2.19	Tetranychus urticae Determine percentage infested leaflets (20 leaflets/tree)	Two-spotted spider mite
9.2.20	Xylosandrus germanus Determine percentage infested (shot holes) of trunk and small low-hanging branches (whole tree). A pest of *Juglans nigra*	Ambrosia beetle

9.3 NEMATODES

9.3.1	Cacopaurus pestis	Pin nematode
9.3.2	Criconemella xenoplax	Ring nematode
9.3.3	Helicotylenchus sp.	Spiral nematode
9.3.4	Longidorus spp. (Transmits virus)	Needle nematode
9.3.5	Meloidogyne spp.	Root knot nematode

	Causal organism	Pest or common name
9.3.6	*Pratylenchus vulnus* (Most important)	Root lesion nematode
9.3.7	*Xiphinema* spp. (Transmits cherry leafroll virus)	Dagger nematode

9.4 DISEASES

		Disease or common name
9.4.1	*Agrobacterium tumefaciens*	Crown gall
9.4.2	*Armillaria mellea*	*Armillaria* root and crown rot
9.4.3	Cherry leafroll virus	Blackline disease
9.4.4	*Cylindrocladium* spp. A pest of *Juglans nigra*	Damping off/Root rot
9.4.5	*Erwinia nigrifluens*	Shallow bark canker
9.4.6	*Erwinia rubrifaciens*	Deep bark canker
9.4.7	*Gnomonia leptostyla*	Walnut bunch disease
9.4.8	*Hendersonula toruloidea*	Branch wilt
9.4.9	Mycoplasma	Walnut bunch disease
9.4.10	*Phytophthora* spp.	*Phytophthora* root and crown rot
9.4.11	*Sirococcus clavigignenti-juglandacearum*	Butternut canker
9.4.12	*Xanthomonas campestris*	Blight

9.5 NOTES

Specify here any additional information

10. BIOCHEMICAL COMPOSITION

10.1 PROTEIN CHARACTERIZATION

10.2 ALLOZYME COMPOSITION

10.3 DNA FINGERPRINTING (RFLP/RAPD)

11. CYTOLOGICAL CHARACTERS AND IDENTIFIED GENES

11.1 2n CHROMOSOME NUMBER

11.2 PLOIDY LEVEL

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Walnut Color Chart. DFA of California (Dried Fruit Association). P.O. Box 270-A, Santa Clara, California 95052, USA

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Ms. Adriana Alercia prepared the text for publication. Illustrations were drawn by Mrs. Pina di Pilla. Mr. Paul Stapleton managed the production of the publication. Scientific direction was provided by Dr. Mark Perry.

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TG/308/1
ORIGINAL: English
DATE: 2015-03-25

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
Geneva

*

PECAN NUT

UPOV Code: CARYA_ILL

Carya illinoinensis (Wangenh.) K. Koch

GUIDELINES

FOR THE CONDUCT OF TESTS

FOR DISTINCTNESS, UNIFORMITY AND STABILITY

Alternative Names:*

Botanical name	*English*	*French*	*German*	*Spanish*
Carya illinoinensis (Wangenh.) K. Koch	Pecan nut	Noix de pécan	Pekan, Pekannuß	Nuez pecán, Pecan, Nogal pecanero

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.

* These names were correct at the time of the introduction of these Test Guidelines but may be revised or updated. [Readers are advised to consult the UPOV Code, which can be found on the UPOV Website (www.upov.int), for the latest information.]

TABLE OF CONTENTS PAGE

1. Subject of these Test Guidelines

These Test Guidelines apply to all varieties of *Carya illinoinensis* (Wangenh.) K. Koch.

2. Material Required

2.1 The competent authorities decide on the quantity and quality of the plant material required for testing the variety and when and where it is to be delivered. Applicants submitting material from a State other than that in which the testing takes place must ensure that all customs formalities and phytosanitary requirements are complied with.

2.2 The material is to be supplied in the form of dormant budsticks or grafted plants.

2.3 The minimum quantity of plant material, to be supplied by the applicant, should be:

8 dormant budsticks or 8 grafted plants.

2.4 The plant material supplied should be visibly healthy, not lacking in vigor, nor affected by any important pest or disease.

2.5 The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If it has been treated, full details of the treatment must be given.

3. Method of Examination

3.1 Number of Growing Cycles

3.1.1 The minimum duration of tests should normally be two independent growing cycles.

3.1.2 The growing cycle is considered to be the period ranging from the beginning of active vegetative growth or flowering, continuing through active vegetative growth or flowering and fruit development and concluding with the harvesting of fruit.

3.1.3 In particular, it is essential that the plants produce a satisfactory crop of fruit in each of the two growing cycles.

3.2 Testing Place

Tests are normally conducted at one place. In the case of tests conducted at more than one place, guidance is provided in TGP/9 "Examining Distinctness".

3.3 Conditions for Conducting the Examination

The tests should be carried out under conditions ensuring satisfactory growth for the expression of the relevant characteristics of the variety and for the conduct of the examination.

3.4 Test Design

3.4.1 Each test should be designed to result in a total of at least 5 trees.

3.4.2 The design of the tests should be such that plants or parts of plants may be removed for measurement or counting without prejudice to the observations which must be made up to the end of the growing cycle.

3.5 Additional Tests

Additional tests, for examining relevant characteristics, may be established.

4. Assessment of Distinctness, Uniformity and Stability

4.1 Distinctness

4.1.1 General Recommendations

It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding distinctness. However, the following points are provided for elaboration or emphasis in these Test Guidelines.

4.1.2 Consistent Differences

The differences observed between varieties may be so clear that more than one growing cycle is not necessary. In addition, in some circumstances, the influence of the environment is not such that more than a single growing cycle is required to provide assurance that the differences observed between varieties are sufficiently consistent. One means of ensuring that a difference in a characteristic, observed in a growing trial, is sufficiently consistent is to examine the characteristic in at least two independent growing cycles.

4.1.3 Clear Differences

Determining whether a difference between two varieties is clear depends on many factors, and should consider, in particular, the type of expression of the characteristic being examined, i.e. whether it is expressed in a qualitative, quantitative, or pseudo-qualitative manner. Therefore, it is important that users of these Test Guidelines are familiar with the recommendations contained in the General Introduction prior to making decisions regarding distinctness.

4.1.4 Number of Plants / Parts of Plants to be Examined

Unless otherwise indicated, for the purposes of distinctness, all observations on single plants should be made on 5 plants or parts taken from each of 5 plants and any other observations made on all plants in the test, disregarding any off-type plants. In the case of observations of parts taken from single plants, the number of parts to be taken from each of the plants should be 2.

4.1.5 Method of Observation

The recommended method of observing the characteristic for the purposes of distinctness is indicated by the following key in the second column of the Table of Characteristics (see document TGP/9 “Examining Distinctness”, Section 4 “Observation of characteristics”):

MG: single measurement 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 observation of individual plants or parts of plants

Type of observation: visual (V) or measurement (M)

> “Visual” observation (V) is an observation made on the basis of the expert’s judgment. For the purposes of this document, “visual” observation refers to the sensory observations of the experts and, therefore, also includes smell, taste and touch. Visual observation includes observations where the expert uses reference points (e.g. diagrams, example varieties, side-by-side comparison) or non-linear charts (e.g. color charts). Measurement (M) is an objective observation against a calibrated, linear scale e.g. using a ruler, weighing scales, colorimeter, dates, counts, etc.

Type of record: for a group of plants (G) or for single, individual plants (S)

> For the purposes of distinctness, observations may be recorded as a single record for a group of plants or parts of plants (G), or may be recorded as records for a number of single, individual plants or parts of plants (S). In most cases, “G” provides a single record per variety and it is not possible or necessary to apply statistical methods in a plant-by-plant analysis for the assessment of distinctness.

In cases where more than one method of observing the characteristic is indicated in the Table of Characteristics (e.g. VG/MG), guidance on selecting an appropriate method is provided in document TGP/9, Section 4.2.

4.2 Uniformity

4.2.1 It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding uniformity. However, the following points are provided for elaboration or emphasis in these Test Guidelines:

4.2.2 For the assessment of uniformity of vegetatively propagated varieties, a population standard of 1% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 5 trees, no off-type is allowed.

4.3 Stability

4.3.1 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, experience has demonstrated that, for many types of variety, when a variety has been shown to be uniform, it can also be considered to be stable.

4.3.2 Where appropriate, or in cases of doubt, stability may be further examined by testing a new plant stock to ensure that it exhibits the same characteristics as those shown by the initial material supplied.

5. Grouping of Varieties and Organization of the Growing Trial

5.1 The selection of varieties of common knowledge to be grown in the trial with the candidate varieties and the way in which these varieties are divided into groups to facilitate the assessment of distinctness are aided by the use of grouping characteristics.

5.2 Grouping characteristics are those in which the documented states of expression, even where produced at different locations, can be used, either individually or in combination with other such characteristics: (a) to select varieties of common knowledge that can be excluded from the growing trial used for examination of distinctness; and (b) to organize the growing trial so that similar varieties are grouped together.

5.3 The following have been agreed as useful grouping characteristics:

(a) Tree: vigor (characteristic 1)
(b) Tree: growth habit (characteristic 3)
(c) Lateral leaflet: petiolule (characteristic 11)
(d) Nut: length (characteristic 19)
(e) Nut: width in lateral view (characteristic 20)
(f) Nut: width in lateral view facing the suture (characteristic 21)
(g) Nut: shape in lateral view (characteristic 22)

5.4 Guidance for the use of grouping characteristics, in the process of examining distinctness, is provided through the General Introduction and document TGP/9 “Examining Distinctness”.

6. Introduction to the Table of Characteristics

6.1 Categories of Characteristics

6.1.1 Standard Test Guidelines Characteristics

Standard Test Guidelines characteristics are those which are approved by UPOV for examination of DUS and from which members of the Union can select those suitable for their particular circumstances.

6.1.2 Asterisked Characteristics

Asterisked characteristics (denoted by *) are those included in the Test Guidelines which are important for the international harmonization of variety descriptions and should always be examined for DUS and included in the variety description by all members of the Union, except when the state of expression of a preceding characteristic or regional environmental conditions render this inappropriate.

6.2 States of Expression and Corresponding Notes

6.2.1 States of expression are given for each characteristic to define the characteristic and to harmonize descriptions. Each state of expression is allocated a corresponding numerical note for ease of recording of data and for the production and exchange of the description.

6.2.2 In the case of qualitative and pseudo-qualitative characteristics (see Chapter 6.3), all relevant states of expression are presented in the characteristic. However, in the case of quantitative characteristics with 5 or more states, an abbreviated scale may be used to minimize the size of the Table of Characteristics. For example, in the case of a quantitative characteristic with 9 states, the presentation of states of expression in the Test Guidelines may be abbreviated as follows:

State	Note
small	3
medium	5
large	7

However, it should be noted that all of the following 9 states of expression exist to describe varieties and should be used as appropriate:

State	Note
very small	1
very small to small	2
small	3
small to medium	4
medium	5
medium to large	6
large	7
large to very large	8
very large	9

6.2.3 Further explanation of the presentation of states of expression and notes is provided in document TGP/7 “Development of Test Guidelines”.

6.3 Types of Expression

An explanation of the types of expression of characteristics (qualitative, quantitative and pseudo-qualitative) is provided in the General Introduction.

6.4 Example Varieties

Where appropriate, example varieties are provided to clarify the states of expression of each characteristic.

6.5 Legend

(*)	Asterisked characteristic	– see Chapter 6.1.2
QL	Qualitative characteristic	– see Chapter 6.3
QN	Quantitative characteristic	– see Chapter 6.3
PQ	Pseudo-qualitative characteristic	– see Chapter 6.3
MG, MS, VG, VS		– see Chapter 4.1.5

(a)-(c) See Explanations on the Table of Characteristics in Chapter 8.1

(+) See Explanations on the Table of Characteristics in Chapter 8.2.

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

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
1. (*) (+)	VG	**Tree: vigor**	**Arbre : vigueur**	**Baum: Wuchsstärke**	**Árbol: vigor**		
QN		weak	faible	gering	débil	Barton, Success	3
		medium	moyenne	mittel	medio	Cheyenne	5
		strong	forte	stark	fuerte	Desirable, Western	7
2. (+)	VG	**Tree: density of branches**	**Arbre : densité des branches**	**Baum: Dichte der Verzweigung**	**Árbol: densidad de las ramas**		
QN		sparse	faible	locker	escasa	Cheyenne	3
		medium	moyenne	mittel	media	Desirable, Mahan	5
		dense	forte	dicht	densa	Success, Wichita	7
3. (*) (+)	VG	**Tree: growth habit**	**Arbre : port**	**Baum: Wuchsform**	**Árbol: hábito de crecimiento**		
QN		upright	dressé	aufrecht	erguido	Success	1
		semi-upright	demi-dressé	halbaufrecht	semierguido	Desirable, Mohawk	2
		spreading	étalé	breitwüchsig	extendido	Shoshoni, Western	3
4.	VG	**One-year-old shoot: color**	**Rameau d'un an : couleur**	**Einjähriger Trieb: Farbe**	**Rama de un año: color**		
PQ		greenish brown	brun verdâtre	grünlichbraun	marrón verdoso	Stuart	1
		reddish brown	brun rougeâtre	rötlichbraun	marrón rojizo	Mahan	2
		brown	brun	braun	marrón	Desirable, Success	3
5.	VG/ MS	**Leaf: length of petiole**	**Feuille : longueur du pétiole**	**Blatt: Länge des Blattstiels**	**Hoja: longitud del pecíolo**		
QN	(a)	short	court	kurz	corto	Desirable	3
		medium	moyen	mittel	medio	Success	5
		long	long	lang	largo	Mahan, Stuart	7
6.	VG/ MS	**Terminal leaflet: length**	**Foliole terminale : longueur**	**Endfieder: Länge**	**Folíolo terminal: longitud**		
QN	(a)	short	courte	kurz	corto	Desirable	3
		medium	moyenne	mittel	medio	Shoshoni, Stuart	5
		long	longue	lang	largo	Mahan	7
7.	VG/ MS	**Terminal leaflet: width**	**Foliole terminale : largeur**	**Endfieder: Breite**	**Folíolo terminal: anchura**		
QN	(a)	narrow	étroite	schmal	estrecho	Desirable	3
		medium	moyenne	mittel	medio	Success	5
		broad	large	breit	ancho		7

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
8.	**VG/ MS**	**Terminal leaflet: ratio length/width**	**Foliole terminale : rapport longueur/largeur**	**Endfieder: Verhältnis Länge/Breite**	**Folíolo terminal: relación longitud/anchura**		
QN	**(a)**	low	bas	klein	baja	Mahan, Stuart	3
		medium	moyen	mittel	media	Shoshoni	5
		high	élevé	groß	alta	Desirable	7
9.	**VG**	**Leaf: intensity of green color**	**Feuille : intensité de la couleur verte**	**Blatt: Intensität der Grünfärbung**	**Hoja: intensidad del color verde**		
QN	**(a)**	light	faible	hell	claro	Desirable	1
		medium	moyenne	mittel	medio	Stuart	2
		dark	forte	dunkel	oscuro		3
10.	**VG**	**Lateral leaflet: curvature along longitudinal axis**	**Foliole latérale : courbure le long de l'axe longitudinal**	**Seitenfieder: Biegung entlang der Längsachse**	**Folíolo lateral: curvatura del eje longitudinal**		
QN	**(a)**	weak	faible	gering	débil	Desirable	1
		medium	moyenne	mittel	media		2
		strong	forte	stark	fuerte	Mahan	3
11. (*)	**VG**	**Lateral leaflet: petiolule**	**Foliole latérale : pétiolule**	**Seitenfieder: Blattfiederstiel**	**Folíolo lateral: peciólulo**		
QL	**(a)**	absent	absent	fehlend	ausente	Desirable	1
		present	présent	vorhanden	presente	Stuart, Success	9
12. (+)	**VG**	**Lateral leaflet: asymmetry at base**	**Foliole latérale : asymétrie à la base**	**Seitenfieder: Asymmetrie an der Basis**	**Folíolo lateral: asimetría en la base**		
QN	**(a)**	absent or weak	absente ou faible	fehlend oder gering	ausente o débil	Desirable	1
		moderate	modérée	mäßig	moderada		2
		strong	forte	stark	fuerte		3
13. (*) (+)	**VG/ MG**	**Catkin: length**	**Chaton : longueur**	**Kätzchen: Länge**	**Amento: longitud**		
QN		short	court	kurz	corto	Desirable	3
		medium	moyen	mittel	medio	Mahan, Stuart	5
		long	long	lang	largo		7
14.	**VG/ MS**	**Female inflorescence: number of flowers**	**Inflorescence femelle : nombre de fleurs**	**Weiblicher Blütenstand: Anzahl Blüten**	**Inflorescencia femenina: número de flores**		
QN		very few	très petit	sehr gering	muy bajo		1
		few	petit	gering	bajo	Success	2
		medium	moyen	mittel	medio	Cape Fear, Harris Super, Stuart	3
		many	grand	groß	alto	Mahan	4
		very many	très grand	sehr groß	muy alto		5

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
15.	**VG**	**Stigma: splitting**	**Stigmate : division**	**Narbe: Spaltung**	**Estigma: división**		
(+)							
QN	**(b)**	absent or weak	absente ou faible	fehlend oder gering	ausente o débil	INTA DELTA II, Mahan	1
		moderate	modérée	mäßig	moderada		2
		strong	forte	stark	fuerte	Cape Fear, Desirable, Stuart	3
16. (*)	**VG**	**Stigma: anthocyanin coloration**	**Stigmate : pigmentation anthocyanique**	**Narbe: Anthocyanfärbung**	**Estigma: pigmentación antociánica**		
QN	**(b)**	absent or weak	absente ou faible	fehlend oder gering	ausente o débil	INTA DELTA II, Mahan	1
		medium	modérée	mittel	media	Desirable, Success	2
		strong	forte	stark	fuerte	Shoshoni	3
17.	**VG**	**Husk: intensity of green color**	**Cosse : intensité de la couleur verte**	**Nußhülle: Intensität der Grünfärbung**	**Vaina: intensidad del color verde**		
QN		light	faible	hell	claro	Shoshoni	1
		medium	moyenne	mittel	medio	Desirable	2
		dark	forte	dunkel	oscuro		3
18. (*) (+)	**VG**	**Husk: prominence of ribs**	**Cosse : proéminence des côtes**	**Nußhülle: Hervortreten der Rippen**	**Vaina: prominencia del acostillado**		
QN		absent or very weak	nulle ou très faible	fehlend oder sehr gering	ausente o muy débil		1
		weak	faible	gering	débil	Shoshoni	3
		medium	moyenne	mittel	medio		5
		strong	forte	stark	fuerte		7
19. (*) (+)	**VG/ MS**	**Nut: length**	**Noix : longueur**	**Nuß: Länge**	**Nuez: longitud**		
QN	**(c)**	short	courte	kurz	corta	Desirable, Success	3
		medium	moyenne	mittel	media	Harris Super, Stuart	5
		long	longue	lang	larga	Mahan	7
20. (*) (+)	**VG/ MS**	**Nut: width in lateral view**	**Noix : largeur en vue latérale**	**Nuß: Breite in Seitenansicht**	**Nuez: anchura en vista lateral**		
QN	**(c)**	narrow	étroite	schmal	estrecha	Desirable, Kernodle, Mahan	3
		medium	moyenne	mittel	media	Stuart	5
		broad	large	breit	ancha	Shoshoni	7
21. (*) (+)	**VG/ MS**	**Nut: width in lateral view facing the suture**	**Noix : largeur en vue latérale en face de la suture**	**Nuß: Breite in Naht zugewandter Seitenansicht**	**Nuez: anchura en vista lateral con la sutura de frente**		
QN	**(c)**	narrow	étroite	schmal	estrecha	Mahan	3
		medium	moyenne	mittel	media	Stuart	5
		broad	large	breit	ancha	Shoshoni	7

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
22. (*) (+)	**VG**	**Nut: shape in lateral view**	**Noix : forme en vue latérale**	**Nuß: Form in Seitenansicht**	**Nuez: forma en vista lateral**		
PQ	**(c)**	ovate	ovale	eiförmig	oval	Amling, Cheyenne, Elliot	1
		circular	circulaire	kreisförmig	circular		2
		elliptic	elliptique	elliptisch	elíptica	Candy, Chickasaw	3
		oblong	oblongue	rechteckig	oblonga	Curtis, Harris Super, Mahan	4
		obovate	obovale	verkehrt eiförmig	oboval	Western Schley	5
23. (*) (+)	**VG**	**Nut: shape in lateral view facing the suture**	**Noix : forme en vue latérale en face de la suture**	**Nuß: Form in Naht zugewandter Seitenansicht**	**Nuez: forma en vista lateral con la sutura de frente**		
PQ	**(c)**	ovate	ovale	eiförmig	oval	Curtis	1
		circular	circulaire	kreisförmig	circular	Major	2
		elliptic	elliptique	elliptisch	elíptica	Kanza	3
		oblong	oblong	rechteckig	oblonga	Harris Super, Mahan, Maramec	4
		obovate	obovale	verkehrt eiförmig	oboval	Chetopa	5
24. (+)	**VG**	**Nut: shape in ventral view facing the attachment**	**Noix : forme en vue ventrale en face de l'attache**	**Nuß: Form in Ansatzstelle zugewandter Bauchansicht**	**Nuez: forma en vista ventral con el punto de inserción de frente**		
PQ		broad oblate	aplatie large	breit breitrund	achatada ancha		1
		medium oblate	aplatie moyenne	mittel breitrund	achatada media	Kernodle	2
		circular	circulaire	kreisförmig	circular	Desirable, Shoshoni	3
25. (*) (+)	**VG**	**Nut: shape of apex in lateral view (excluding tip)**	**Noix : forme du sommet en vue latérale (pointe exclue)**	**Nuß: Form des Scheitels in Seitenansicht (ohne Spitze)**	**Nuez: forma del ápice en vista lateral (excluida la punta)**		
PQ		acute	aigu	spitz	aguda	Desirable, Stuart	1
		obtuse	obtus	stumpf	obtusa	Success	2
		rounded	arrondi	abgerundet	redondeada	Major	3
26. (*) (+)	**VG/ MS**	**Nut: length of tip**	**Noix : longueur de la pointe**	**Nuß: Länge der Spitze**	**Nuez: longitud de la punta**		
QN		absent or short	absente ou courte	fehlend oder kurz	ausente o corta	Major	1
		medium	moyenne	mittel	media	Chetopa	2
		long	longue	lang	larga	Curtis, Mahan, Sioux	3
27. (+)	**VG**	**Nut: ground color**	**Noix : couleur de fond**	**Nuß: Grundfarbe**	**Nuez: color de fondo**		
PQ		grey brown	brun-gris	graubraun	marrón grisáceo	Barton	1
		light brown	brun clair	hellbraun	marrón claro	Desirable, Mahan, Success	2
		medium brown	brun moyen	mittelbraun	marrón medio	Harris Super, Stuart	3
		dark brown	brun foncé	dunkelbraun	marrón oscuro	Kernodle, Shoshoni	4

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
28.	VG	**Nut: area covered by spots**	**Noix : surface couverte de tâches**	**Nuß: mit Flecken bedeckte Fläche**	**Nuez: superficie que ocupan las manchas**		
QN		small	petite	klein	pequeña	Desirable, Harris Super, Kernodle	3
		medium	moyenne	mittel	media	Mahan	5
		large	grande	groß	grande	Stuart	7
29. (*)	VG/ MS	**Nut: thickness of shell**	**Noix : épaisseur de la coque**	**Nuß: Dicke der Schale**	**Nuez: grosor de la cáscara**		
QN		thin	mince	dünn	delgada	Candy, Curtis, Hastings	1
		medium	moyenne	mittel	media	Desirable, Stuart	2
		thick	épaisse	dick	gruesa	Elliot, Moneymaker	3
30. (+)	VG	**Kernel: size in relation to size of nut**	**Cerneau : taille par rapport à la taille de la noix**	**Kern: Größe im Verhältnis zur Größe der Nuß**	**Semilla: tamaño en relación con el tamaño de la nuez**		
QN	(c)	small	petit	klein	pequeña	Jackson, Shoshoni	1
		medium	moyen	mittel	media	Melrose, Kiowa	2
		large	grand	groß	grande	Hastings, Stuart	3
31. (*) (+)	MS	**Kernel: weight**	**Cerneau : poids**	**Kern: Gewicht**	**Semilla: peso**		
QN		light	bas	leicht	liviano	Mahan	3
		medium	moyen	mittel	medio	Pawnee	5
		heavy	élévé	schwer	pesado	Wichita	7
32.	VG	**Kernel: intensity of brown color**	**Cerneau : intensité de la couleur brune**	**Kern: Intensität der Braunfärbung**	**Semilla: intensidad del color marrón**		
QN		light	faible	hell	claro	Desirable	1
		medium	moyenne	mittel	medio	Pawnee	2
		dark	forte	dunkel	oscuro	Stuart	3
33. (+)	VG	**Tree: persistence of husk after nut fall**	**Arbre : persistance de la cosse après la chute de la noix**	**Baum: Anhaften der Nußhülle nach dem Abfallen der Nuß**	**Árbol: persistencia de la vaina tras la caída de la nuez**		
QN		not persistent	nulle	nicht anhaftend	no persistente	Success	1
		partially persistent	partielle	teilweise anhaftend	parcialmente persistente		2
		fully persistent	totale	vollständig anhaftend	completamente persistente	Desirable, Stuart	3
34. (+)	MG	**Time of leaf bud burst**	**Époque du débourrement foliaire**	**Zeitpunkt des Aufbruchs der Blattknospen**	**Época de brotación de las yemas foliares**		
QN		early	précoce	früh	temprana	Woodroof	3
		medium	moyenne	mittel	media	Curtis, Kernodle	5
		late	tardive	spät	tardía	Stuart, Success	7

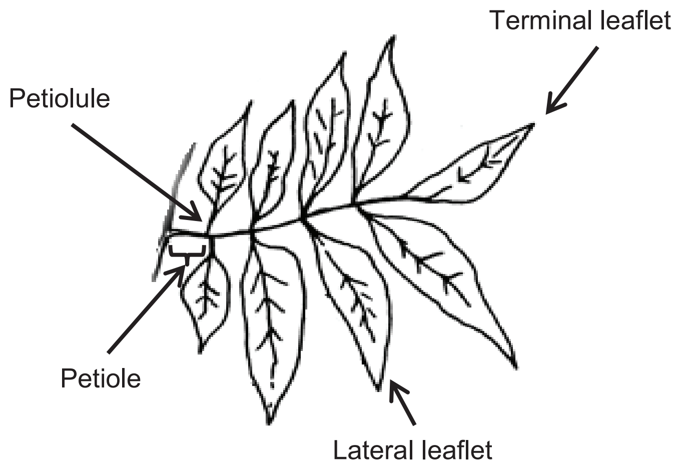
		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
35. (+)	**MG**	**Time of leaf fall**	**Époque de la chute des feuilles**	**Zeitpunkt des Laubfalls**	**Época de caída de las hojas**		
QN		early	précoce	früh	temprana	Dooley, Stuart	3
		medium	moyenne	mittel	media	Colby	5
		late	tardive	spät	tardía	Comanche, Woodroof	7
36. (+)	**MG**	**Time of husk opening**	**Époque de l'ouverture de la cosse**	**Zeitpunkt der Öffnung der Nußhülle**	**Época de dehiscencia de las vainas**		
QN		early	précoce	früh	temprana	Norton,	3
		medium	moyenne	mittel	media	Elliot, Sioux	5
		late	tardive	spät	tardía	Kernodle	7

8. Explanations on the Table of Characteristics

8.1 Explanations covering several characteristics

Characteristics containing the following key in the second column of the Table of Characteristics should be examined as indicated below:

(a) Leaf/Leaflet: observations should be made on fully developed leaves on the middle section of a one year old shoot at the end of leaflet expansion.



(b) Flower: observations should be made at full receptivity of stigma when stigma is turgid and sticky. Observations should be made on the terminal section of a one-year-old shoot.

(c) Husk/Nut: observations should be made on fully developed nuts from the terminal section of a one-year-old shoot at husk opening stage.

8.2 Explanations for individual characteristics

Ad. 1: Tree: vigor

The vigor of the plant should be considered as the overall abundance of vegetative growth.

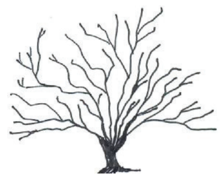
Ad. 2: Tree: density of branches

The density of branches of the plant should be considered as the overall abundance of branches during the dormant period.

Ad. 3: Tree: growth habit

1
upright

2
semi-upright



3
spreading

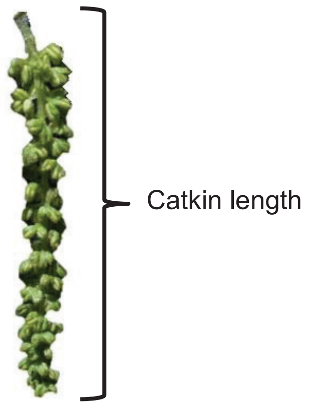
Ad. 8: Terminal leaflet: ratio length/width

3	5	7
low	medium	high

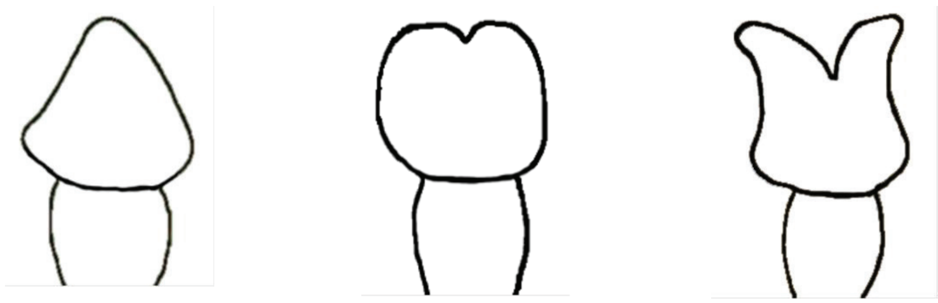
Ad. 12: Lateral leaflet: asymmetry at base

1	2	3
absent or weak	moderate	strong

Ad. 13: Catkin: length



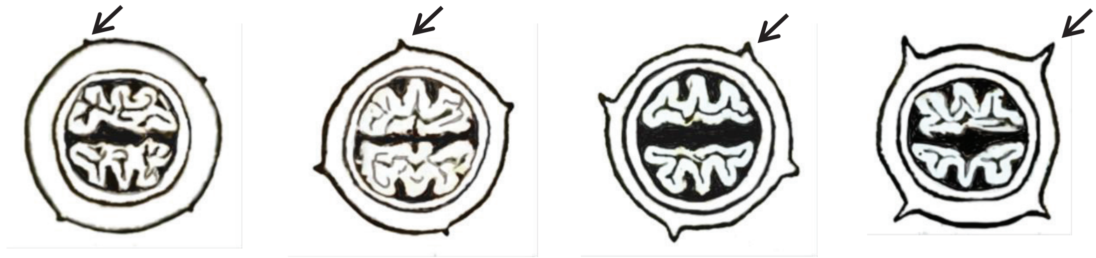
Ad. 15: Stigma: splitting



1	2	3
absent or weak	moderate	strong

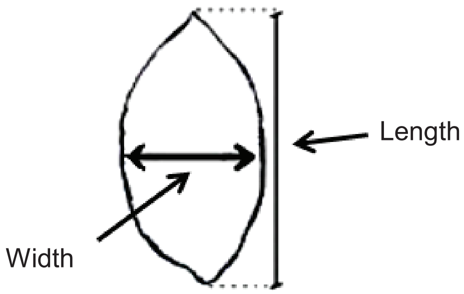
Ad. 18: Husk: prominence of ribs

To be observed before husk opening.

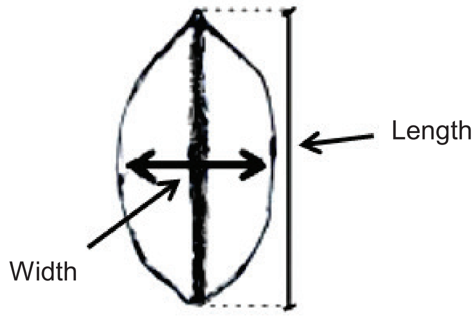


1	3	5	7
absent or very weak	weak	medium	strong

Ad. 19: Nut: length
Ad. 20: Nut: width in lateral view
Ad. 21: Nut: width in lateral view facing the suture

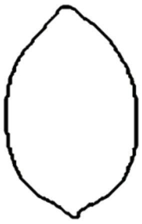
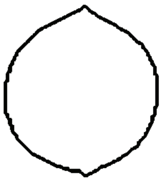


lateral view



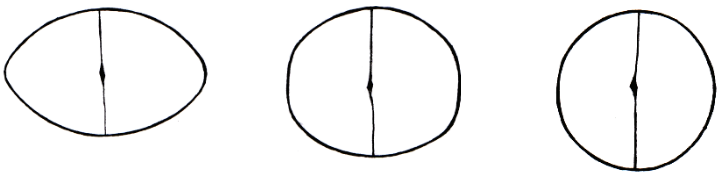
lateral view facing the suture

Ad. 22: Nut: shape in lateral view
Ad. 23: Nut: shape in lateral view facing the suture

	← broadest part →		
	below middle	at middle	above middle
narrow (high) ↑		 4 oblong	
width (ratio length/width)	 1 ovate	 3 elliptic	 5 obovate
↓ broad (low)		 2 circular	

Ad. 24: Nut: shape in ventral view facing the attachment

To be observed with suture in vertical position



1	2	3
broad oblate	medium oblate	circular

Ad. 25: Nut: shape of apex in lateral view (excluding tip)

1 acute	2 obtuse	3 rounded

Ad. 26: Nut: length of tip

1 absent or short	2 medium	3 long

Ad. 27: Nut: ground color

The color is observed on the surface of the nut, disregarding the spots.

Ad. 30: Kernel: size in relation to size of nut

1 small	2 medium	3 large

Ad. 31: Kernel: weight

The weight of the kernel should be assessed as the average weight of 10 kernels when ready for consumption.

Ad. 33: Tree: persistence of husk after nut fall

The persistence of the husk is its retention on the shoot after the fall of the nuts. The observation is made during late winter.

Ad. 34: Time of leaf bud burst

The time of leaf burst is when 75% of the buds are open.

Ad. 35: Time of leaf fall

The time of leaf fall is when 75% of the leaves have fallen.

Ad. 36: Time of husk opening

The time of husk opening is when 75% of the husks are split.

9. Literature

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Madero, E., Frusso E., Cajaravilla, P., 1997: La nuez pecan. Estación Experimental Agropecuaria INTA Delta del Paraná (INTA), Buenos Aires, AR, pp. 16.

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Wood, B. W., Smith, M.W., Worley, R.E., Anderson, P.C., Thompson, T.T., Grauke, L.J. 1997: Reproductive and vegetative characteristics of pecan cultivars. HortScience 32: 1028-1033 pp.

Worley, R. E., Mullinixy, B. G. 1997: Pecan cultivar performance at the coastal plain experiment station 1921-1994. The University of Georgia, Tifton, Georgia, US, pp. 34

10. Technical Questionnaire

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Application date: (not to be filled in by the applicant)

TECHNICAL QUESTIONNAIRE
to be completed in connection with an application for plant breeders' rights

1. Subject of the Technical Questionnaire

1.1 Botanical name	*Carya illinoinensis* (Wangenh.) K. Koch
1.2 Common name	Pecan Nut

2. Applicant

Name	
Address	
Telephone No.	
Fax No.	
E-mail address	
Breeder (if different from applicant)	

3. Proposed denomination and breeder's reference

Proposed denomination (if available)	
Breeder's reference	

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

#4. Information on the breeding scheme and propagation of the variety

4.1 Breeding scheme

Variety resulting from:

4.1.1 Crossing

(a) controlled cross [ ]
(please state parent varieties)

(……………………………………………) x (……………………………………………)
female parent male parent

(b) partially known cross [ ]
(please state known parent variety(ies))

(……………………………………………) x (……………………………………………)
female parent male parent

(c) unknown cross [ ]

4.1.2 Mutation [ ]
(please state parent variety)

4.1.3 Discovery and development [ ]
(please state where and when discovered and how developed)

4.1.4 Other [ ]
(please provide details)

Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire.

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

4.2 Method of propagating the variety

4.2.1 Seed-propagated varieties

(a)	Self-pollination	[ ]
(b)	Cross-pollination	
	(i) population	[ ]
	(ii) synthetic variety	[ ]
(c)	Hybrid	[ ]
(d)	Other (please provide details)	[ ]

4.2.2 Vegetative propagation

(a)	cuttings	[ ]
(b)	*in vitro* propagation	[ ]
(c)	grafting	[ ]
(d)	other (state method)	[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

5. Characteristics of the variety to be indicated (the number in brackets refers to the corresponding characteristic in Test Guidelines; please mark the note which best corresponds).

	Characteristics	Example Varieties	Note
5.1 (1)	**Tree: vigor**		
	very weak		1[ ]
	very weak to weak		2[ ]
	weak	Barton, Success	3[ ]
	weak to medium		4[ ]
	medium	Cheyenne	5[ ]
	medium to strong		6[ ]
	strong	Desirable, Western	7[ ]
	strong to very strong		8[ ]
	very strong		9[ ]
5.2 (3)	**Tree: growth habit**		
	upright	Success	1[ ]
	semi-upright	Desirable, Mohawk	2[ ]
	spreading	Shoshoni, Western	3[ ]
5.3 (11)	**Lateral leaflet: petiolule**		
	absent	Desirable	1[ ]
	present	Stuart, Success	9[ ]
5.4 (19)	**Nut: length**		
	very short		1[ ]
	very short to short		2[ ]
	short	Desirable, Success	3[ ]
	short to medium		4[ ]
	medium	Harris Super, Stuart	5[ ]
	medium to long		6[ ]
	long	Mahan	7[ ]
	long to very long		8[ ]
	very long		9[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Characteristics	Example Varieties	Note
5.5 (20)	**Nut: width in lateral view**		
	very narrow		1[ ]
	very narrow to narrow		2[ ]
	narrow	Desirable, Kernodle, Mahan	3[ ]
	narrow to medium		4[ ]
	medium	Stuart	5[ ]
	medium to broad		6[ ]
	broad	Shoshoni	7[ ]
	broad to very broad		8[ ]
	very broad		9[ ]
5.6 (21)	**Nut: width in lateral view facing the suture**		
	very narrow		1[ ]
	very narrow to narrow		2[ ]
	narrow	Mahan	3[ ]
	narrow to medium		4[ ]
	medium	Stuart	5[ ]
	medium to broad		6[ ]
	broad	Shoshoni	7[ ]
	broad to very broad		8[ ]
	very broad		9[ ]
5.7 (22)	**Nut: shape in lateral view**		
	ovate	Amling, Cheyenne, Elliot	1[ ]
	circular		2[ ]
	elliptic	Candy, Chickasaw	3[ ]
	oblong	Curtis, Harris Super, Mahan	4[ ]
	obovate	Western Schley	5[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

6. Similar varieties and differences from these varieties

Please use the following table and box for comments to provide information on how your candidate variety differs from the variety (or varieties) which, to the best of your knowledge, is (or are) most similar. This information may help the examination authority to conduct its examination of distinctness in a more efficient way.

Denomination(s) of variety(ies) similar to your candidate variety	Characteristic(s) in which your candidate variety differs from the similar variety(ies)	Describe the expression of the characteristic(s) for the **similar** variety(ies)	Describe the expression of the characteristic(s) for **your** candidate variety
Example	*Kernel: intensity of brown color*	*light*	*dark*

Comments:

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

#7. Additional information which may help in the examination of the variety

7.1 In addition to the information provided in sections 5 and 6, are there any additional characteristics which may help to distinguish the variety?

Yes [ ] No [ ]

(If yes, please provide details)

7.2 Are there any special conditions for growing the variety or conducting the examination?

Yes [ ] No [ ]

(If yes, please provide details)

7.3 Other information

7.4 A representative color photograph of the variety displaying its main distinguishing feature(s), should accompany the Technical Questionnaire. The photograph will provide a visual illustration of the candidate variety which supplements the information provided in the Technical Questionnaire.

The key points to consider when taking a photograph of the candidate variety are:

- Indication of the date and geographic location
- Correct labeling (breeder's reference)
- Good quality printed photograph (minimum 10 cm x 15 cm) and/or sufficient resolution electronic format version (minimum 960 x 1280 pixels)

Further guidance on providing photographs with the Technical Questionnaire is available in document TGP/7 "Development of Test Guidelines", Guidance Note 35 (http://www.upov.int/tgp/en/).

[The link provided may be deleted by members of the Union when developing authorities' own test guidelines.]

8. Authorization for release

(a) Does the variety require prior authorization for release under legislation concerning the protection of the environment, human and animal health?

Yes [ ] No [ ]

(b) Has such authorization been obtained?

Yes [ ] No [ ]

If the answer to (b) is yes, please attach a copy of the authorization.

Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire.

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

9. Information on plant material to be examined or submitted for examination

9.1 The expression of a characteristic or several characteristics of a variety may be affected by factors, such as pests and disease, chemical treatment (e.g. growth retardants or pesticides), effects of tissue culture, different rootstocks, scions taken from different growth phases of a tree, etc.

9.2 The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If the plant material has undergone such treatment, full details of the treatment must be given. In this respect, please indicate below, to the best of your knowledge, if the plant material to be examined has been subjected to:

(a)	Microorganisms (e.g. virus, bacteria, phytoplasma)	Yes [ ]	No [ ]
(b)	Chemical treatment (e.g. growth retardant, pesticide)	Yes [ ]	No [ ]
(c)	Tissue culture	Yes [ ]	No [ ]
(d)	Other factors	Yes [ ]	No [ ]

Please provide details for where you have indicated “yes”.

………

10. I hereby declare that, to the best of my knowledge, the information provided in this form is correct:

Applicant’s name

Signature Date

[End of document]

ALMOND DESCRIPTORS

(Revised)

AGPG: IBPGR / 85 / 36
October 1985
Replacing:
AGP: IBGR / 80 / 88
August 1981

International Board for Plant Genetic Resources

Descriptors list for Almond (*Prunus amygdalus*) (Revised)

Editor:

R. Gülcan

IBPGR Secretariat
Rome

The International Board for Plant Genetic Resources (IBPGR) is an autonomous international scientific organization under the aegis of the Consultative Group on International Agricultural Research (CGIAR). The IBPGR was established by the CGIAR in 1974 and its Executive Secretariat is provided by the Food and Agriculture Organization of the United Nations. The basic function of the IBPGR is to promote and coordinate an international network of genetic resources centres to further the collection, conservation, documentation, evaluation and use of plant germplasm and thereby contribute to raising the standard of living and welfare of people throughout the world. The Consultative Group mobilizes financial support from its members to meet the budgetary requirements of the Board.

IBPGR Executive Secretariat
Crop Genetic Resources Centre
Plant Production and Protection Division
Food and Agriculture Organization of the United Nations
Via delle Terme di Caracalla, 00100 Rome, Italy

Contents

PREFACE

A draft list of descriptors for almond (*Prunus amygdalus*) had been prepared by Professor M. Dokuzoguz and Professor R. Gülcan and submitted to a GREMPA (Groupe de Recherches et d'Etudes Mediterraneen Pour 1'Amandier)
Symposium at Izmir, Turkey, 16-22 June 1980. A preliminary list of descriptors was formulated from this at the Symposium and was subsequently published by the IBPGR in August 1981.

The *Prunus* Working Group from the European Cooperative Programme for Conservation and Exchange of Crop Genetic Resources, Phase II, recognized the need to update the almond descriptors. Consequently Professor Gülcan prepared a new version.

The IBPGR encourages the collection of data on the first four categories of this list; 1. Accession; 2. Collection; 3. and 4. Characterization and Preliminary evaluation. The IBPGR endorses the information in categories 1 - 4 as the minimum that ideally should be available for any one accession. Other descriptors are given in categories 5 onwards that will enable the simple encoding of further characterization and evaluation data and which can serve as examples for the creation of additional descriptors in the IBPGR form by any user.

The suggested coding should not be regarded as the definitive scheme, although this format has the full backing of the IBPGR and is promoted worldwide. The descriptor list given here provides an international format and thereby produces a universally understood 'language' for all plant genetic resources data. The adoption of this scheme for all data encoding, or at least the production of a transformation method to convert other schemes to the IBPGR format, will produce a rapid, reliable and efficient means for information storage, retrieval and communication. This will greatly assist the utilization of germplasm throughout the international plant genetic resources network. It is recommended, therefore, that information should be produced by closely following this descriptor list with regard to: ordering and numbering descriptors; using the descriptors specified; and using the descriptor states recommended.

Errors and omissions are the responsibility of the editor. Any suggestions for modifications will be welcomed by the IBPGR Secretariat, Rome, and by the editor, especially before encoding new descriptors.

DESCRIPTOR LIST FOR ALMOND

The IBPGR now uses the following definitions in genetic resources documentation:

i) **passport** (accession identifiers and information recorded by collectors);

ii) **characterization** (consists of recording those characters which are highly heritable, can be easily seen by the eye and are expressed in all environments);

iii) **preliminary evaluation** (consists of recording a limited number of additional traits thought desirable by a consensus of users of the particular crop).

Characterization and preliminary evaluation will normally be the responsibility of the curators, while further characterization and evaluation should be carried out by the plant breeder. The data from further evaluation should be fed back to the crop coordinator who will maintain a data file.

The following internationally accepted standards for the scoring or coding of descriptor states should be followed as indicated below:

a) measurements are made in metric units;

b) many descriptors which are continuously variable are recorded on a 1-9 scale. The authors of this list have sometimes described only a selection of the states, e.g. 3, 5 and 7 for such descriptors. Where this has occurred the full range of codes is available for use by extension of the codes given or by interpolation between them - e.g. in 8. (Pest and disease susceptibility) 1 = extremely low susceptibility and 8 - high to extremely high susceptibility;

c) presence/absence of characters are scored as 1 (present) and 0 (absent);

d) for descriptors which are not generally uniform throughout the accession (e.g. mixed collection, genetic segregation) mean and standard deviation could be reported where the descriptor is continuous or mean and 'x' where the descriptor is discontinuous (frequencies can be recorded in NOTES descriptor, 11);

e) when the descriptor is inapplicable, '0' is used as the descriptor value. For example, if an accession does not form flowers, a '0' would be scored for the following descriptor

Flower colour

1 White
2 Yellow
3 Red
4 Purple

f) blanks are used, for information not yet available;

g) standard colour charts e.g. Royal Horticultural Society Colour Chart, Methuen Handbook of Colour, Munsell Color Charts for Plant Tissues are strongly recommended for all ungraded colour characters. The precise chart used should be specified in the NOTES descriptor, 11.

For the observations on the fruit, 20 typical fruits should be selected out of a minimum of 40 from two trees. All observations on the fruits should be made on fruits ripened on the tree.

PASSPORT

1 ACCESSION DATA

INTRODUCTORY

1.1 ACCESSION NUMBER

This number serves as a unique identifier for an accession at a given site and is assigned by the curator of a particular genebank site when an accession is entered into the site genebank. It must not be re-used even if the accession is lost. Letters should occur before the number to identify the genebank or national system (e.g. PI indicates an accession within the USA system, and EC indicates an accession within the CEC Fruit Genetic Resources Scheme). A site may choose to use a Genetic Resource Scheme (GRS) ACCESSION NUMBER (see 1.4) as the only unique identifier

1.2 DONOR NAME (= Source of acquisition)

The name and address of the person or institute responsible for donating the germplasm to the genebank collection at the site (see 1.14) at which the plants are held

1.3 DONOR IDENTIFICATION NUMBER

The number (or name) assigned by the person or institute above (1.2) donating the accession to the site specified at 1.14

1.4 OTHER NUMBERS ASSOCIATED WITH THE ACCESSION
(see also 1.18 and 2.1)

Other identification number known to exist in other collections for this accession, e.g. CEC Genetic Resources Scheme (EC) number or United States Plant Inventory (PI) number. EC and PI numbers serve as unique identifiers for an accession in a particular GRS, and must not be re-used; they are assigned by the EC or PI coordinator, and not by the site curator

1.4.1 EC number

(CEC GRS accession number)

1.4.2 PI number

(United States Plant Inventory accession number)

1.4.3 Etc.

1.5 SCIENTIFIC NAME
(Use *Prunus amygdalus* for the cultivated almond)

1.5.1 Genus (e.g. *Prunus*)

1.5..2 Species (e.g. *amygdalus*)

1.5.3 Subspecies (if applicable)

1.5.4 Botanical variety (if applicable)

For complex hybrids refer to 1.12

1.6 PEDIGREE OF ACCESSIONS

1.6.1 Female parent (of the accession)

1.6.2 Male parent (of the accession)

1.6.3 Mother of female parent

1.6.4 Father of female parent

1.6.5 Mother of male parent

1.6.6 Father of male parent

1.6.7 Nomenclature and designations

Identities and additional pedigree assigned to breeder's material

1.7 ACQUISITION DATE
The month and year in which the accession entered the collection, expressed numerically, e.g. June = 06, 1981 = 1981

1.7.1 Month

1.7.2 Year

1.8 DATE OF LAST REGENERATION OR MULTIPLICATION
The month and year expressed numerically, e.g. October = 10, 1978 = 1978

1.8.1 Month

1.8.2 Year

1.9 ACCESSION SIZE
Approximate number of seeds or plants of accession in collection

1.10 NUMBER OF TIMES ACCESSION REGENERATED

Number of regenerations or multiplications since original collection

1.11 TYPE OF MAINTENANCE

1 Vegetative
2 Seed
3 Pollen
4 Tissue culture
5 More than one type (specify in NOTES descriptor, 11)

1.12 GENETIC ORIGIN

1 Self pollination
2 Intraspecific hybrid
3 Interspecific hybrid
4 Clonal selection
5 Bud spontaneous mutation
6 Bud induced mutation
7 Open pollination
8 Etc.

Specify further information on complex hybrids in the NOTES descriptor, 11

SITE SPECIFIC

1.13 COUNTRY WHERE MAINTAINED

Code letters for country in which plants are grown. Use the three letter abbreviations supported by the Statistical Office of the United Nations. Copies of the abbreviations are available from the IBPGR Secretariat and have been published in the FAO/IBPGR Plant Genetic Resources Newsletter No. 49

e.g. GRC Greece
USA United States of America

1.14 SITE WHERE MAINTAINED

Institute at which plants are grown. (If codes are used they must be unique for a particular country and, to avoid duplication, should be communicated to IBPGR)

e.g. ANGS Station de Recherches d'Arboriculture Fruitière, Angers

EMRS East Mailing Research Station, Kent

FRNZ Istituto di Coltivazioni Arboree, Firenze

1.15 CURATOR

The officer responsible for maintaining the genetic resources material held at the site specified above

1.16 LOCAL NAME

The name by which the cultivar or species is listed at the above site. This may be either some combination of the Genetic Identifiers (1.21 and 1.22) or a synonym

1.17 LOCAL CLONE/MUTANT/VARIANT NAME

The clone or mutant name of the cultivar or species (if any) by which it is identified at the above site. This may be either the internationally accepted name (1.22) or a synonym

1.18 LOCAL PLANT NUMBER

This identifies a single plant within a population of plants having the same site accession ¯number. It may be any combination of plot identity, row number, and tree position within the row

1.19 DISTRIBUTION LIMITED

1 Unlimited
2 Limited - specify restrictions in the NOTES descriptor, 11

1.20 YEAR OF PROBABLE DISCARD

Enter year that tree(s) will probably be discarded, e.g. 1988. Regeneration of genebank accessions should take place at least two years before the year of probable discard

1.21 YEAR TREE PLANTED (e.g. 1972)

FURTHER IDENTIFIERS

1.22 GENETIC NAME

The name of the cultivar or species as internationally accepted or defined by the Genetic Resources Scheme coordinator, e.g. Texas

1.23 GRS CLONE/MUTANT/VARIANT NAME

The internationally accepted name (if any) of the clone or mutant of the cultivar or species, e.g. Tardy Nonpareil

1.24 PATENT NUMBER
(or Plants Variety Rights Number)

Patented cultivars	record the patent number or, if the patent number is not known write '1'
Non-patented cultivars	record as '0'

1.2.5 SYNONYMS
Other useful names (excluding those occurring above) in alphabetical order

2 COLLECTION DATA

2.1 COLLECTOR'S NUMBER
Original number assigned by collector of the sample, normally composed of the name or initials of the collector(s) followed by a number. This item is essential for identifying duplicates held in different collections and should always accompany sub-samples wherever they are sent

2.2 COLLECTING INSTITUTE
Institute or person collecting/sponsoring the original sample

2.3 DATE OF COLLECTION OF ORIGINAL SAMPLE
Expressed numerically, e.g. March = 03, 1980 = 1980

2.3.1 Month

2.3.2 Year

2.4 COUNTRY OF COLLECTION OR COUNTRY WHERE CULTIVAR/VARIETY BRED (=Origin)
Use the three letter abbreviations supported by the Statistical Office of the United Nations (see 1.13)

2.5 PROVINCE/STATE
Name of the administrative subdivision of the country in which the sample was collected

2.6 LOCATION OF COLLECTION SITE

2.6.1 Collected in the wild

Number of kilometers and direction from nearest town, village or map grid reference (e.g. IZMIR7S means 7 km south of Izmir)

2.6.2 Postal address

For material originating at a clearly identifiable postal address

2.7 LATITUDE OF COLLECTION SITE

Degrees and minutes followed by N (North) or S (South), e.g. 1030S

2.8 LONGITUDE OF COLLECTION SITE

Degrees and minutes followed by E (East) or W (West), e.g. 7625W

2.9 ALTITUDE OF COLLECTION SITE

Elevation above sea level in meters

2.10 COLLECTION SOURCE

1 Wild
2 Farm land
3 Farm store
4 Backyard
5 Village market
6 Commercial market
7 Institute
8 Other (specify in the NOTES descriptor, 11)

2.11 STATUS OF SAMPLE

1 Wild
2 Weedy
3 Breeders' line
4 Primitive cultivar (landrace)
5 Advanced cultivar (bred)
6 Other (specify in the NOTES descriptor, 11)

2.12 LOCAL/VERNACULAR NAME

Name given by farmer to cultivar/landrace/weed

2.13 NUMBER OF PLANTS SAMPLED

Approximate number of plants collected (sampled) in the field to produce this accession

2.14 PHOTOGRAPH

Was a photograph taken of the accession or environment at collection?

0 No;

1 Yes

2.15 HERBARIUM SPECIMEN

0 No;

1 Yes

2.16 TYPE OF SAMPLE

1 Vegetative
2 Seed
3 Both

2.17 NATURE OF VEGETATIVE SAMPLE

1 Cuttings - for grafting
2 Cuttings - for rooting
3 Rooted plants
4 Tissue culture
5 Other (specify in the NOTES descriptor, 11)

2.18 VIRUS DISEASE STATUS (including mycoplasma)

1 Virus disease free; specify viruses known to be absent in the NOTES descriptor, 11 and year of last virus test
2 Virus disease present; specify viruses present in the NOTES descriptor, 11 and year of last virus test
3 Not tested
4 Virus free by treatment

2.19 END USE, GENERAL

1 Fruit use
2 Plant use
3 Both

2.20 FRUIT USE

1 Scion cultivar - dessert
2 Scion cultivar - processing including distilling
3 Dual or multipurpose consumption
4 Other (specify in the NOTES descriptor, 11)

2.21 PLANT USE

1 Clonal rootstock
2 Clonal interstock
3 Seedling rootstock
4 Ornamental/pollinator
5 Dual or multipurpose use
6 Botanical (wild) species
7 Other (specify in the NOTES descriptor, 11)

2.22 OTHER NOTES FROM COLLECTOR

Collectors should record ecological/climatic information. For cultivated crops, cultivation practices should be recorded

CHARACTERIZATION AND PRELIMINARY EVALUATION

3 SITE DATA

3.1 COUNTRY OF CHARACTERIZATION AND PRELIMINARY EVALUATION

See 1.13 for coding procedure

3.2 SITE (RESEARCH INSTITUTE)

See 1.14 for coding procedure

3.3 NAME OF PERSON IN CHARGE OF CHARACTERIZATION

3.4 ROOTSTOCK

Name of rootstock on which accession is grafted (if any)

3.5 CONDITION OF TREE

Choose the one condition that best fits the accession

1 Dying
2 Old - declining
3 Mature - diseased
4 Mature - non-vigorous
5 Mature - vigorous
6 Young - not yet bearing
7 Healthy - cropping poorly
8 Healthy - cropping well

3.6 CROPPING

A preliminary assessment of 'cropping efficiency' (descriptor 6.2.9)

3 Cropping poorly
5 Intermediate
7 Cropping well

4 PLANT DATA

4.1 VEGETATIVE

4.1.1 Propagation method

Suitable method(s) employed for multiplication (0 = No, 1 =Yes)

4.1.1.1 Grafting (including budding)

4.1.1.2 Hardwood cuttings

4.1.1.3 Softwood cuttings

4.1.1.4 Stool beds

4.1.1.5 Layering

4.1.1.6 Micropropagation

4.1.1.7 Seed

4.1.1.8 Etc.

4.1.2 Chromosome number

4.2 Inflorescence and flowering

4.2.1 **Season of flowering**

Date of full flower

		Reference
1	Extremely early	Cavaliera
2	Very Early	Desmaye Largueta
3	Early	Nec Plus Ultra
4	Early / intermediate	
5	Intermediate	Nonpareil
6	Intermediate / late	Drake
7	Late	Texas
8	Very late	Ferragnes
9	Extremely late	Tardy nonpareil

4.2.2 Harvest maturity

Season maturity for picking. When available, average maturity in terms of days post-blossom can be recorded in the Notes descriptor, 11

		References
1	Extremely early	Cavaliera
3	Early	Nonpareil
5	Medium	Ferragnes
7	Late	Marcona
9	Extremely late	Texas

4.3 Kernel

4.3.1 Kernel size

		Reference
1	Extremely small	Kapareil
3	Small	Texas
5	Intermediate	Nonpareil
7	Large	Ferragnes

9	Extremely large	Bartre

4.3.2 Kernel Shape

Expressed by Kernel width / length ratio in a sample of 100 nuts

1	Extremely narrow	<. 40
2	Narrow	.40 - .48
3	Intermediate	.49 - .55
4	Broad	.56 - .65
5	Extremely broad	> .65

FURTHER CHARACTERIZATION AND EVALUATION

5 SITE DATA

5.1 COUNTRY OF FURTHER CHARACTERIZATION AND EVALUATION

5.2 SITE (RESEARCH INSTITUTE)

5.3 NAME OF PERSON IN CHARGE OF EVALUATION

5.4 ROOTSTOCK

Name of rootstock on which the accession is grafted (if any)

6 PLANT DATA

6.1 VEGETATIVE

SCIONS GRAFTED ON ROOTSTOCKS OR SELF-ROOTED

6.1.1 Tree Habit (of branches)
Natural Habit of an untrained, non-juvenile tree
(See Figure 1)

		Reference
1	Extremely upright	Bartre
3	Upright	Texas, Ferragnes
5	Spreading	Ne Plus Ultra
7	Drooping	Drake
9	Weeping	A'i, Demaye

6.1.2 Tree vigour
Based on height and spread measurements of adult trees on their own roots, or relative to reference cultivars on the same rootstock (use reference cultivars or species on a common rootstock for each site)

		Reference
3	Weak	Marcona
5	Intermediate	Nonpareil
7	Strong	Fleur en bas

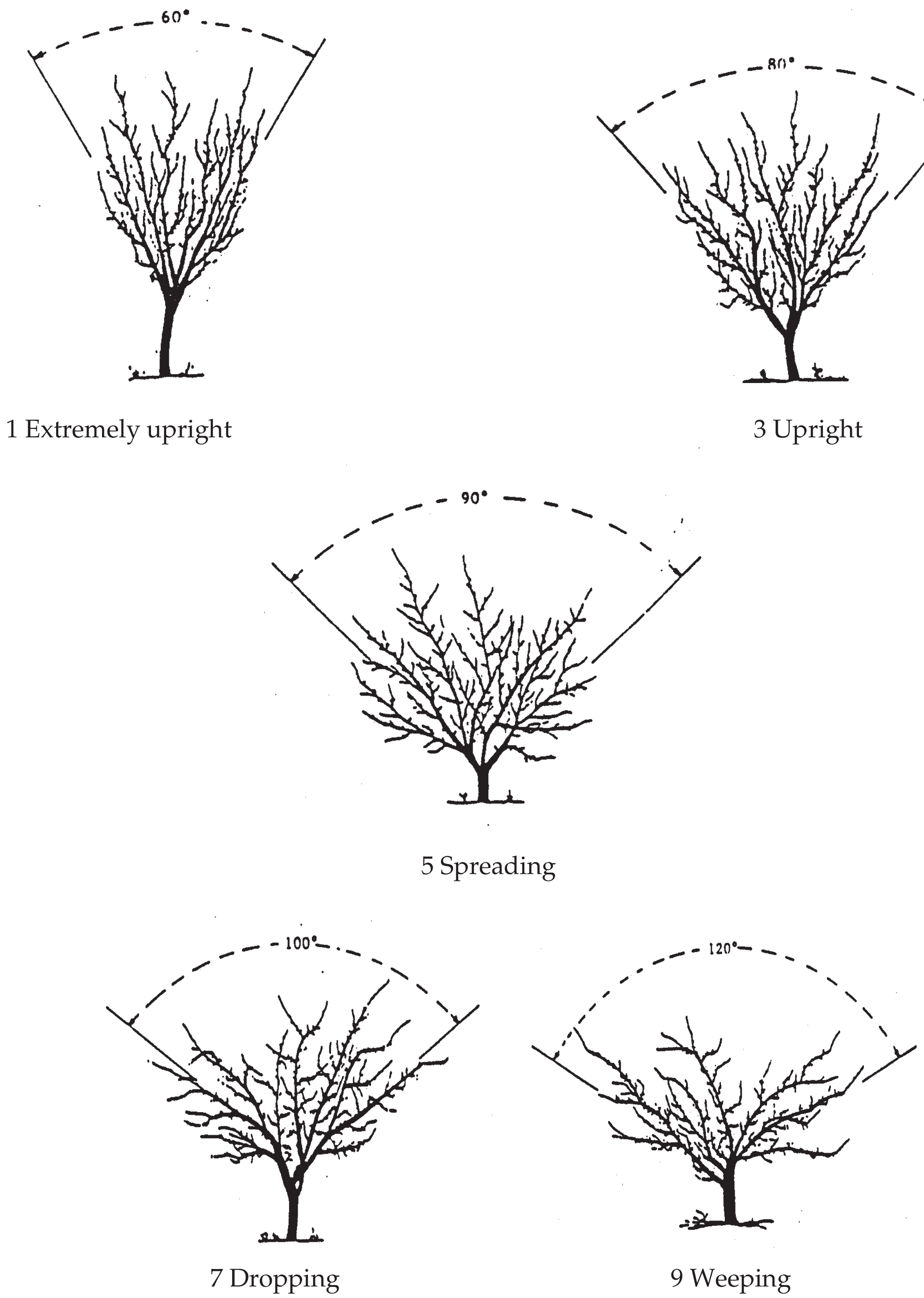


Fig 1 Tree habit

6.1.3 Ramification

		Reference
0	Absent	Bartre
3	Sparse	Texas
5	Intermediate	Desmaye Largueta
7	Dense	Marcona
9	Extremely dense	A'i

6.1.4 Coloration of shoot tip

Anthocyanin coloration on one-year old shoots

		Reference
0	No anthocyanin coloration	
3	Low	Desmaye Largueta
5	Intermediate	Bartre
7	Strong	Texas

6.1.5 Foliage density

		Reference
3	Low	Nonpareil
5	Intermediate	Texas
7	Dense	Jordalono

6.1.6 Scion / rootstock compatibility

The compatibility of scion accession on the rootstock named in 5.4
Based on a 1 – 9 scale where

3	Poor
5	Intermediate
7	Good

6.1.7 Tree chilling requirement

Information concerning the method of recording this character must be included in the Notes descriptor, 11

		Reference
1	Extremely low	
3	Low	Marcona, Ne Plus Ultra
5	Medium	Texas, Primorskyi
7	High	Tuono, Filippoceo
9	Extremely high	Cristomorto, Ferragnes

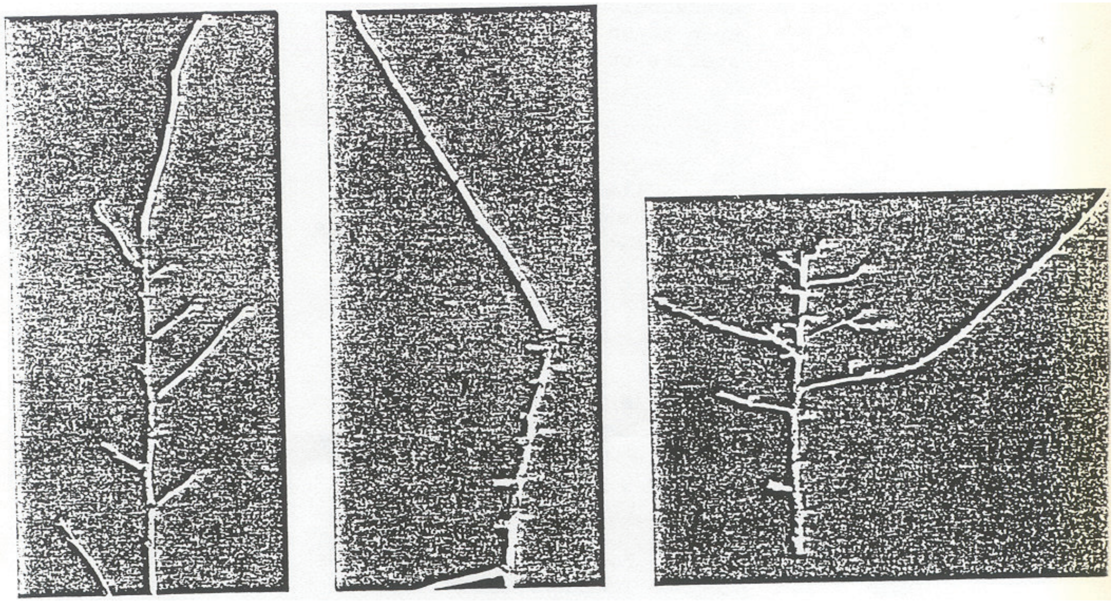
6.1.8 Heat requirements for flower bud bursting

		Reference
1	Extremely low	
3	Low	Tuono, Filippoceo
5	Medium	Desmayo, Ne Plus Ultra
7	High	Nonpareil, Marcona
9	Extremely high	Rachele, Primorskyi

6.2 INFLORESCENCE AND FRUIT

6.2.1 Location of flower buds
(see figure 2)

		Reference
1	Most flower buds on one year old shoots	A'I
2	Most flower	Tuono
3	Mixed	Texas



1 most flower buds on one-year old shoots 2 most flower buds on spurs 3 mixed

Fig. 2 Location of flower buds

6.2.2 Duration of flowering
In days, on average of at least four years

6.2.3 Tendency to biennial bearing

		Reference
3	Weak	Nonpareil
5	Intermediate	Marcona
7	Strong	Rachele

6.2.4 Self compatibility of flowers
0 Incompatible
1 Compatible

6.2.5 Precocity of bearing

A precocious tree is defined as one which starts to crop at an early age relative to other cultivars or species on the same rootstock

		Reference
1	Extremely low	Fleur en bas
3	Low	Bartre
5	Intermediate	Nonpareil
7	High	Marcona

6.2.6 Colour of petas

		Reference
1	White	Bartre
2	Light pink	A'i
3	Pink	Marcona

6.2.7 Double flower in buds

3 few
2 Intermediate
3 Many

6.2.8 Number of pistils

Flower with the following number of pistils

		Reference
1	One	Nonpareil
2	One to two	Desmaye Largueta
3	Two	
4	One to three	

6.2.9 Cropping efficiency (productivity)

The yield per unit area of land relative to other cultivars on the same rootstock, under the same management system at the same site.

		Reference
3	Low	Davey
5	Intermediate	
7	High	Marcona

6.2.10 Ease of harvesting

As indicated by fruit drop

3 Low
5 Intermediate
7 High

6.2.11 Ease of hulling

3 Low
5 Intermediate
7 High

6.2.12 Nut size

		Reference
3	Small	Texas
5	Medium	Nonpareil
7	Large	Ardechoise
9	Extremely large	Bartre

6.2.13 Nut Shape

(See Figure 3)

		Reference
1	Round	Marcona
2	Ovate	Texas
3	Oblong	A'i
4	Cordate	Cristomorto
5	Extremely narrow	

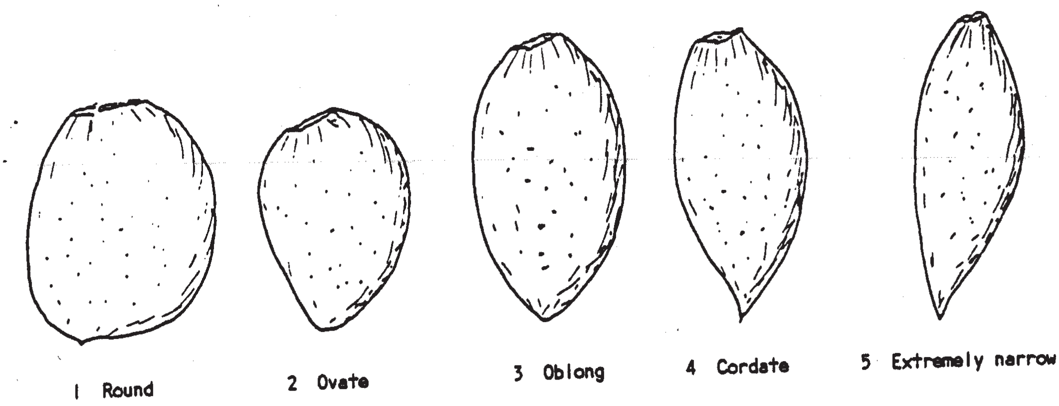


Fig. 3 Nut Shape

6.2.14 Shell colour intensity

		Reference
1	Extremely light	Abiod
3	Light	Peerless
5	Intermediate	
7	Dark	Marcona

6.2.15 Marking of outer shell

(See Figure 4)

0 Without pores
3 Sparsely pored
5 Intermediate
7 Densely pored
9 Scribed

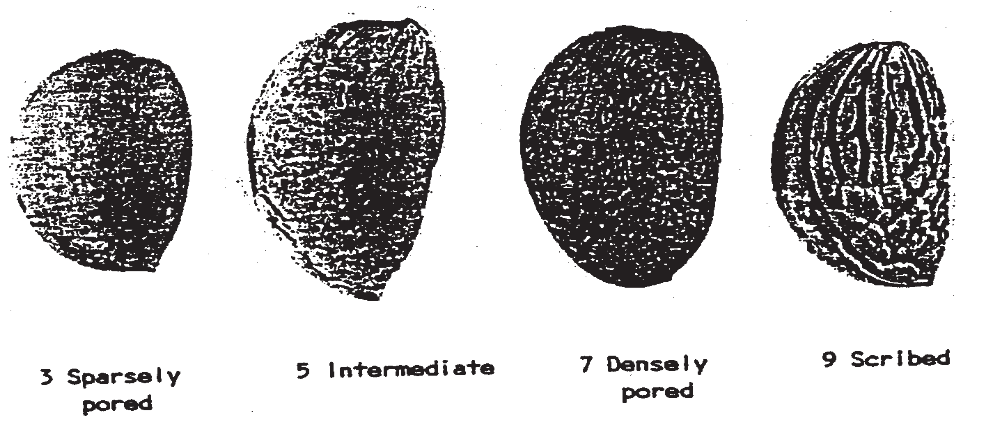


Fig 4 Marking of outer shell

6.2.16 Suture opening of the shell

(See figure 5)

0	Excellent seal (no openings)
5	Open (about 2 mm)
9	Very wide

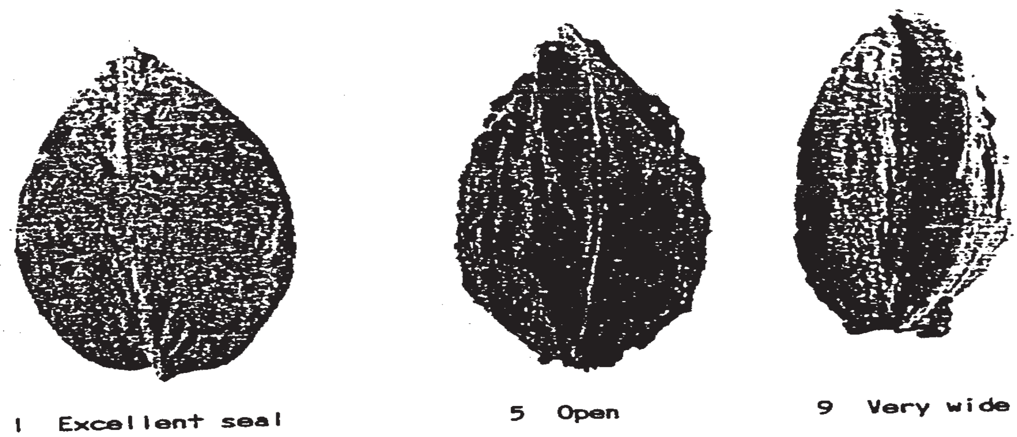


Fig. 5 Suture opening of the shell

6.2.17 Shell retention

Portion of outer corky layer of shell

(See Figure 6)

0	None retained
5	Partly missing
9	All retained

Fig. 6 Shell retention

6.2.18 Softness of shell

		Reference
1	Extremely hard (very difficult to break, need hammer)	Bartre
2	Hard (difficult to Break, need hammer)	Desmaye Largueta
5	Intermediate (broken by hand with effort)	Texas
7	Soft (broken by hand)	Princesse
9	Paper (very thin, easily removed)	Nonpareil

6.3 Kernel

6.3.1 Kernel colour intensity

		Reference
1	Extremely light	Davey
3	Light	Nonpareil
5	Intermediate	Ne Plus Ultra
7	Dark	Texas
9	Extremely dark	Furnat de Brézenaud

6.3.2 Shriveling of kernel
(See Figure 7)

		Reference
3	Slightly wrinkled	Nonpareil
5	Intermediate	
7	Wrinkled	

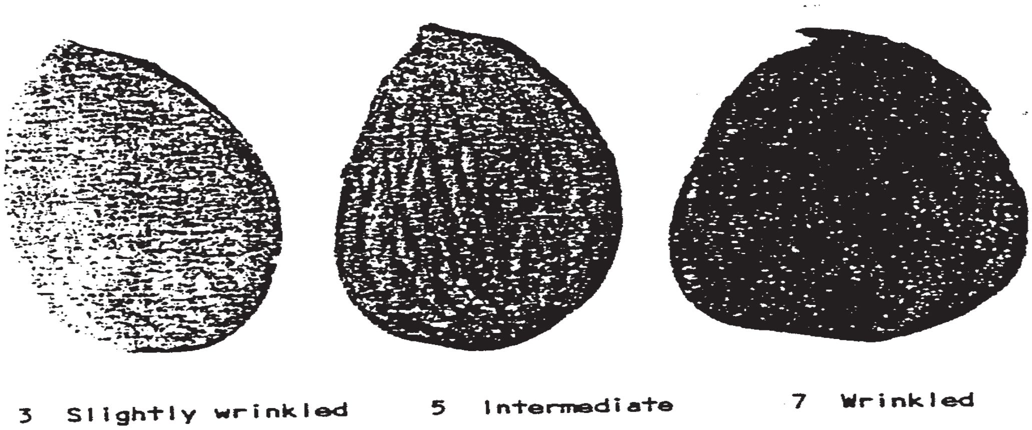


Fig. 7 Shrivelling of Kernel

6.3.3 Kernel Pubescence

		Reference
3	Low	Nonpareil
5	Intermediate	Desmaye
7	High	Ferragnes
9	Extremely high	Ardechiose

6.3.4 Kernel Taste

		Reference
3	Sweet	Nonpareil
5	Intermediate	Texas
7	Bitter	

6.3.5 Percentage of sound Kernels
The percentage of sound Kernels in a sample of 100 nuts

6.3.6 Percentage of double Kernel
The percentage of double kernel in a sample of 100 nuts (See figure 8)

Fig. 8 Example of double Kernel

6.3.7 Percentage of twin Kernels

The percentage of twin kernels in a sample of 100 nuts. A twin kernel is a seed in which more than one embryo occurs. These can be detected by the outline of the small embryo showing through the seed coat.
(See figure 9)

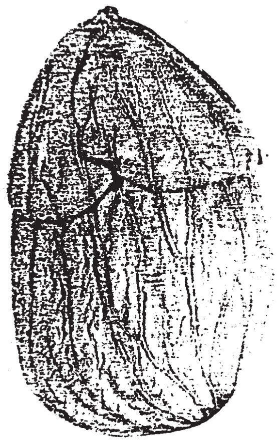


Fig. 9 Example of twin Kernel

7 STRESS SUSCEPTIBILITY

Based on a 1 – 9 scale of general field susceptibility, where

3	Low susceptibility
5	Medium Susceptibility
7	High susceptibility

7.1 Low temperature

Additional information concerning type of susceptibility can be recorded in the Notes descriptor 11, i.e. minimum temperature without damage, differences in bud and wood susceptibility etc.

7.1.1 Low temperature – spring

Observed at critical stages in relation to flowering

		Reference
1	Extremely hardy	Ardechoise
3	Hardy	1.X.L
5	Intermediate	Peerless
7	Tender	Marcona
9	Extremely tender	Ne Plus Ultra

7.2 High temperature

7.3 Drought

7.4 High soil moisture

7.5 Chlorosis

8 PEST AND DESEASE SUSCEPTIBILTY

Based on a 1 – 9 scale of general field susceptibility

3 low susceptibility
5 intermediate
7 high susceptibility

If the race is known, record it in Notes descriptor, 11

8.1 PESTS

8.1.1 ***Anthonomus ornatus Reiche***
8.1.2 ***Cimbex quadrimaculata Mull.***
8.1.3 ***Eurytoma amygdali***
8.1.4 ***Odinodiplosis amygdali Anognos***
8.1.5 Etc.

8.2 FUNGI

8.2.1 ***Monilinia Laxa*** **(Aderh. et Ruhl.)**

	Reference
3	A'i
5	Cristomorto
7	Drake

8.2.2 ***Botrytis cinerea Pers.***

	Reference
3	Cristomorto
5	Peerless
7	Marcona

8.2.3 ***Fusicoccum amygdali Del.***

	Reference
3	Texas
5	Nonpareil
7	Jordanolo

8.2.4 ***Fusicladium carpophilum (Thöm.) Oud.***

	Reference
3	Marcona
5	Nonpareil
7	Ne Plus Ultra

8.2.5 Polystigma echraceum (Wahl.) Sacc.

	Reference
3	A'i Rachele
5	Nonpareil
7	Tuono

8.2.6 Taphirina deforms (Berk.) Tul.

8.2.7 Coryneum beijerinickii Oud.

8.2.8 Etc.

8.3 BACTERIA

8.3.1 ***Pseudomonas syringae*** **Van Hall**

8.3.2 ***Agrobacterium tumefaciens*** **(Smith et Town.) Conn**

8.3.3 Etc.

8.4 VIRUS AND MICROPLASMA

8.5 GENETIC DISORDER

8.5.1 Noninfectious Bud Failure (BF)

8.5.2 Etc.

9 ALLOENZYME COMPOSITION

This may prove to be a useful tool for identifying duplicates accessions

10 CYTOLOGICAL CHARACTERS AND IDENTIFIED GENES

11 NOTES

Give additional information where descriptor state is noted as "Other" as, for example, in descriptors 2.10 and 4.1.1.8. Also include here any further relevant information

ECPGR Characterization and Evaluation Descriptors for Pear Genetic Resources

Pear (*Pyrus communis*)

M. Lateur, D. Szalatnay, M. Höfer, M. Bergamaschi, A. Guyader, I. Hjalmarsson, M. Militaru, C. Miranda Jiménez, G. Osterc, A. Rondia, T. Sotiropoulos, M.K. Zeljković, M. Ordidge

The **European Cooperative Programme for Plant Genetic Resources (ECPGR)** is a collaborative programme among most European countries aimed at rationally and effectively conserving *ex situ* and *in situ* plant genetic resources for food and agriculture, providing access and increasing their sustainable use (http://www.ecpgr.cgiar.org).

The Programme, which is entirely financed by the member countries, is overseen by a Steering Committee composed of National Coordinators nominated by the participating countries. The Coordinating Secretariat is hosted by the Alliance of Bioversity International and CIAT.

The Programme operates through Working Groups composed of pools of experts nominated by the National Coordinators. The ECPGR Working Groups deal with either crops or general themes related to plant genetic resources (documentation and information, and *in situ* and on-farm conservation). Members of the Working Groups carry out activities based on specific ECPGR objectives, using ECPGR funds and/or their own resources.

This work was supported by the Federal Ministry of Food and Agriculture, Germany

Federal Ministry of Food and Agriculture

Citation: Lateur M, Szalatnay D, Höfer M, Bergamaschi M, Guyader A, Hjalmarsson I, Militaru M, Miranda Jiménez C, Osterc G, Rondia A, Sotiropoulos T, Zeljković M K, Ordidge M. 2022. ECPGR Characterization and Evaluation Descriptors for Pear Genetic Resources. European Cooperative Programme for Plant Genetic Resources, Rome, Italy.

Cover illustration: Diverse pear cultivars. Courtesy of © M. Lateur, Centre Wallon de Recherches Agronomiques (CRA-W), Belgium.

CONTENTS

Introduction

Developing standards to collect and share information about plant genetic resources is vital for their conservation and use by farmers, gardeners, scientists, conservationists and breeders.

In recent years, the ECPGR *Malus/Pyrus* Working Group highlighted the need to synthesize, harmonize and prioritize an agreed set of characterization and evaluation descriptors for *Malus/Pyrus* cultivated species (Lateur *et al*. 2006, Lateur *et al.* 2013), and committed to filling this need. Common protocols and descriptors were consequently adapted, initially by a task force formed by representatives of the *Malus/Pyrus* Working Group (M. Lateur, D. Szalatnay, E. Dapena, M. Kellerhals). Further on, in the framework of an ECPGR Grant Scheme Activity named 'Common ECPGR protocols and tools available for Characterization & Evaluation of *Malus/Pyrus* genetic resources', and supported by the Federal Ministry of Food and Agriculture, Germany, it was planned to finalize a new updated version of the former *Descriptor List for Pear (*Pyrus*)* published nearly 40 years ago.
This publication brings all the above efforts together and includes enhanced descriptions of methods/protocols and technical practical information. As far as possible, it was attempted to retain descriptors already in use, and many of the descriptors proposed are the same as previously published by, or adapted from ECPGR, UPOV, CPVO and/or *Obst-Deskriptoren NAP – Descripteurs de Fruits PAN* (Szalatnay, 2006). Further descriptors are from protocols already developed and in use by collection curators, and a small number of novel descriptors have been added where no suitable descriptor was available.

Genetic resources, by their nature, contain a wide diversity of traits. Scales must be sufficiently open to include this range. A general rule has been to use 1–9 scales with extreme classes (1 and 9) described as 'Extremely…', which should be taken to mean outside of what is generally known. To maximize the accuracy of a trait description, in many tables, it is recommended to use the intermediate class types referenced in the descriptor tables as 'X'.

Describing colour can be challenging, and illustrations are presented in the document thanks to the work of Szalatnay (2006). It is recommended, when possible, to control the judgement of colour against a standard colour chart such as the Royal Horticultural Society Colour Chart, and reference to this is either included or needs to be included in due course in line with UPOV (2019).

Even for characterization traits, variability is observed among fruits, among sites and across years. It is therefore ideal to collect data over a sufficiently long time to be able to show the variability of the character and to define a 'median' relative value for each trait.

Most descriptors are based on comparison to reference cultivars. However, in some cases, illustrations or absolute values have been added for further clarity. For most descriptors, it is recommended that the list of reference cultivars is extended so that, for each category, at least one is available for comparison.

One very important objective in standardizing descriptors is to be able to compare and analyze data from different collections, and it is crucial to clearly describe the methodology used for each descriptor. To aid with the comparison across different collections, it is important to record experimental methods, numbers of replicates, ages of trees, rootstocks and management scheme (e.g. fungicide application), and to include reference cultivars as far as possible. Climatic data such as mean rainfall for each season can also be important to include.

It is hoped that the descriptors herein will allow the potential ranking of accessions through relative classification; ranking will obviously need to be applied within specific contexts.

It is recommended that field observations on descriptions and/or descriptors should be maintained for later reference and/or consideration.

Further information on the concepts of crop descriptors is downloadable from:

- https://cgspace.cgiar.org/handle/10568/56589

Online information on pear descriptors can also be found at:

- https://cpvo.europa.eu/sites/default/files/documents/pyrus_communis_1.pdf
- https://hdl.handle.net/10568/72906
- http://www.cpc-skek.ch/fileadmin/pdf/NAP_Beschreibungshandbuecher/deskriptoren-handbuch_nap.pdf

Methods and prioritized descriptors for pear (*Pyrus*)

The aim of the below is to recommend a range of descriptors to successfully describe and discriminate between key characters in most accessions. Ideally, characters should meet the criteria of being:

- Highly stable over time with low interaction with environmental factors
- Highly polymorphic
- Easy to score in practice
- Able to combine characterization and agronomic evaluation value where possible.

The proposed list was mostly compiled using:

- *Pear Descriptors*, IBPGR (Thibaut, Watkins and Smith, 1983) – Referenced in the text as '**IBPGR**'
- *Protocol for distinctness, uniformity and stability tests* – Pyrus communis – *PEAR*, CPVO-TP/15/1 Final (27/03/2003) – Referenced in the text as **'PVO'**
- UPOV Guidelines for the conduct of tests for distinctness, uniformity and stability (Pear – *Pyrus communis*): TG/15/3 (2000)
- *Obst-Deskriptoren NAP – Descripteurs de Fruits PAN* (Szalatnay, 2006).

A priority ranking of the descriptors is included. It is acknowledged that capability will depend on time and resources. The primary characterization and evaluation traits are recommended for prioritization. First-priority descriptors are indicated in the document with '**Priority 1**'; second- and third-priority descriptors with '**Priority 2/3**'. Second- and third-priority descriptors represent useful tools that can be used by curators who have the capacity to do further evaluation and/or characterization work.

Since many scores are relative, it is important to have representatives from a minimum set of common reference cultivars (ideally, a minimum of 2/3) in each characterization/evaluation site. Recommended cultivars for general comparison are listed below and are based on a survey of the members of the ECPGR *Malus/Pyrus* Working Group:

- Abate Fetel (syn. Abbé Fétel)
- Beurré Alexandre Lucas (syn. Alexander Lucas, Alexander Lucas Butterbirne, Lucasova Maslovka)
- Beurré de Mérode (syn. Double-Philippe, Doyenné Boussoch)
- Beurré d’Hardenpont (syn. Glou Morceau, Beurré d’Arenberg – in France, Ardenpont d'Inverno, Butirra d'Hardenpont d'Inverno, Hardenpontova Maslovka, Hardenpont's Winterbutterbirne)
- Beurré Hardy (syn. Hardy, Gellerts Butterbirne, Butirra Hardy)
- Beurré Superfin (syn. Butirra Sopraffina, Hochfeine Butterbirne)
- Blanquilla (syn. Spadona)
- Clapp’s Favourite
- Comtesse de Paris (syn. Gräfin von Paris, Paris)
- Conference
- Doyenne du Comice
- Durondeau (syn. Tongre, Poire de Tongre, Tongern, Beurré Durondeau)
- Kontoula
- Kristalli
- Légipont (syn. Fondante de Charneux, Köstliche von Charneux)
- Louise Bonne d’Avranches
- Nec Plus Meuris (syn. Beurré d’Anjou, Anjou Pear, Butirra d'Anjou)

- Nouveau Poiteau (syn. Neue Poiteau, Patawinka Poiteau)
- Précoce de Trévoux (syn. Frühe aus Trévoux)
- Williams’ Bon Chrétien (syn. Bartlett, Williams, Williams Christbirne)

General notes on methodology for characterization

Data should be recorded on representative trees. Ideally, data should be recorded in representative years.

Extreme climatic conditions such as high spring temperature, severe spring frost or hail are known to affect floral phenology and fruit set/quality.

Ideally, data from several **representative** years should be recorded before accessions can be fully classified.

All recorded dates should be transformed into number of days from the first of January. Phenological classifications can then be expressed as ‘+’ or ‘–‘ (X) day differences from the reference cultivars classified in the medium period.

It is important to organize training for technicians and field workers who will perform the evaluation. It is recommended to check the reproducibility of data (between data collected on the same object by different observers) and the repeatability (between observations made by the same observer at different times).

1. Flowers

Assessment of trees two to three times per week is generally recommended in order to observe the correct moment when flowers open. The primary stages which need at least to be observed are: E2 (BCCH: 59), F (BCCH: 61), F2 (BCCH: 65) and H (BCCH: 69), (according to Fleckinger and Meier, 2001 – **Figure 1)**. For further detail it is recommended to follow the BBCH flowering stages codes (Anonym, 1989, Meier, 2001). As a general rule, the assessment of flowers should not include those appearing on one-year shoots.

Some cultivars tend to produce a second flowering phase a few months after the spring flowering period. The intensity of this flowering is much less important, but incidence represents a risk of infection by fire blight (*Erwinia amylovora*). Independent descriptors relating to secondary flowering are proposed.

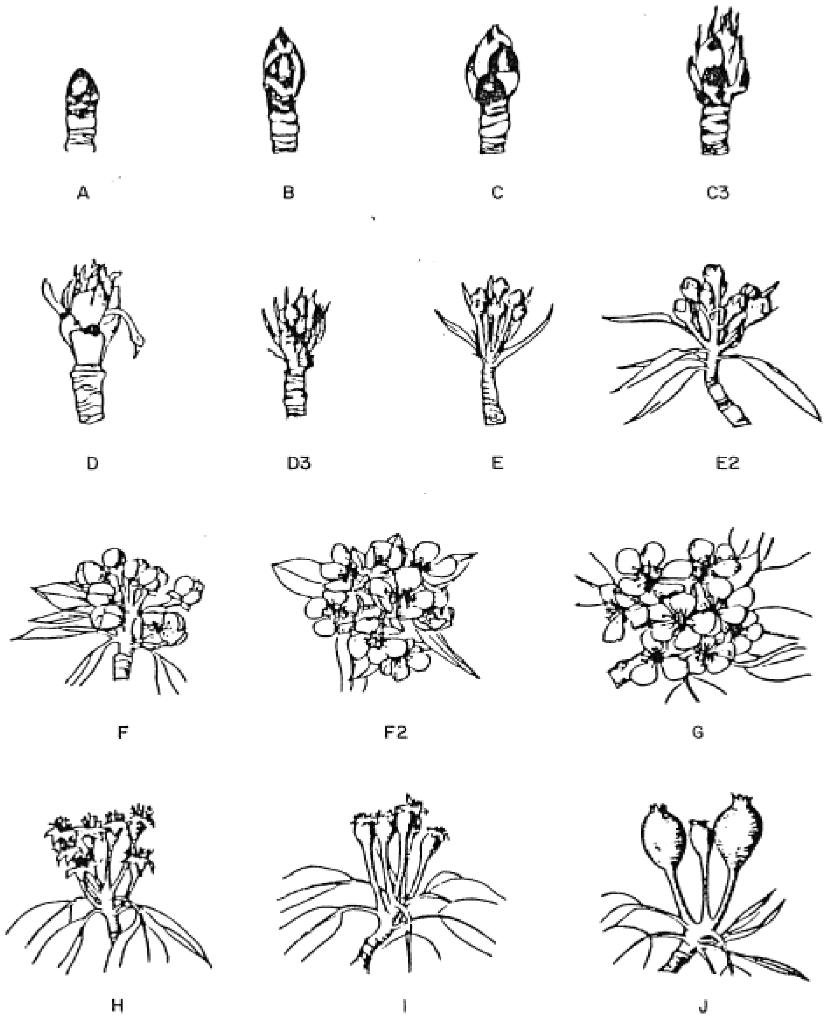


Figure 1. Fleckinger's phenological flower stages for pear.

1.1 Flowering phenology (*Priority 1*)

When flowering intensity is very low (fewer than 5% of the buds are flower buds), it is not representative to evaluate the flowering season. It is useful to note and/or assess the flowering intensity of the trees by using the assessment key defined in **Table 1**. The relative flowering season of a cultivar (**Table 2**) can then be assessed by comparison against the flowering period of reference cultivars. It is recommended that for standardization, reference cultivars like Beurré Hardy, Conference and/or Williams Bon Chrétien need to be considered as a central point for all areas. For this comparison; the reference flower stage can be either 'F' (BCCH: 61), or 'F2' (BCCH: 65).

Table 1. Flowering intensity (Lateur and Populer, 1996)

State	Flowering intensity	Field observations
1	No flower	Absence of any flower
2	Extremely low	Flower clusters represent up to 5% of all buds
3	Low	Flower clusters represent approx. 10% of all buds
4	Low to medium	X
5	Medium	Flower clusters represent approx. 30% of all buds
6	Medium to high	X
7	High	Flower clusters represent approx. 50% of all buds
8	High to extremely high	X
9	Extremely high	Over 90% of all buds are floral

‘X’: Intermediate rating.

Table 2. Relative flowering season (adapted from Lateur and Populer, 1996)

State	Flowering period	Example of reference cultivars
1	Extremely early	
2	Very early	Beurré Alexandre Lucas, Comtesse de Paris, Kontoula, Kristalli
3	Early	Louise Bonne d’Avranches, Précoce de Trévoux, Passe Crassane, Blanquilla
4	Early/medium	Beurré de Mérode, Durondeau
5	Medium	Packhams’s Triumph, Williams' Bon Chrétien (syn. Bartlett), Conference, Beurré Hardy
6	Medium/late	Triomphe de Vienne
7	Late	Doyenné du Comice, Jeanne d’Arc
8	Very late	Frangipane
9	Extremely late	

1.2 Regularity of flowering (*Priority 3*)

Following the assessment of flowering intensity over four to six representative years, accessions can be placed in categories of flowering regularity. Thinning methods must not be in place as these will act to mitigate this characteristic.

Table 3. Relative regularity of flowering (adapted from IBPGR, 1983)

State	Regularity of flowering	Example of reference cultivars
1	Very often irregular/Biennial	Gieser Wilderman
2	Intermediate behaviour	Louise Bonne d’Avranches, Nec Plus Meuris (syn. Beurré d’Anjou, Anjou Pear)
3	Very often regular	Conference, Williams' Bon Chrétien, Kristalli

1.3 Occurrence of secondary flowering during summertime (*Priority 2*)

Secondary flowering should initially be assessed in terms of intensity as per **Table 4**. Following at least five to six seasons, accessions can be then classified into different levels of frequency of secondary flowering (**Table 5**).

Table 4. Intensity of secondary flowering

The assessment is done several weeks after the end of flowering (petal fall).

State	Secondary flowering intensity	Field observations
1	Low	Absence of any secondary flowering
2	Medium	Flower clusters represent up to 5% of all buds
3	High	Flower clusters represent more than 5% of all buds

Table 5. Frequency of secondary flowering (IBPGR, 1983)

State	Frequency of secondary flowering	Reference cultivars
1	Rare	Beurré Hardy, Conference, Doyenné du Comice
2	Intermediate	Williams' Bon Chrétien
3	Frequent	Durondeau, Triomphe de Vienne, Clapp’s Favourite, Passe Crassane, Général Leclerc, Abbé Fetel

2. Fruit

A sample of at least 6 to 12 representative fruits should be evaluated. Having identified the most representative fruits on the tree, the same protocol should be used for each accession, e.g. fruits taken from the sunny side at ¾ of the height of the trees. It is important to avoid the terminal (king) fruits. In general, it is recommended to perform fruit assessments in the orchard, in front of the tree where possible.

As per the CPVO Protocol (2006), it is recommended that all descriptions should be carried out at an optimal stage of ripening for fresh consumption. Unfortunately, there are no simple criteria to define an accession's good state of ripening, and this will remain a subjective judgement based on the expertise of the curators; frequent observation of the trees is recommended. Some factors offer useful indication, e.g. first preharvest drop of healthy fruit, change in ground and overcolour of the fruit, and taste of the fruit (acidity, starchiness, sugar level, firmness) but it is noted that these are themselves characterization/evaluation characters. Iodine starch index can also be a good indicator, but this is not always the case. It is generally recommended to not pick the fruit before reaching the 6-7 starch index score (Vaysse, Landry, 2004). For many cultivars, it may be necessary to either analyze samples of fruit picked as late as possible or after a period of postharvest ripening.

Since ripening time is difficult to accurately predict, and it is often not practical to finely monitor each individual accession, it is recommended as a method that the level of maturity at the date of picking and tasting is noted against the scale in **Table 6**. Scores of 1 or 5 should be taken to indicate that fruits are not suitable for a true assessment.

Table 6. Note provided after the estimation of the ripening stage of fruits when picked and/or tasted

State	Optimal ripening stage assessment
1	Much before optimal ripening stage
2	Just before optimal ripening stage
3	Optimal ripening stage
4	Just after optimal ripening stage
5	Much after the optimal ripening stage

2.1 Time of fruit ripening for eating (harvest maturity) (*Priority 1*)

It is recommended that the optimal date of picking be recorded during at least four to six representative seasons. Recording notes on the ripening stage (**Table 6**) should make it possible to estimate the average optimal ripening period and classify accessions in their relative maturity in comparison with reference cultivars as per **Table 7**.

It is noted that the range below may not be wide enough to represent the full range of ripening times across Europe and this descriptor should be optimized further accordingly in the future.

Table 7. Relative harvest maturity

State	Harvest maturity	Reference cultivars (IBPGR)	Approximate and indicative periods of picking (for north-western Europe)
1	Extremely early	Doyenné d'Eté (syn. Doyenné de Juillet), Kontoula	July–early August
2	Very early	Précoce de Trévoux, Beurré Giffard, Kristalli	Early August
3	Early	Clapp's Favourite	Mid-August
4	Early/Medium	Williams' Bon Chrétien, Beurré Superfin, Beurré de Mérode	Mid-August–Early September
5	Medium	Conference, Beurré Lebrun, Beurré Hardy	Mid-September
6	Medium/Late	Louise Bonne d'Avranches	End September–early October
7	Late	Nec Plus Meuris, Doyenné du Comice	Early October
8	Very late	Comtesse de Paris	Mid-October
9	Extremely late	Passe Crassane, Beurré d'Hardenpont (syn. Glou Morceau)	End October–November

2.2 Tendency to drop fruit at harvest time (*Priority 3*)

Assessment should be specific to healthy fruits (i.e. avoiding those that drop due to damage or factors other than ripening) and should be carried out at the judged time of optimal harvest as above.

Table 8. Tendency to drop fruit at harvest.

State	Drop observed	Proportion of fruit drop at harvest (%)
1	No drop observed	0
2	Very low drop	1–10
3	Low	11–25
4	Low to medium	X
5	Medium	± 50
6	Medium to high	X
7	High	± 75
8	High to very high	X
9	Very high	> 90

'X': Intermediate rating.

2.3 Precocity of fruit bearing (*Priority 2*)

Precocious trees of a given cultivar are defined as the ones that start to crop at an early age relative to other cultivars in a comparable situation. Assessment should be carried out on the same rootstock, place, type of tree and year of planting. The age of tree at planting, rootstock and other relevant factors should be noted for wider comparison.

Table 9. Relative precocity of fruit bearing

State	Precocity of fruit bearing	Example of reference cultivars
1	Extremely low	Doyenne du Comice, Magness
2	Low	Williams' Bon Chrétien
3	Intermediate	Beth, Devoe
4	High	Delbias, Kieffer
5	Extremely high	*P. calleryana*

2.4 Productivity (*Priority 2*)

Productivity can be assessed as the relative yield per tree. It is recommended that the assessment be carried out over a minimum of four to six years before an average score can be allocated as per **Table 10**.

Table 10. Productivity (adapted from IBPGR, 1983)

State	Productivity	Example of reference cultivars
1	Extremely low	Magness
2	X	
3	Low	Doyenne du Comice, Nec Plus Meuris
4	X	
5	Medium	Beurré Superfin, Williams' Bon Chrétien
6	X	
7	High	Beurré Alexandre Lucas, Kristalli
8	X	Conference
9	Extremely high	

'X': Intermediate rating.

2.5 Fruit shape (*Priority 1)*

It is recommended assessing fruit shape in three components as per **Figure 2**. Initially, the profile of the bottom (stalk end) of the fruit should be judged according to **Table 11**, then the relative position of the fruit's maximal diameter should be judged according to **Table 12,** and finally the ratio of fruit length to maximal diameter should be calculated and scored as per **Table 13**.

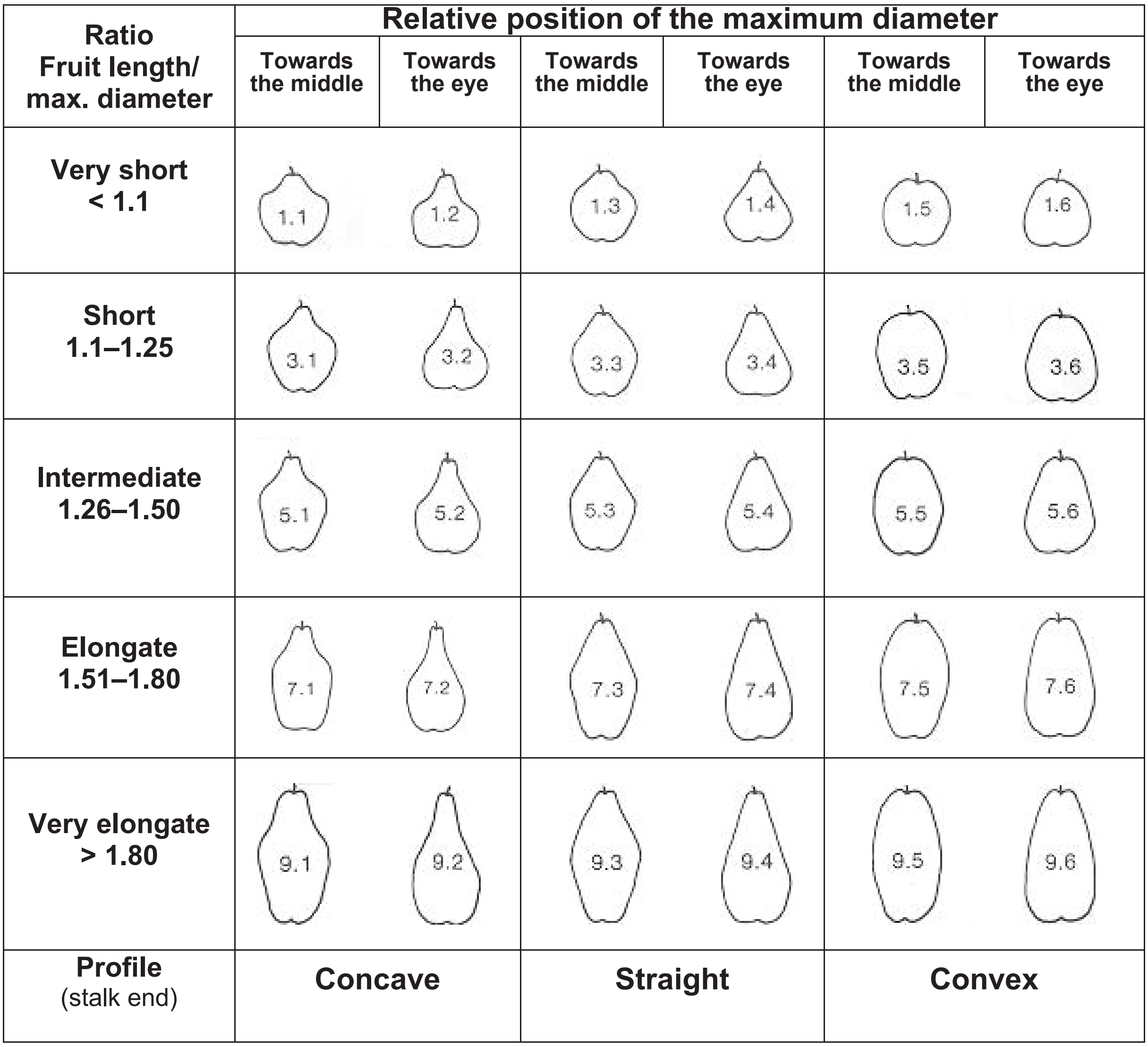


Figure 2. Global fruit shape – Shape/length relative to the maximum diameter, profile and position of the maximum diameter. (Modified from IBPGR, 1983) (***Priority 1***)

Table 11. Profile of bottom (stalk end) of fruit

State	Profile
1	Concave
2	Straight
3	Convex

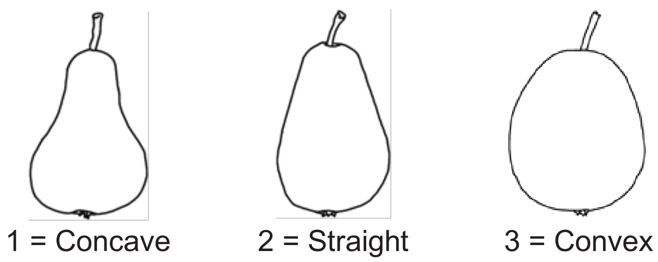


Figure 3. Profile of bottom (stalk end) of fruit

Table 12. Relative position of maximal diameter

State	Position
1	Towards the middle
2	Towards the eye

Table 13. Ratio of fruit length to maximum diameter

State	Ratio
1	< 1.1
2	1.1–1.25
3	1.26–1.50
4	1.51–1.80
5	> 1.80

2.6 Regularity of shape in profile (*Priority 3*)

Table 14. Fruit shape variability

State	Fruit shape variability	Reference cultivars
1	Regular shape	Nec Plus Meuris
2	Slightly variable shape	Doyenné du Comice
3	Highly variable shape	Conference (due to parthenocarpy)

2.7 Regularity of the symmetry of the fruit (*Priority 3*)

Table 15. Fruit symmetry variability

State	Fruit symmetry variability	Reference cultivars (CPVO)
1	Regularly symmetric	Passe Crassane
2	Slightly asymmetric	Beurré Bosc
3	Highly asymmetric	Beurré Clairgeau, Nouveau Poiteau

2.8 Fruit size (*Priority 1*)

At least 12 representative fruits should be evaluated over a minimum of four to six years. An average and relative score can then be assigned according to **Table 16**. It should be noted that these indicative values will differ across locations and growing systems.

Table 16. Fruit size

State	Fruit size	**Example of reference cultivars** (CPVO, IBPGR & Lateur)
1	Extremely small	
2	Very small	Petit Muscat, Doyenné d'Eté
3	Small	Doyenné de Juillet, Moscatellina
4	Small to medium	Beurré Giffard, Tyson, Beurré Superfin
5	Medium	Dr Jules Guyot, Epine du Mas, Clapp's Favourite, Beth, Nec Plus Meuris
6	Medium to large	Conference, Williams' Bon Chrétien
7	Large	Doyenné du Comice, Passe Crassane, Merton Pride
8	Very large	Marguerite Marillat, Pitmaston's Duchess
9	Extremely large	

2.9 Depth of fruit stalk cavity (*Priority 1*)

Crowning should be scored relative to the images in **Figure 4** and classifications in **Table 17**.

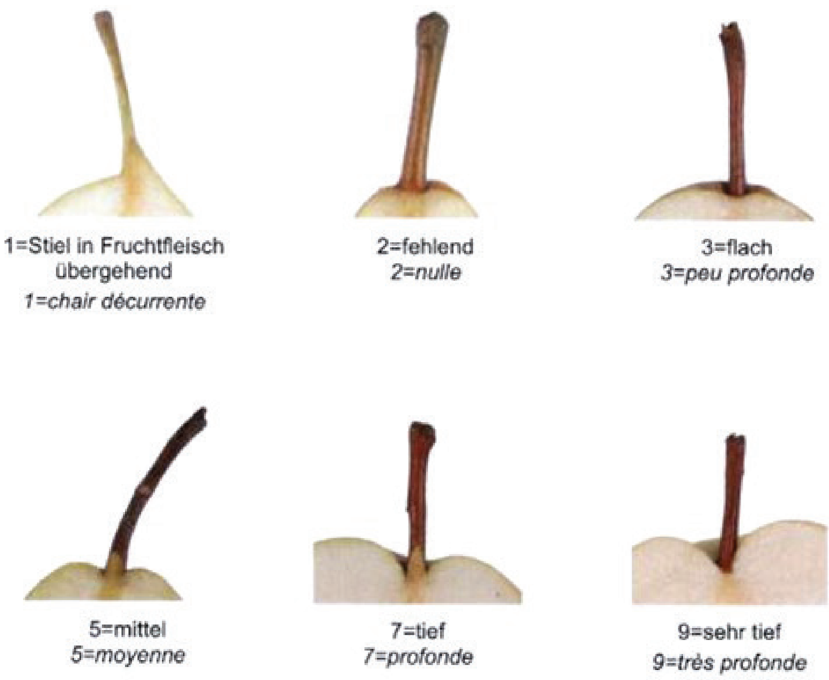


Figure 4. Illustration of stalk cavity depth (reproduced from Szalatnay, 2006).

Table 17. Depth of fruit stalk cavity

State	Cavity	Reference cultivars
1	Stalk in continuity with the fruit flesh	Beurré de Naghin, Madame Favre, Kontoula
2	Absent	Conference, Kristalli
3	Very shallow	Joséphine de Malines
4	Shallow	Doyenné du Comice, Louise Bonne d'Avranches
5	Medium	Précoce de Trévoux
6	X	-
7	Deep	Passe Crassane, Doyenné d'Hiver
8	X	Olivier de Serre
9	Very deep	-

'X': Intermediate rating

2.10 Thickness of fruit stalk (*Priority 3*)

Table 18. Average thickness of the stalk (Szalatnay, 2006)

State	Average thickness	**Example of reference cultivars** (CPVO, Szalatnay)
1	Thin (< 2mm)	Concorde, Beurré Bosc
2	Medium (2–3mm)	Beurré de Trévoux, Beurré Hardy
3	Thick (> 3mm)	Nec Plus Meuris, Clapp's Favourite

2.11 Attitude of stalk insertion in relation to axis of fruit (*Priority 3*)

Table 19. Average insertion of stalk in relation to fruit axis (CPVO)

State	Insertion of stalk	Example of reference cultivars
1	Straight	Doyenné de Juillet
2	Between 10° and 45°	Doyenné du Comice, Beurré Clairgeau
3	> 45°	Abbé Fétel, Marguerite Marillat

2.12 Colour of fruit skin ground (if visible) (*Priority 1*)

It is recommended, when possible, to control the judgement of colour against a standard colour chart such as the Royal Horticultural Society Colour Chart and reference to this is either included or needs to be in due course in line with UPOV (2019).

Ground colour could be scored relative to the images in **Figure 5** and classifications in **Table 20**. State 6 Orange is included as per Szalatnay (2006) and should be really considered based on use as a descriptor of ground colour.

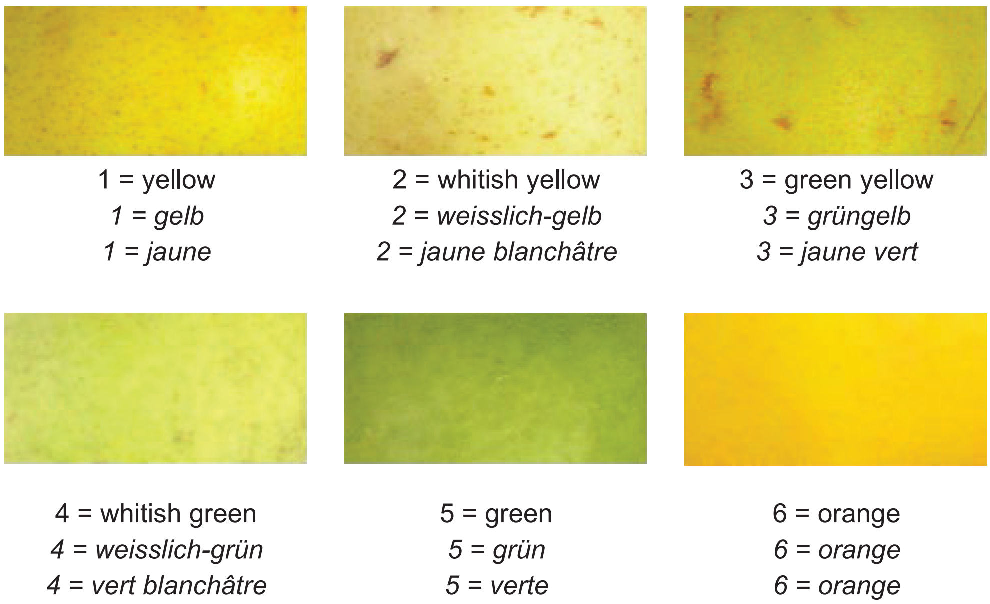


Figure 5. Illustration of fruit skin ground colours (Szalatnay, 2006)

Table 20. Ground colour

State	Ground colour	**Example reference cultivars** (IBPGR, CPVO)
1	Yellow	Passé Crassane, Williams' Bon Chrétien
2	Whitish yellow	
3	Green yellow	Conference, Beurré Hardy, Beurré Giffard, Kristalli
4	Whitish green	
5	Green	Nec Plus Meuris, Nouveau Poiteau
6	(Yellow) – Orange	

2.13 Average amount of overcolour on fruit skin (*Priority 1*)

Table 21. Overcolour coverage

State	Overcolour coverage	Estimated percentage of coverage (%)	Example reference cultivars (e.g. CPVO)
1	Absent	0	Grand Champion, Passe Crassane, Beurré Lebrun, Conference
2	Very low	0–1	
3	Low	1–5	
4	Low to medium	X	Précoce de Trévoux
5	Medium	20–30	Louise Bonne d’Avranches
6	Medium to high	X	Herbst Forelle
7	High	± 50	Beurré Clairgeau
8	High to very high	X	
9	Very high	> 90	Red Bartlett, Red Anjou, Starkrimson

‘X’: Intermediate rating

2.14 Overcolour of the fully mature fruit skin (*Priority 1)*

Again, it is recommended when possible, to control the judgement of colour against a standard colour chart such as the Royal Horticultural Society Colour Chart and reference to this is either included or need to be in due course in line with UPOV (2019).

Overcolour could be scored relative to the images in **Figure 6** and classifications in **Table 19**.

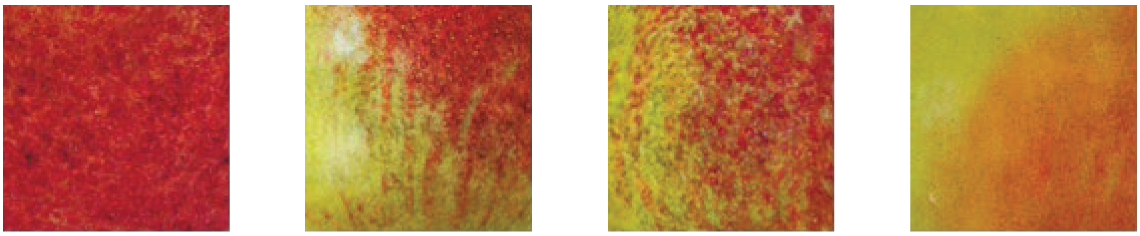
Figure 6. Illustration of skin overcolours (adapted from Szalatnay, 2006)

Table 22. Overcolour

State	Overcolour	Reference cultivars (e.g. UPOV)
0	Absent	
1	Orange	Précoce de Trévoux
2	Pink/(red)	Belle Angevine
3	Red	Herbst Forelle
4	Dark red	Starkrimson
5	Purple	Red Anjou
6	Brownish red	

2.15 Pattern of overcolour on fruit skin (*Priority 3*)

Pattern of overcolour should be scored relative to the images in **Figure 7** and classifications in **Table 23**.



1 = Solid flush 2 = Striped 3 = Mottled 4 = Washed out

Figure 7. Fruit skin overcolour patterns (adapted from Szalatnay, 2006)

Table 23. Overcolour pattern (adapted from Szalatnay, 2006)

State	Overcolour pattern	Example of reference cultivars (CPVO-UPOV 2003)
1	Only solid flush	Hortensia
2	Only striped	Précoce de Trévoux
3	Mainly mottled	Louise Bonne d'Avranches, Herbst Forelle
4	Washed out (faded)	Beurré Giffard

2.16 Overall amount of russet on fruit skin (*Priority 1*)

For fruit russet coverage, at least 6–12 representative fruits should be evaluated. An average score for overall coverage is recorded at harvest, at full fruit ripeness (**Table 24**).

Table 24. Overall russet coverage

State	Russet coverage	Estimated percentage of coverage (%)	Examples of reference cultivars (partially CPVO, IBPGR & Petzold)
1	Absent	0	Grand Champion, Clapp's Favourite, Kontoula
2	Very low	0–1	Beurré Lebrun, Kristalli
3	Low	1–5	Beurré d'Hardenpont, Packam's Triumph
4	Low to medium	X	William's Bon Chrétien
5	Medium	20–30	
6	Medium to high	X	Comtesse de Paris, (Conference)
7	High	± 50	Jeanne d'Arc, (Conference)
8	High to very high	X (± 75)	Beurré Hardy, Callebasse Bosc
9	Very high	> 90	Madame Verte

'X': Intermediate rating

2.17 Russet area around stalk cavity (adapted from Szalatnay, 2006) (*Priority 3*)

Table 25. Russet around stalk cavity

State	Russet coverage	Estimated percentage of coverage (%)
1	Absent	0
2	Very low	x
3	Low	± 25
4	Low to medium	x
5	Medium	± 50
6	Medium to high	x
7	High	± 75
8	High to very high	x
9	Very high	> 90

'X': Intermediate rating

2.18 Russet area around eye basin (adapted from Szalatnay, 2006) (*Priority 3*)

Table 26. Russet around eye basin

State	Russet coverage	Estimated percentage of coverage (%)
1	Absent	0
2	Very low	x
3	Low	± 25
4	Low to medium	x
5	Medium	± 50
6	Medium to high	x
7	High	± 75
8	High to very high	x
9	Very high	> 90

'X': Intermediate rating

2.19 Aperture of eye (*Priority 3*)

For aperture of eye, at least 6–12 representative fruits should be evaluated (**Table 27**) at full fruit ripeness.

Table 27. Aperture of eye

State	Aperture of eye	Examples of reference cultivars (Petzold)
1	Closed	Le Lectier, Beurré Alexandre Lucas
2	Partly open	Beurré Diel, Beurré d'Hardenpont, Conference
3	Fully open	Comtesse de Paris, Durondeau, Beurré Hardy

2.20 Insertion of eye sepals at harvest (*Priority 3*)

At least 6–12 representative fruits should be evaluated (**Table 28**) at full fruit ripeness

Table 28. Insertion of sepals at their base

State	Insertion of sepals	**Examples of reference cultivars** (Petzold)
1	Fully welded sepals forming a visible ring like a crown	Josephine de Malines, Beurré Alexandre Lucas, Clapp's Favourite, Comtesse de Paris
2	Half-welded – half-free sepals	Williams' Bon Chrétien, Conference
3	Fully free sepals	Beurré Diel

2.21 Length of stalk (*Priority 3*)

Length of stalk is a variable character and representative sampling is important – at least 12 representative fruits should be evaluated at harvest (**Table 29**).

Table 29. Stalk length (adapted from Szalatnay, 2006)

State	Stalk length	Average length (mm)	**Example of reference cultivars** (Petzold, CPVO)
1	Very short	< 15	Nec Plus Meuris
2	Short	15–24	Beurré Clairgeau
3	Medium	25–34	Comtesse de Paris, Beurré Hardy, Beurré d'Hardenpont, Beurré Alexandre Lucas, Doyenné du Comice
4	Long	35–44	Beurré Six, Triomphe de Vienne, Légipont, Conference
5	Very long	≥ 45	Ulmer Butterbirne, Curé, Beurré Bosc

2.22 Flesh colour (*Priority 3*)

Table 30. Flesh colour at full maturity (transversal cut)

State	Flesh colour	Example of reference cultivars
1	White	Comtesse de Paris
2	Greenish white	
3	Yellowish white	
4	Yellowish	
5	Pinkish red	Sanguinole

2.23 Number of seeds (*Priority 1*)

An average of fully formed seeds from approximately 12–20 fruits should be calculated. An average lower than 3–4 indicates that a cultivar is likely triploid and a complete lack of seeds can be taken as an indicator of parthenocarpy (Lateur, 1996). Note that this characteristic can be highly influenced by environmental conditions and pollen availability.

Table 31. Number of seeds

State	Average number of well-formed seeds	Example of reference cultivars
1	0	
2	1–3	Beurré Alexandre Lucas
3	4–5	
4	6–10	
5	11–15	
6	> 15	

2.24 Photographs of picked fruit samples (adapted from Szalatnay, 2006) (***Priority 1***)

It is important that samples are representative and very young. Old, high- and low-yielding trees should be avoided, along with seasons with uncharacteristic conditions. Labels should include, as a minimum: accession name, accession number, tree position and date. Photographs may be taken under natural light (avoiding early morning or late afternoon) or artificial light (including flashlight in studio conditions). A standard size reference (ideally grid) should be included as well as a minimum set of views (as shown in **Figure 8**). All accessions for entry into ECPGR databases should have photographs available.

Further advisory details on photography can be found in **Annex 1**.

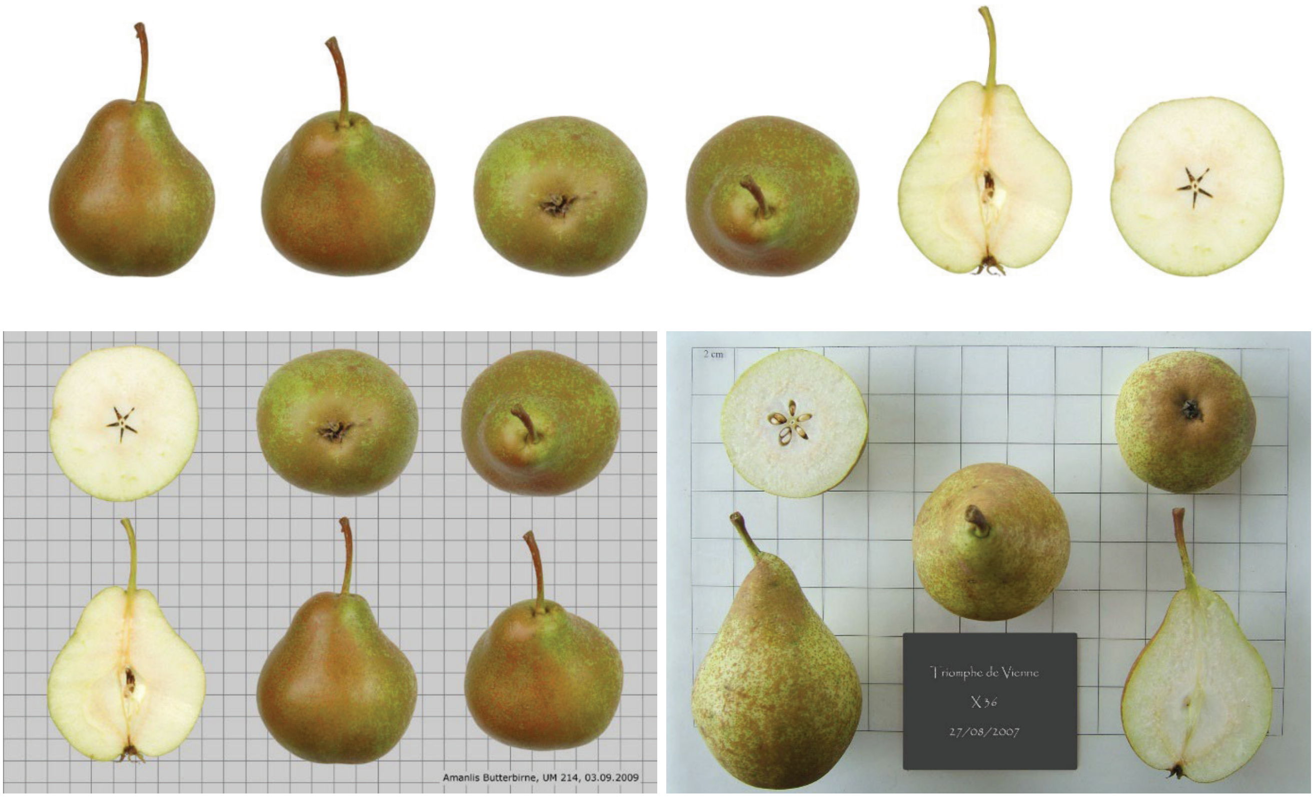


Figure 8 – Examples of illustrations of fruit pictures. (Pictures: Top and bottom left, Szalatnay (2016); bottom right, CRA-W)

2.25 Photographs of fruit hanging on the tree (*Priority 1*)

A representative fruit, or group of fruits well placed on the tree, should be selected. It is often practical to take a picture firstly of the tree label and/or the name on a list in order to trace the name of the accession. When possible, it is very important to get a clear view of the fruit eye (**Figure 9**). It is recommended to use a white panel as a natural light reflector as this can improve the precision of the fruit image.

Figure 9. Examples of pear fruit cultivars photographed on the tree (CRA-W)

3. Tree

3.1 Tree global architecture (*Priority 2*)

Tree architecture should be characterized when trees are at least 10 years old and should be scored using the IBPGR and CPVO classifications (**Table 32** and **Figure 10**).

Table 32. Tree architecture

State	Tree form	Example of reference cultivars
1	Very upright or 'Fastigiate'	Jeanne d'Arc, Président Héron, Général Leclerc
2	X	November Birne (syn. Nojabrskaja), Colorée de Juillet
3	Upright	Beurré Clairgeau, Doyenné du Comice, William Bon Chretien, Kristalli
4	X	Conference
5	Spreading	Madame Baltet
6	X	
7	Drooping	Beurré Alexandre Lucas, Clapp's Favourite; Beurré Diel, Beurré Six
8	X	
9	Weeping	Beurré d'Amanlis

'X': Intermediate rating

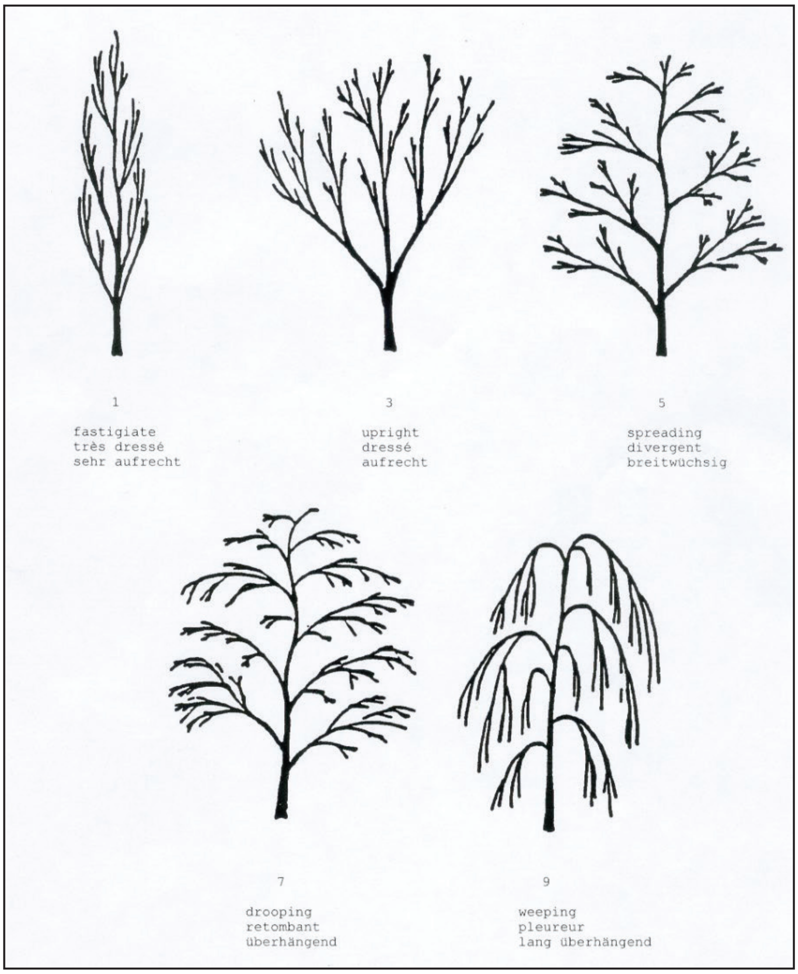


Figure 10. Global tree shape (CPVO, 2003).

3.2 Affinity or compatibility with Quince (*Priority 3*)

Degrees of incompatibility may differ between quince rootstocks, and it is necessary to record the specific stock in use. It is also possible to observe incompatibility in both the nursery and in trees planted out in the orchard. Therefore, the age of trees should also be noted (**Table 33**).

Table 33. Affinity with Quince

State	Affinity	Example of reference cultivars
1	Extremely poor	Beurré Chaboceau
2	Very poor	Clapp's Favourite, Gieser Wilderman, Beurré Bosc, Triomphe de Vienne
3	Poor	Dr Jules Guyot, St Rémy, Epine du Mas, Beurré Alexandre Lucas
4	Poor to intermediate	
5	Intermediate	Louise Bonne d'Avranches, Précoce de Trévoux, Williams' Bon Chrétien
6	Intermediate to good	
7	Good	Général Leclerc
8	X	Curé
9	Extremely good	Passe Crassane, Beurré Hardy, Doyenné du Comice

'X': Intermediate rating

4. Pest and disease susceptibility

For pest and disease susceptibility assessment, it is particularly important to note details of the management scheme for fungicide and/or insecticide application during at least five years preceding the first evaluation. It is strongly recommended to not spray evaluation orchards for several seasons before the evaluation process (at least five years would be ideal).

It is also important to carefully check that the pest/disease is homogeneously distributed inside the plot, and useful to plant sufficient susceptible control cultivars throughout the field to help identify the occurrence of localized infections.

The most widely used assessment keys are based on a global approach for the assessment of the intensity of the pest/disease. Intensity is the sum of two components: *incidence* and *severity*. *Incidence* is the qualitative 'presence' and 'absence' of symptoms (generally defined by the proportion of organs affected by at least one symptom); *severity* is the quantitative proportion of a surface, length or volume of an organ that is infected by the disease. In some instances, when more precision is needed on the type of resistance, it can be valuable to evaluate the two components of disease, *incidence* and *severity*, independently.

4.1 Scab (*Venturia pyrina*) (*Priority 2*)

Photo 1. Scab primary infection symptoms on young pear fruit during springtime (CRA-W).

At least one observation should be made per year: at the end of the growing season for fruit scab. If possible, though, it is recommended to assess leaf scab at least two times in the season in order to be able to evaluate the primary (**Photo 1**) and secondary infections. Pear scab symptoms on leaves are mostly developed on the back of the leaf (**Photos 2 and 3**) and are more difficult to detect during the second half of the growing season. Therefore, it is recommended to assess leave scab susceptibility in June. It is much easier to make the assessment when leaves are dry. Assessment on shoots (**Photo 4**) should be made just after leaves are fallen and on shoots that are 1–3 years old.

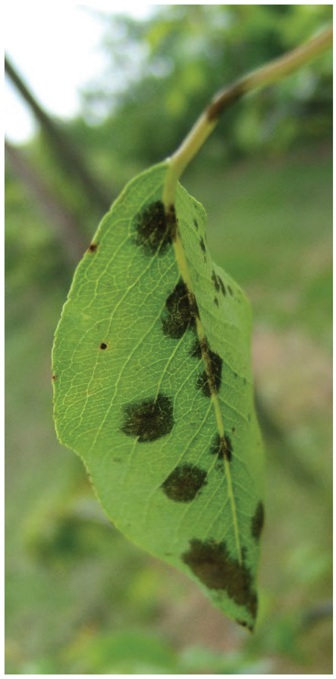
The most common and easiest way for assessing the intensity of symptoms on leaves, fruits and twigs is based on the use of **global assessment** scales that take into account and integrate into one global score, the incidence and severity status (**Tables 34, 35** and **36**).

'*Incidence*' is defined as the estimated percentage of infected organs (leaves or fruits) that express at least one clear and visible symptom of the disease. 'S*everity*' refers to the estimated mean area of the infected organs covered by clear symptoms.

Table 34. Global Assessment scale for scab infection on **leaves** (adapted from Lateur and Populer, 1996)

State	Field observations	Visual rating estimation	
		Incidence (%)	**Severity (%)**
1	No visible symptom	0	-
2	A few small scab spots are detectable on close scrutiny of the tree	≤ 1	-
3	Scab immediately apparent, with lesions very thinly scattered over the tree	> 1–5	-
4	X	X	-
5	Infection widespread over the tree, majority of leaves with at least one lesion	≥ 50	≤ 5
6	X	≥ 50	X
7	Heavy infection; multiple lesions or larger surfaces covered by scab on most leaves	≥ 50	± 25
8	X	≥ 50	X
9	Maximum infection; leaves black with scab and most of them are falling.	≥ 50	> 75

'X': Intermediate rating



Photos 2 and 3. Scab symptoms on the lower side of a young pear tree during springtime (CRA-W).

Table 35. Global assessment scale for scab infection on **fruits** (adapted from Lateur and Populer, 1996)

State	Field observations	Visual rating estimation	
		Incidence (%)	Severity (%)
1	No visible symptom	0	-
2	A few small scab spots are detectable on close scrutiny of the tree	≤ 1	-
3	Scab immediately apparent, with lesions on fruits very thinly scattered over the tree	≤ 5	-
4	X	X	-
5	Infection widespread over the tree, majority of fruits with at least one lesion	≥ 50	≤ 5
6	X	≥ 50	X
7	Heavy infection; multiple lesions or more large surfaces covered by scab on most fruits, some fruits with skin cracks in scabbed lesions	≥ 50	± 25
8	X	≥ 50	X
9	Maximum infection; fruits black with scab; most of them are dropping and/or infected by *Monilinia* sp.	≥ 50	> 75

'X': Intermediate rating

Table 36. Global assessment scale for scab infection on **twigs** (adapted from Lateur and Populer, 1996)

State	Field observations	Visual rating estimation	
		Incidence (%)	Severity (%)
1	No visible symptom	0	-
2	A few small scab symptoms are detectable on close scrutiny of the branches	≤ 1	-
3	Scab symptoms immediately apparent, with lesions scattered over the tree	≤ 5	5–10
4	X	X	-
5	Infection widespread over the branches, majority of fruits with at least one lesion; some large surfaces covered by scab – 5 to 10cm long – extremity of twigs with few leaves, but no dead twigs	≥ 50	± 25
6	X	≥ 50	X
7	Heavy infection; multiple lesions on the longest part of twigs and more large surfaces covered by scab on most branches, portion of young twigs extremities are dead	≥ 50	± 50
8	X	≥ 50	± 75
9	Maximum infection; mostly all young twigs are killed by scab necrosis.	≥ 50	> 90

'X': Intermediate rating

Photo 4. Scab infection symptoms on young twig (CRA-W).

Alternatively, and at a lower priority level, when a more precise approach is justified, it could be recommended to separate the assessment of the two complementary components of disease intensity by making an assessment for incidence and another for severity.

The key for incidence assessment is given in **Table 37** and the key for severity assessment is given in **Table 38**.

Table 37. Incidence assessment key for pear scab – wither on leaves, fruits or twigs (***Priority 4***).

State	Mean visual estimated proportion of infected parts (leaves, fruits or twigs) (%)
1	0
2	]0–1]
3	]1–5]
4	X
5	± 25
6	X
7	± 50
8	X
9	> 90

'X': Intermediate rating

Table 38 & Figure 11. Severity assessment key for pear scab – Either on leaves, fruits or twigs – ***(Priority 4).***

State	Mean visual estimated proportion of scab-infected surface (leaves, fruits or twigs) (%)
1	0
2	]0–1]
3	]1–5]
4	X
5	± 25
6	X
7	± 50
8	X
9	> 90

'X': Intermediate rating

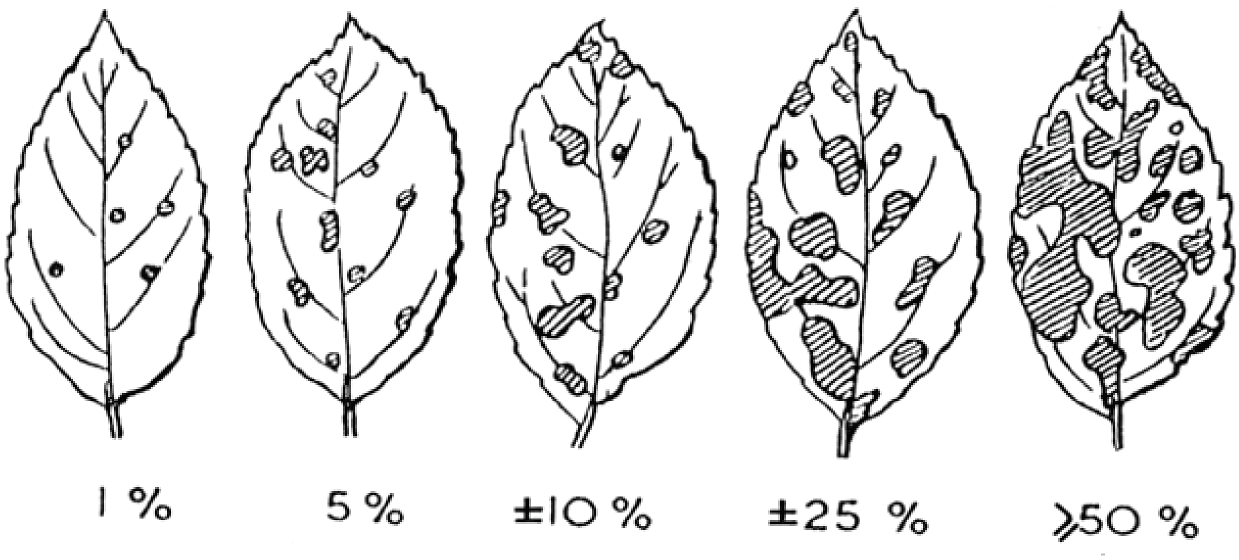


Figure 11. Assessment of scab severity on leaves (reproduced from Croxall *et al.,* 1952)

4.2 Pear rust (*Gymnosporangium sabinae*) (*Priority 2*)

Assessment should be done in the evaluation orchard at the end of summertime.

Table 39. Pear rust global infection assessment scale on leaves

State	Field observations	Visual rating estimation	
		Incidence (%)	Severity (%)
1	No visible symptom	0	-
2	A few small rust spots are detectable on close scrutiny of the tree	≤ 1	-
3	Rust spots immediately apparent, with lesions very thinly scattered over the tree	≤ 5	-
4	X	X	-
5	Infection widespread over the tree, majority of leaves with at least one rust spot	≥ 50	≤ 5
6	X	≥ 50	X
7	Heavy infection; several rust spots covered on most leaves	≥ 50	± 25
8	X	≥ 50	X
9	Maximum infection	≥ 50	> 75

‘X’: Intermediate rating

4.3 *Neonectria* canker (*Neonectria ditissima*) (*Priority 3*)

Neonectria ditissima is very often a much less important disease for pear tree cultivars than for apples. Accurate evaluation needs to consider the distribution of the disease across the orchard; it is normally achieved when more than 50% of the trees are at least moderately infected. **Table 40** shows an assessment scale.

Table 40. Infection assessment scale of *Neonectria* canker on branches (Lateur, 1999)

State	Observation in the orchard	Visual rating estimation Incidence – Proportion of twigs and branches infected (%)
1	No visible canker symptom	0
2	One or very few small cankers, detectable only on close scrutiny of the tree	0–1
3	Directly apparent cankers without important consequences for the tree	1–5
4	X	X
5	Cankers widespread over the branches, inducing the death or the ablation of a large part of the crown	± 25
6	X	X
7	Heavy infection; about half of the crown is badly affected with risk of ablation or death	± 50
8	X	X
9	Maximum infection, tree completely affected, nearly dead	> 90

‘X’: Intermediate rating

4.4 Fire blight (*Erwinia amylovora*) (*Priority 2*)

Even if the EU recently (2020) classified it as a “regulated non-quarantine pests” organism (Commission Implementing Directive (EU) 2020/177), fire blight (*Erwinia amylovora)* is still a major threat to pear orchards and can have a major impact in the safe management of repository and evaluation orchards. Monitoring of the disease is needed in terms of prophylactic measures, and needs to start during the flowering period.

An assessment scale is shown in **Table 41**.

Table 41. Infection assessment scale to fire blight on branches (Lateur, 1999)

State	Observation in the orchard	Visual rating estimation Incidence (%)
1	No visible symptom	0
2	One or very few small infections, detectable only on close scrutiny of the tree	0–1
3	Directly apparent infections without important consequences for the tree	1–5
4	X	X
5	Disease widespread over the branches, inducing the death or the ablation of a large part of the crown	± 25
6	X	X
7	Heavy infection; about half of the crown is badly affected with risk of ablation or death	± 50
8	X	X
9	Maximum infection, tree completely affected, nearly dead	> 90

‘X’: Intermediate rating.

4.5 Fruit brown rot (*Monilinia fructigena*) (*Priority 2*)

Table 42. Fruit brown rot assessment scale at harvest period.

State	Brown rot susceptibility	Incidence (Estimated % of infected fruits)
1	No symptom visible	0
2	Very low	0–1
3	Low	1–5
4	Low to medium	X
5	Medium	± 25
6	Medium to high	X
7	High	± 50
8	High to very high	± 75
9	Very high	> 90

‘X’: Intermediate rating.

4.6 Pear leaf blister mite (*Eriophyes pyri*) (*Priority 3*)

Symptoms should be evaluated during late spring (**Photo 4**).

Table 43. Assessment scale for infection by pear leaf blister mites

State	Field observations	Visual rating estimation	
		Incidence (%)	Severity (%)
1	No visible symptom	0	-
2	A few small spots are detectable on close scrutiny of the tree	≤ 1	-
3	Spots immediately apparent, with lesions very thinly scattered over the tree	≤ 5	-
4	X	X	-
5	Infection widespread over the tree, majority of leaves with at least one spot	≥ 50	≤ 5
6	X	≥ 50	X
7	Heavy infection; several spots covered on most leaves	≥ 50	± 25
8	X	≥ 50	X
9	Maximum infection	≥ 50	> 75

'X': Intermediate rating.

Photo 5 – Symptoms of pear leaf blister mite on young pear leaves during springtime (CRA-W)

NB: *Other pests or diseases susceptibility assessments (*e.g. Contarinia pirivora, Psylla piri, Mycosphaerella sentina*, etc.) may be developed following the same scoring principles.*

4.7 Global tree foliage health (*Priority 3*)

Assessment should be based on overall appearance, and will represent a combination of disease tolerance, robustness and good nutrients uptake efficiency indicated by healthy green leaves. (**Table 44**).

Table 44. Assessment scale for global tree foliage health

State	Appearance
1	Extremely low health foliage (> 90% of leaves suffering diverse heavy foliar deficiencies)
2	X
3	Low health foliage (± 75% of leaves suffering diverse heavy foliar deficiencies)
4	X
5	Medium health foliage (± 50% of leaves without foliar deficiency)
6	X
7	High health foliage (± 75% of leaves without foliar deficiency)
8	X
9	Extremely high health foliage (> 90% of leaves without any foliar deficiency)

‘X’: Intermediate rating

5. Fruit quality traits

As an initial evaluation procedure, sensory assessment is simple and efficient; it provides relative values that simulate the consumer habit, but it requires some experience. In principle, a first sensory analysis can be performed directly in the orchard in front of the tree.

When assessing fruit quality by sensorial approach, it is important to select a representative fruit sample and neutralize the influence of the sample previously tasted, since this could affect the assessment. The sensorial analysis should be ideally performed by two people and the fruit should be tasted without the skin.

Accurately predicting ripening times is difficult and it is recommended to note the actual level of maturity at the date of picking and tasting by using the scale in **Table 6**.

The use of instrumental measurements can be more precise but much more time-consuming, although recommendations for these are also provided. General rules and methods recommended for the instrumental fruit trait analysis are defined in the CTIFL reference publication (Vaysse and Landry, 2004).

In general, quality measures should be assessed at eating maturity and the sample of fruit should be taken from the upper part of the tree, on the sunny side.

Pears need to be picked at their correct maturity stage – for autumn and winter pears, this means well before their eating maturity – and have to be stored in a cool room, cellar or fridge for a number of days, weeks or even months before reaching their optimal ripeness. Some cultivars are not suitable for fresh consumption before having matured.

Periodically, fruits should be inspected and the change in ground colour can be used as an indication of their maturity stage. The greenish ground colour starting to turn yellow is a useful indication. This can be cultivar specific, and for some cultivars, the assessment must be carried out earlier; for others, it is necessary to wait until the ground colour becomes fully yellow. Nowadays, people like more and more to eat pears before they reach their typically smelting texture and this is another factor that complicates the evaluation process.

Ideally, each trait linked with fruit-eating quality needs to be assessed at the optimal fruit-ripening stage.

Many old pear cultivars were only used for baking in the oven or cooking in water or after other simple processing methods (canning, drying, cider, syrup, etc.). These specific quality traits are not taken into account in the present document.

5.1 Eating maturity (*Priority 1*)

As described above, fruit samples should be stored in air at optimal temperature and humidity for their ripening process. Each week, it is necessary to check their ripening process and taste samples that reach the right ripening stage – often when fruit ground colour is just turning from green to yellow green.

Table 45. Assessment scale for estimation of the optimal eating maturity period

State	Eating maturity – Optimal relative period for best eating quality	Example of reference cultivars (Petzold and IBPGR)
1	Extremely early	Doyenné d'Eté (syn. Doyenné de Juillet), Précoce de Morettini
2	Very early	Précoce de Trévoux, Beurré Giffard
3	Early	Clapp's Favourite
4	X	Williams' Bon Chrétien, Beurré Superfin
5	Medium	Conference, Beurré Lebrun, Beurré Hardy
6	X	Louise Bonne d'Avranches
7	Late	Doyenné du Comice
8	Very late	Nec Plus Meuris, Beurré d'Hardenpont (Syn. Glou Morceau), Joséphine de Malines
9	Extremely late	Passe Crassane, Comtesse de Paris

'X': Intermediate rating

5.2. Susceptibility to fruit flesh internal core breakdown (*Priority 2*)

During the post-harvest process of ripening, some cultivars are very susceptible to an internal brown softening from their core flesh. The assessment should be made at the time of optimal eating maturity and eventually, just after.

Table 46. Assessment scale for susceptibility to develop internal fruit flesh core breakdown (Lateur, 1999)

State	Level of susceptibility	Incidence (%)	Example reference cultivars
1	Extremely low	0	
2	Very low	0–1	Beurré d'Hardenpont
3	Low	1–5	
4	X	X	
5	Medium	± 25	
6	X	X	Conference
7	High	± 50	Blanquilla
8	X	X	Beurré Lebrun, Beurré de Mérode, Calebasse à la Reine
9	Extremely high	> 90	

'X': Intermediate rating

5.3 Fruit firmness (Priority 2/3)

5.3.1. Using a penetrometer (*Priority 3*)

Following the protocol described by Vayse and Landry (2004), the assessment should be performed at a minimum at picking time, on a sample of at least six fruits, making two opposite measurements situated at the widest part of the fruit. Measurements should be taken on both sides of the fruits (for bicoloured fruit at the borders between the overcoloured zone and ground colour).

Ideally, a series of measurements should be taken at picking time, the time of transition of ground colour from green to yellow, and at eating maturity (where these differ). In all cases, an 8mm (0.5cm^2) probe should be used and skin should be removed. The data are expressed as kg/cm^2.

5.3.2. Sensory analysis (*Priority 2*)

Firmness should be evaluated at optimal eating maturity by assessing the relative force needed for masticating a bit of fruit (**Table 47**).

Table 47. Sensory assessment scale of fruit firmness

State	Fruit firmness	**Example reference cultivars** (IBPGR et CPVO)
1	Extremely soft	Beurré Giffard, Doyenné du Comice
2	Very soft	
3	Soft	Jeanne d'Arc
4	X	
5	Intermediate	Beurré Hardy, Légipont (syn. Fondante de Charneux), Conference, Williams' Bon Chrétien
6	X	
7	Firm	Comtesse de Paris, Nec Plus Meuris
8	Very firm	
9	Extremely firm	

'X': Intermediate rating

5.4 Skin thickness (*Priority 3*)

Skin thickness should be scored by sensory assessment based on the resistance to masticating the skin (**Table 48**) at the full optimal maturity stage.

Table 48. Fruit skin thickness sensory assessment scale

State	Skin thickness	**Example reference cultivars** (UPOV, Szalatnay)
1	Extremely thin	
2	Very thin	Grand Champion, Williams' Bon Chrétien
3	Thin	Beurré Bosc
4	X	
5	Medium	Doyenné du Comice, Conference
6	X	Beurré Superfin
7	Thick	Curé, Comtesse de Paris, Jeanne d'Arc
8	Very thick	St Rémy
9	Extremely thick	

'X': Intermediate rating

5.5 Flesh sweetness (*Priority 2/3)*

5.5.1 Sensory analysis (*Priority 2*)

Flesh sweetness should be assessed at optimal eating maturity.

Table 49. Flesh sweetness sensory assessment scale

State	Sweetness
1	Extremely low
2	Very low
3	Low
4	X
5	Intermediate
6	X
7	High
8	Very high
9	Extremely high

'X': Intermediate rating

5.5.2 Refractometer method (*Priority 3*)

In a laboratory: this is done, at a minimum, at optimal picking time on a sample of at least six representative fruits and is expressed as ° Brix. Standard protocols extract the juice of the fruits from two slices/fruit – with a press or an extractor – and then make the measurement on the obtained juice with a refractometer at room temperature.

In the field: the simplest method consists of putting on the refractometer a mix of at least four droplets of juice extracted by pressure between thumbs and index of pieces of fruits from different representative fruits. Another way of extracting the droplets consists of driving a glass stick into the fruit at two opposite sites situated on the largest diameter of the fruit (for bicoloured fruit at the borders between the overcoloured zone and ground colour).

Scores should be expressed as ° Brix.

5.6 Flesh acidity

Flesh acidity should be assessed and/or measured at optimal eating maturity

5.6.1. Sensory analysis (*Priority 2*)

Table 50. Flesh acidity sensory assessment scale

State	Flesh acidity
1	Extremely low acidity
2	Very low acidity
3	Low acidity
4	X
5	Intermediate acidity
6	X
7	High acidity
8	Very high acidity
9	Extremely high acidity

'X': Intermediate rating.

5.6.2. Measurement with a pH meter (*Priority 3*)

Measurements should be taken on juice from a sample of at least six representative fruits using the same juice extraction techniques as for flesh sugar measurement.

5.6.3. Measurement by titration (*Priority 3*)

Standard methods (Vaysse and Landry, 2004) should be used, with titration using NaOH. Data should be expressed in g Malic acid/l.

5.7 Ratio between acidity and sweetness (*Priority 1*)

When tasting a sample of fruit at optimal ripening stage, a general impression of the balance between acidity and sweetness should be scored (**Table 51**).

Table 51. Ratio acidity/sweetness of flesh sensory assessment scale

State	Acidity/sweetness	Example of reference cultivars
1	Extremely more acid than sweet	
2	Much more acid than sweet	Durondeau, Curé
3	More acid than sweet	Beurré Superfin, Beurré de Mérode, Beurré Alexander Lucas, Précoce de Trévoux
4	X	Williams' Bon Chrétien, Louise Bonne d'Avranches
5	Good balance acid/sugar	Doyenné du Comice
6	X	
7	More sweet than acid	
8	Much more sweet than acid	Conference, Triomphe de Vienne
9	Extremely more sweet than acid	Seigneur Esperen

'X': Intermediate rating

5.8 Flesh juiciness (*Priority 2*)

Juiciness sensory evaluation is defined as the assessment of the quantity of juice extracted from a sample of fruit at optimal maturity stage when it is masticated (**Table 52**).

Table 52. Sensory assessment scale for flesh juiciness

State	Flesh juiciness	Example reference cultivars (CPVO)
1	Extremely low	
2	Very low	
3	Low	
4	X	
5	Intermediate	
6	X	Williams' Bon Chrétien, Kontoula
7	High	Conference, Grand Champion, Kristalli
8	Very high	Doyenné du Comice, Beurré Hardy
9	Extremely high	

'X': Intermediate rating

5.9 Flesh crunchiness (*Priority 2*)

Crunchiness should be assessed as the sustained granular resistance of flesh during mastication at optimal maturity stage. It can be distinguished from crispness, in that crispness is generally associated with brittleness and the shattering of food and is short-lived. Crunchiness can also be identified by the noise made during mastication (**Table 53**).

Table 53. Flesh crunchiness sensory assessment scale

State	Flesh crunchiness	Reference cultivars
1	Extremely low	
2	Very low	
3	Low	
4	X	
5	Intermediate	
6	High	
7	Very high	
8	X	
9	Extremely high	

‘X’: Intermediate rating

5.10 Astringency feeling of the fruits (*Priority 1*)

Some specific cultivars and/or unripe cultivars and/or old specific cooking cultivars express a quantitative sensory reaction of ‘astringency’ that can be described as a “variable intensity of drying and puckering feeling on your tongue and oral cavity caused by the presence of some polyphenols and tannins” (Jiang *et al*. 2014). In some old descriptions, the term “*vinous flavour*” is used for describing some level of astringency expressed by some cultivars.

Should be assessed sensorially based on **Table 54**.

Table 54. Assessment scale for astringency quantitative feeling of pear fresh flesh

State	Astringency	Example reference cultivars
1	Extremely low	
2	Very low	
3	Low	Durondeau
4	X	
5	Medium	
6	X	Pitmaston Duchess
7	High	
8	Very high	Saint-Remy
9	Extremely high	

‘X’: Intermediate rating

5.11 Intensity of musky taste/aroma (*Priority 1*)

In old literature, flesh quality descriptions used the terminology “musky taste” or “trace of muskiness” which defines a specific aroma of some well-known cultivars like Williams' Bon Chrétien, which illustrates this specific “pear aroma”. Muskiness should be assessed as the intensity of this type of aroma at the point of optimal eating maturity (**Table 55**).

Table 55. Musky aroma intensity sensory assessment scale

State	Intensity	Example reference cultivars
1	Extremely low	Doyenné du Comice
2	Very low	
3	Low	
4	X	
5	Medium	Beurré Lebrun
6	X	
7	High	
8	Very high	Williams' Bon Chrétien
9	Extremely high	

'X': Intermediate rating

5.12 Fruit flesh texture (*Priority 1*)

The fineness or "buttery texture" or at the opposite, "coarseness" of flesh texture should be assessed sensorially and scored according to **Table 56**.

Table 56. Fruit flesh texture sensory assessment scale

State	Flesh texture	Example reference cultivars (CPVO, IBPGR)
1	Extremely fine	
2	Very Fine	Grand Champion, Doyenné du Comice, Beurré Giffard, Joséphine de Malines
3	Fine	Beurré Hardy, Conférence, Beurré Superfin, Williams' Bon Chrétien
4	X	Beurré Alexandre Lucas
5	Intermediate	Beurré Bosc, President Drouard, Nec Plus Meuris
6	X	Pitmaston Duchess (syn. Williams Duchess), Beurré Diel
7	Coarse	Précoce de Henin, Curé, Durondeau, Beurré Clairgeau
8	Very Coarse	
9	Extremely coarse	St Rémy

'X': Intermediate rating

5.13 Presence of grit cells in the flesh (*Priority 2*)

Some pear cultivars have typical grid cells of variable intensity and texture inside their flesh and especially around their central part.

Should be assessed sensorially on flesh and especially from close to the core of the fruit (**Table 57**).

Table 57. Presence of grit cells sensory assessment scale

State	Presence	Example reference cultivars (IBPGR)
1	Extremely low	Précoce de Trévoux
2	Very low	Beurré Lebrun, Louise Bonne d'Avranches
3	Low	Williams' Bon Chrétien, Ananas de Courtrai, Doyenné du Comice
4	X	Conference
5	Medium	Beurré Bosc
6	X	Précoce Henin
7	High	Kieffer
8	Very high	Saint-Remy
9	Extremely high	

'X': Intermediate rating

5.14 Overall fruit quality (*Priority 1*)

It is an obvious hedonic and relative global evaluation of the fruit quality based on multi-criteria analysis. An assessment should be made of the overall quality of the fully ripe fruit, considering all the individual quality traits. It is important to maintain an objective and comparative approach, and to avoid being influenced by personal tastes (**Table 58**).

Table 58. Overall fruit quality

State	Fruit quality	**Example reference cultivars** (IBPGR)
1	Extremely poor	Saint-Remy
2	Very poor	
3	Poor	
4	Poor to good	Ananas de Courtrai
5	Good	Conference
6	Good to very good	Williams' Bon Chrétien
7	Very good	Précoce de Trévoux, Kristalli, Kontoula
8	X	Beurré Superfin, Louise Bonne d'Avranches
9	Extremely good	Doyenné du Comice

'X': Intermediate rating

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Annex 1

Further guidance on photography

Correct camera settings are essential. **Figure 12** shows how to do it correctly.

Camera setting	✓	✗
Focus		
Exposure		
White balance		

Figure 12 – Correct camera settings

Suggested camera settings

-F25

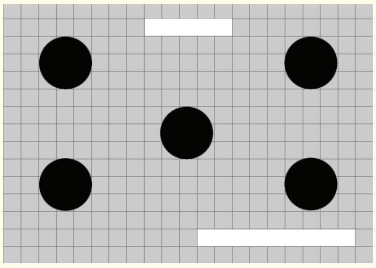
-1/640

-ISO100

Photographs can be taken in two different ways (**Figures 13** and **14**):

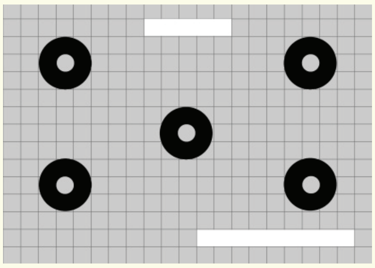
- The first option is appropriate if photographs are needed for a database only
- The second option is appropriate if pictures need to be used for high-quality printing and/or as a reference for identification/verification.

Option 1. Taking all views at once



Print templates available at http://www.clg-champollion-voisins.ac-versailles.fr/IMG/pdf/papiers_millimetres-2.pdf

Attach template on a cardboard box and put holes in cardboard box and template at places where fruits need to be placed

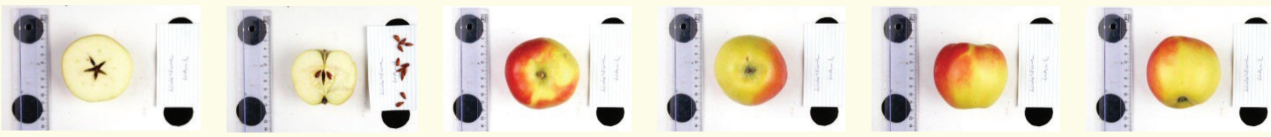


Print templates available at: http://www.clg-champollion-voisins.ac-versailles.fr/IMG/pdf/papiers_millimetres-2.pdf

Use rings (plastic, metal, model clay, …) to place fruits in the right spots

Option 2. Taking all views separately, create a picture with photo-editing software

Take a photograph of every view/angle separately



Resize every picture and cut out the fruit with photo-editing software (Adobe Photoshop or other)

Combine photographs into a picture

Main advantage: → much higher quality

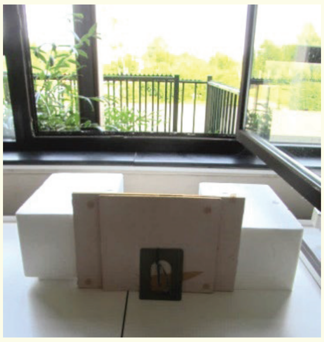
Figure 13. Suggestions for standard photography

As an alternative, another less sophisticated option for taking fruit pictures is building a simple natural 'light chamber', as illustrated in **Figure 14**.

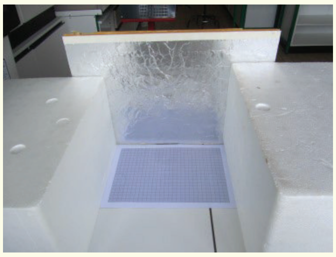
Choose a room with large windows oriented north or north-west, place a table near the window and build a 'light chamber' with sides being either white or covered with aluminium film. Leave an opening in front of the window as illustrated below.

In north-west European countries, the best quality pictures are obtained between around 10:00 am and 15:00 pm.

1. View of the handmade light chamber



Build your light chamber in front of a north/north-east window.

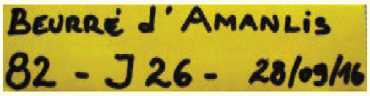


Print grey template available at http://www.clg-champollion-voisins.ac-versailles.fr/IMG/pdf/papiers_millimetres-2.pdf and place it in front of the backplate.

2. Fruit arrangement, label and taking pictures

Use rings (plastic, metal, model clay, etc.) to place fruits at the right spots (here plums as examples).

Put a label with: accession name, accession number, Tree ID, date.



Take the picture in a well perpendicular position with adapted camera tuning and having prior to that regulated the 'white balance'.

Figure 14. Illustration of an alternative way to take fruit pictures

E

TG/92/4
ORIGINAL: English
DATE: 2004-03-31

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

PERSIMMON

(*Diospyros kaki* L.) *

GUIDELINES

FOR THE CONDUCT OF TESTS

FOR DISTINCTNESS, UNIFORMITY AND STABILITY

Alternative Names:*

Latin	*English*	*French*	*German*	*Spanish*
Diospyros kaki L.	Persimmon	Plaqueminier	Kakipflaume	Caqui, Kaki

ASSOCIATED DOCUMENTS

These guidelines should be read in conjunction with document TG/1/3, "General Introduction to the Examination of Distinctness, Uniformity and Stability and the Development of Harmonized Descriptions of New Varieties of Plants" (hereinafter referred to as the "General Introduction") and its associated "TGP" documents.

* These names were correct at the time of the introduction of these Test Guidelines but may be revised or updated. [Readers are advised to consult the UPOV Code, which can be found on the UPOV Website (www.upov.int), for the latest information.]

TABLE OF CONTENTS PAGE

1. Subject of these Test Guidelines

These Test Guidelines apply to all varieties of *Diospyros kaki* L. and their hybrids.

2. Material Required

2.1 The competent authorities decide on the quantity and quality of the plant material required for testing the variety and when and where it is to be delivered. Applicants submitting material from a State other than that in which the testing takes place must ensure that all customs formalities and phytosanitary requirements are complied with.

2.2 The material is to be supplied in the form of one-year-old grafted plants on rootstocks of *Diospyros kaki* L. or *Diospyros lotus* L.

2.3 The minimum quantity of plant material, to be supplied by the applicant, should be:

5 plants.

2.4 The plant material supplied should be visibly healthy, not lacking in vigor, nor affected by any important pest or disease. It should preferably not be obtained from *in vitro* propagation. If it has been produced by *in vitro* propagation, this fact must be stated by the applicant.

2.5 The plant material should not have undergone any treatment, which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If it has been treated, full details of the treatment must be given.

3. Method of Examination

3.1 Duration of Tests

The minimum duration of tests should normally be two independent growing cycles. For the purposes of these Test Guidelines, a growing cycle refers to the fruiting cycle.

3.2 Testing Place

The tests should normally be conducted at one place. If any characteristics of the variety, which are relevant for the examination of DUS, cannot be observed at that place, the variety may be tested at an additional place.

3.3 Conditions for Conducting the Examination

The tests should be carried out under conditions ensuring satisfactory growth for the expression of the relevant characteristics of the variety and for the conduct of the examination. In particular, it is essential that the trees produce a satisfactory crop of fruit in each of the two growing cycles.

3.4 Test Design

3.4.1 Each test should be designed to result in a total of at least 5 plants.

3.4.2 The design of the tests should be such that plants or parts of plants may be removed for measurement or counting without prejudice to the observations which must be made up to the end of the growing cycle.

3.5 Number of Plants / Parts of Plants to be Examined

Unless otherwise indicated, all observations determined by measuring or counting should be made on 5 plants or parts taken from each of 5 plants. In the case of parts of plants, the number to be taken from each of the plants should be 2.

3.6 Additional Tests

Additional tests, for examining relevant characteristics, may be established.

4. Assessment of Distinctness, Uniformity and Stability

4.1 Distinctness

4.1.1 General Recommendations

It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding distinctness. However, the following points are provided for elaboration or emphasis in these Test Guidelines.

4.1.2 Consistent Differences

The minimum duration of tests recommended in Section 3.1 reflects, in general, the need to ensure that any differences in a characteristic are sufficiently consistent.

4.1.3 Clear Differences

Determining whether a difference between two varieties is clear depends on many factors, and should consider, in particular, the type of expression of the characteristic being examined, i.e. whether it is expressed in a qualitative, quantitative, or pseudo-qualitative manner. Therefore, it is important that users of these Test Guidelines are familiar with the recommendations contained in the General Introduction prior to making decisions regarding distinctness.

4.2 Uniformity

4.2.1 It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding uniformity.

4.2.2 For the assessment of uniformity a population standard of 1% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 5 plants, no off-types are allowed.

4.3 Stability

4.3.1 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, experience has demonstrated that, for many types of variety, when a variety has been shown to be uniform, it can also be considered to be stable.

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

5. Grouping of Varieties and Organization of the Growing Trial

5.1 The selection of varieties of common knowledge to be grown in the trial with the candidate varieties and the way in which these varieties are divided into groups to facilitate the assessment of distinctness is aided by the use of grouping characteristics.

5.2 Grouping characteristics are those in which the documented states of expression, even where produced at different locations, can be used, either individually or in combination with other such characteristics: (a) to select varieties of common knowledge that can be excluded from the growing trial used for examination of distinctness; and (b) to organize the growing trial so that similar varieties are grouped together.

5.3 The following have been agreed as useful grouping characteristics:

(a) Fruit: general shape in lateral view (characteristic 21);

(b) Varieties with astringency always absent or sometimes present only: Fruit: color of skin (characteristic 37);

(c) Varieties with astringency always present only: Fruit: color of skin (characteristic 38);

(d) Varieties with astringency always absent or sometimes present only: Time of ripeness for eating (characteristic 48);

(e) Varieties with astringency always present only: Time of ripeness for eating (characteristic 49);

(f) Fruit: astringency (characteristic 50).

5.4 Guidance for the use of grouping characteristics, in the process of examining distinctness, is provided through the General Introduction.

6. Introduction to the Table of Characteristics

6.1 Categories of Characteristics

6.1.1 Standard Test Guidelines Characteristics

Standard Test Guidelines characteristics are those which are approved by UPOV for examination of DUS and from which members of the Union can select those suitable for their particular circumstances.

6.1.2 Asterisked Characteristics

Asterisked characteristics (denoted by *) are those included in the Test Guidelines which are important for the international harmonization of variety descriptions and should always be examined for DUS and included in the variety description by all members of the Union, except when the state of expression of a preceding characteristic or regional environmental conditions render this inappropriate.

6.2 States of Expression and Corresponding Notes

States of expression are given for each characteristic to define the characteristic and to harmonize descriptions. Each state of expression is allocated a corresponding numerical note for ease of recording of data and for the production and exchange of the description.

6.3 Types of Expression

An explanation of the types of expression of characteristics (qualitative, quantitative and pseudo-qualitative) is provided in the General Introduction.

6.4 Example Varieties

Where appropriate, example varieties are provided to clarify the states of expression of each characteristic.

6.5 Legend

(*) Asterisked characteristic – see Section 6.1.2

QL Qualitative characteristic – see Section 6.3
QN Quantitative characteristic – see Section 6.3
PQ Pseudo-qualitative characteristic – see Section 6.3

(a)-(d) See Explanations on the Table of Characteristics in Chapter 8, Section 8.1

(+) See Explanations on the Table of Characteristics in Chapter 8, Section 8.2

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

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
1.	**(a)**	**Tree: vigor**	**Arbre: vigueur**	**Baum: Wuchsstärke**	**Árbol: vigor**		
QN		weak	faible	gering	débil	Akagaki, Izu, Kurogaki	3
		medium	moyenne	mittel	medio	Shogatsu	5
		strong	forte	stark	fuerte	Hiratanenashi, Saijo	7
2. **(*)**	**(a)**	**Tree: habit**	**Arbre: port**	**Baum: Wuchsform**	**Árbol: porte**		
PQ		upright	dressé	aufrecht	erecto	Saijo	1
		semi-upright	demi-dressé	halbaufrecht	semierecto	Hiratanenashi	2
		spreading	divergent	breitwüchsig	rastrero	Fuyu	3
		drooping	retombant	überhängend	colgante	Shakokushi	4
3. **(*)**	**(a)**	**One-year-old shoot: length**	**Rameau d'un an: longueur**	**Einjähriger Trieb: Länge**	**Rama de un año: longitud**		
QN		short	court	kurz	corta	Izu	3
		medium	moyen	mittel	media	Suruga	5
		long	long	lang	larga	Fuyu	7
4.	**(a)**	**One-year-old shoot: thickness**	**Rameau d'un an: épaisseur**	**Einjähriger Trieb: Dicke**	**Rama de un año: grosor**		
QN		thin	fin	dünn	delgada	Gosho, Nishimurawase	3
		medium	moyen	mittel	media	Jiro	5
		thick	épais	dick	gruesa	Fuyu, Hiratanenashi	7
5.	**(a)**	**One-year-old shoot: length of internode**	**Rameau d'un an: longueur de l'entre-nœud**	**Einjähriger Trieb: Länge des Inter-nodiums**	**Rama de un año: longitud del entre-nudo**		
QN		short	court	kurz	corto	Nishimurawase	3
		medium	moyen	mittel	medio	Gosho	5
		long	long	lang	largo	Fuyu, Gionbo	7

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
6.	**(a)**	**One-year-old shoot: number of lenticels**	**Rameau d'un an: nombre de lenticelles**	**Einjähriger Trieb: Anzahl Lentizellen**	**Rama de un año: número de lenticelas**		
QN		few	petit	gering	bajo	Toyoka	3
		medium	moyen	mittel	medio	Fuyu, Hiratanenashi, Jiro	5
		many	grand	groß	alto	Amahyakume, Takura	7
7.	**(a)**	**One-year-old shoot: size of lenticels**	**Rameau d'un an: taille des lenticelles**	**Einjähriger Trieb: Größe der Lenti-zellen**	**Rama de un año: tamaño de las lenticelas**		
QN		small	petites	klein	pequeñas	Aizumishirazu, Yotsumizo	3
		medium	moyennes	mittel	medias	Fuyu, Saijo	5
		large	grandes	groß	grandes	Moriya, Takura	7
8.	**(a)**	**One-year-old shoot: shape of lenticels**	**Rameau d'un an: forme des lenticelles**	**Einjähriger Trieb: Form der Lentizellen**	**Rama de un año: forma de las lenticelas**		
PQ		elliptic	elliptiques	elliptisch	elípticas	Fuyu, Hiratanenashi, Jiro	1
		circular	circulaires	kreisförmig	circulares	Hanagosho, Nishimurawase	2
		oblong	oblongues	rechteckig	oblongas	Koshuhyakume	3
9.	**(a)**	**One-year-old shoot: color (sunny side)**	**Rameau d'un an: couleur (face ensoleillée)**	**Einjähriger Trieb: Farbe (Sonnenseite)**	**Rama de un año: color (en la cara soleada)**		
PQ		grey brown	brun gris	graubraun	marrón grisáceo	Sanja, Yotsumizo	1
		yellow brown	brun jaune	gelbbraun	marrón amarillento	Hiratanenashi	2
		brown	brun	braun	marrón	Atago	3
		red brown	brun rouge	rotbraun	marrón rojizo	Fuyu	4
10. (*) (+)	**(a)**	**One-year-old shoot: shape of bud in profile view**	**Rameau d'un an: forme du bourgeon vu de profil**	**Einjähriger Trieb: Form der Knospe in der Seitenansicht**	**Rama de un año: forma de la yema vista de perfil**		
PQ		triangular	triangulaire	dreieckig	triangular	Aizumishirazu, Fuyu	1
		broad ovate	ovale large	breit eiförmig	ovalada ancha	Jiro, Saijo	2
		circular	circulaire	kreisförmig	circular	Hiratanenashi	3

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
11.	**(b)**	**Leaf blade: length**	**Limbe: longueur**	**Blattspreite: Länge**	**Limbo: longitud**		
QN		short	court	kurz	corto	Hanagosho, Hiratanenashi	3
		medium	moyen	mittel	medio	Fuyu, Nishimurawase	5
		long	long	lang	largo	Aizumishirazu, Saijo	7
12.	**(b)**	**Leaf blade: width**	**Limbe: largeur**	**Blattspreite: Breite**	**Limbo: anchura**		
QN		narrow	étroit	schmal	estrecho	Eboshi	3
		medium	moyen	mittel	medio	Fuyu, Jiro	5
		broad	large	breit	ancho	Koshuhyakume	7
13. **(*)** **(+)**	**(b)**	**Leaf blade: shape**	**Limbe: forme**	**Blattspreite: Form**	**Limbo: forma**		
PQ		elliptic	elliptique	elliptisch	elíptica	Aizumishirazu, Fuyu	1
		ovate	ovale	eiförmig	oval	Hanagosho, Hiratanenashi	2
		obovate	obovale	verkehrt eiförmig	oboval	Shakokushi	3
14. **(*)** **(+)**	**(b)**	**Leaf blade: shape of base**	**Limbe: forme de la base**	**Blattspreite: Form der Basis**	**Limbo: forma de la base**		
PQ		narrow acute	aiguë étroite	schmalspitz	aguda estrecha	Eboshi	1
		broad acute	aiguë large	breitspitz	aguda ancha	Aizumishirazu	2
		obtuse	obtuse	stumpf	obtusa	Fuyu, Gosho	3
		rounded	arrondie	abgerundet	redondeada	Amahyakume, Suruga	4
15. **(+)**	**(b)**	**Leaf blade: shape of apex**	**Limbe: forme du sommet**	**Blattspreite: Form der Spitze**	**Limbo: forma del ápice**		
PQ		acuminate	acuminé	mit aufgesetzter Spitze	acuminado	Aizumishirazu	1
		acute	aigu	spitz	agudo	Atago, Fuyu, Jiro, Saijo	2
		obtuse	obtus	stumpf	obtuso	Hiratanenashi, Suruga	3

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
16. (*)	(a)	**Tree: sex expression of flowers**	**Arbre: expression du sexe des fleurs**	**Baum: Geschlechtsausprägung der Blüten**	**Árbol: expresión del sexo de las flores**		
QL		female only	femelles seulement	nur weiblich	sólo femeninas	Fuyu, Hiratanenashi, Jiro	1
		female and male	femelles et mâles	weiblich und männlich	femeninas y masculinas	Hanagosho	2
		female, male and hermaphrodite	femelles, mâles et hermaphrodites	weiblich, männlich und zwittrig	femeninas, masculinas y hermafroditas	Kubogataobishi, Meotogaki	3
17. (*)	(c)	**Female flower: diameter of corolla**	**Fleur femelle: diamètre de la corolle**	**Weibliche Blüte: Durchmesser der Krone**	**Flor femenina: diámetro de la corola**		
QN		small	petit	klein	pequeño	Kubo, Yotsumizo	3
		medium	moyen	mittel	medio	Aizumishirazu	5
		large	grand	groß	grande	Amahyakume, Koshuhyakume	7
18. (+)	(c)	**Female flower: shape of calyx viewed from above**	**Fleur femelle: forme du calice vu de dessus**	**Weibliche Blüte: Form des Kelches von oben gesehen**	**Flor femenina: forma del cáliz visto desde arriba**		
PQ		circular	circulaire	kreisförmig	circular	Anzai	1
		rounded rhombic	losangique arrondi	abgerundet rautenförmig	rómbico redondeado	Izu	2
		rhombic	losangique	rautenförmig	rómbico	Aizumishirazu, Fuyu	3
		regular cruciform	cruciforme régulier	regelmäßig kreuzförmig	cruciforme regular	Hiratanenashi, Jiro	4
		irregular cruciform	cruciforme irrégulier	unregelmäßig kreuzförmig	cruciforme irregular	Oshorokaki	5
19. (*)	(c)	**Female flower: number of corolla lobes**	**Fleur femelle: nombre de lobes de la corolle**	**Weibliche Blüte: Anzahl Kronzipfel**	**Flor femenina: número de lóbulos de la corola**		
QL		four	quatre	vier	cuatro	Koshuhyakume	1
		more than four	plus de quatre	mehr als vier	más de cuatro	Marcatelli	2

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
20. (*)	**(d)**	**Fruit: size**	**Fruit: taille**	**Frucht: Größe**	**Fruto: tamaño**		
QN		small	petit	klein	pequeño	Yotsumizo	3
		medium	moyen	mittel	medio	Hiratanenashi, Izu	5
		large	gros	groß	grande	Fuyu, Koshuhyakume	7
21. (*) (+)	**(d)**	**Fruit: general shape in lateral view**	**Fruit: forme générale en vue latérale**	**Frucht: allgemeine Form in der Seitenansicht**	**Fruto: forma general en vista lateral**		
PQ		narrow elliptic	elliptique étroit	schmal elliptisch	elíptico estrecho		1
		elliptic	elliptique	elliptisch	elíptico	Saijo	2
		circular	circulaire	kreisförmig	circular	Aizumishirazu, Amahyakume	3
		oblate	aplati	breitrund	achatado	Fuyu, Izu, Jiro	4
		transverse broad oblong	oblong transversal large	quer breit rechteckig	oblongo ancho transversal	Hiratanenashi	5
		ovate	ovale	eiförmig	oval	Atago, Yotsumizo	6
		broad ovate	ovale large	breit eiförmig	oval ancho	Koshuhyakume	7
		very broad ovate	ovale très large	sehr breit eiförmig	oval muy ancho	Hanagosho	8
22. (*) (+)	**(d)**	**Fruit: general shape in cross section**	**Fruit: forme générale en section transversale**	**Frucht: allgemeine Form im Querschnitt**	**Fruto: forma general en sección transversal**		
PQ		circular	circulaire	kreisförmig	circular	Aizumishirazu, Fuyu	1
		irregular rounded	arrondi irrégulier	unregelmäßig abgerundet	redondeado irregular	Nishimurawase	2
		square	quadrangulaire	quadratisch	cuadrado	Hiratanenashi, Jiro	3

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
23. **(*)** **(+)**	**(d)**	**Fruit: shape of apex in longitudinal section**	**Fruit: forme du sommet en section longitudinale**	**Frucht: Form der Spitze im Längsschnitt**	**Fruto: forma del ápice en sección longitudinal**		
PQ		acuminate	acuminé	mit aufgesetzter Spitze	acuminado	Hoshomaru	1
		obtuse	obtus	stumpf	obtuso		2
		rounded	arrondi	abgerundet	redondeado	Hanagosho, Nishimurawase	3
		truncate	tronqué	abgeflacht	truncado	Akagaki, Fuyu	4
		retuse	échancré	eingedrückt	retuso	Aizumishirazu, Zenjimaru	5
24. **(+)**	**(d)**	**Fruit: grooving at apex**	**Fruit: cannelures au sommet**	**Frucht: Riefung an der Spitze**	**Fruto: acanalado del ápice**		
QN		absent or weak	absentes ou faibles	fehlend oder gering	ausente o débil	Saijo, Suruga	1
		moderate	modérées	mäßig	moderado	Atago, Hanagosho	2
		strong	importantes	stark	fuerte	Aizumishirazu	3
25. **(+)**	**(d)**	**Fruit: shallow concentric cracking around apex**	**Fruit: craquelures concentriques superficielles autour du sommet**	**Frucht: flaches konzentrisches Platzen um die Spitze**	**Fruto: agrietamiento concéntrico superficial alrededor del ápice**		
QN		absent or weak	absentes ou faibles	fehlend oder gering	ausente o débil	Fuyu, Hiratanenashi, Jiro	1
		moderate	modérées	mäßig	moderado	Saijo	2
		strong	importantes	stark	fuerte	Dojohachiya, Ichidagaki	3
26. **(+)**	**(d)**	**Fruit: cracking of apex**	**Fruit: craquelures du sommet**	**Frucht: Platzen der Spitze**	**Fruto: agrietamiento del ápice**		
QN		absent or weak	absentes ou faibles	fehlend oder gering	ausente o débil	Fuyu, Hiratanenashi, Saijo	1
		moderate	modérées	mäßig	moderado	Gosho, Hanagosho	2
		strong	importantes	stark	fuerte	Jiro, Okugosho	3

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
27. **(+)**	**(d)**	**Fruit: longitudinal grooving**	**Fruit: cannelures longitudinales**	**Frucht: Längs-riefung**	**Fruto: acanalado longitudinal**		
QN		absent to very shallow	absentes à très superficielles	fehlend bis sehr flach	ausente a muy superficial	Fuyu, Hiratanenashi	1
		shallow	superficielles	flach	superficial	Mizushima	3
		medium	moyennes	mittel	medio	Jiro	5
		deep	profondes	tief	profundo	Gionbo	7
28.	**(d)**	**Fruit: wrinkles at calyx end**	**Fruit: rides à l'œil**	**Frucht: Runzeln am Kelchende**	**Fruto: arrugas en el extremo del cáliz**		
QN		absent to very few	absentes à très rares	fehlend bis sehr wenige	ausentes a muy pocas	Fuyu, Hiratanenashi	1
		few	rares	wenige	pocas	Akagaki, Koshuhyakume	3
		medium	moyennes	mittel	medias	Jiro	5
		many	nombreuses	viele	muchas	Fujiwaragosho	7
29. **(+)**	**(d)**	**Fruit: calyx attachment**	**Fruit: attache du calice**	**Frucht: Kelchansatz**	**Fruto: inserción del cáliz**		
QN		level	plate	eben	al mismo nivel	Saijo	1
		slightly depressed	légèrement creuse	leicht eingesenkt	ligeramente deprimido	Yotsumizo	2
		strongly depressed	très creuse	stark eingesenkt	fuertemente deprimido	Fuyu, Hiratanenashi, Izu, Jiro	3
30. **(+)**	**(d)**	**Fruit: groove at calyx end**	**Fruit: cannelure à l'œil**	**Frucht: Furche am Kelchende**	**Fruto: acanaladura en el extremo del cáliz**		
QL		absent	absente	fehlend	ausente	Fuyu, Jiro	1
		present	présente	vorhanden	presente	Damopan, Fudegaki	9
31.	**(d)**	**Fruit: cracking at calyx end**	**Fruit: craquelures à l'œil**	**Frucht: Platzen am Kelchende**	**Fruto: agrieta-miento en el extremo del cáliz**		
QN		absent or weak	absentes ou faibles	fehlend oder gering	ausente o débil	Hiratanenashi, Zenjimaru	1
		moderate	modérées	mäßig	moderado	Fuyu	2
		strong	importantes	stark	fuerte	Hanagosho, Suruga	3

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
32. **(+)**	**(d)**	**Fruit: calyx size compared with fruit diameter**	**Fruit: taille du calice par rapport au diamètre du fruit**	**Frucht: Größe des Kelches im Vergleich zum Durchmesser der Frucht**	**Fruto: tamaño del cáliz en relación con el diámetro del fruto**		
QN		small	petit	klein	pequeño	Naganogosho	3
		medium	moyen	mittel	medio	Atago, Fuyu, Hiratanenashi	5
		large	grand	groß	grande	Amahyakume, Dojohachiya	7
33. **(*)** **(+)**	**(d)**	**Fruit: attitude of calyx**	**Fruit: port du calice**	**Frucht: Haltung des Kelches**	**Fruto: porte del cáliz**		
QN		erect	dressé	aufrecht	erecto	Aizumishirazu, Saijo	1
		semi-erect	demi-dressé	halbaufrecht	semierecto	Hiratanenashi, Jiro	2
		horizontal	horizontal	waagerecht	horizontal	Dojohachiya, Fuyu, Izu	3
34. **(+)**	**(d)**	**Fruit: width of sepal**	**Fruit: largeur du sépale**	**Frucht: Breite des Kelchblattes**	**Fruto: anchura del sépalo**		
QN		narrow	étroit	schmal	estrecho	Kubo, Saijo	3
		medium	moyen	mittel	medio	Akagaki, Hanagosho	5
		broad	large	breit	ancho	Fuyu, Gosho, Jiro, Yotsumizo	7
35.	**(d)**	**Fruit: length of stalk**	**Fruit: longueur du pédoncule**	**Frucht: Länge des Stieles**	**Fruto: longitud del pedúnculo**		
QN		short	court	kurz	corto	Fuyu, Hanagosho, Jiro	3
		medium	moyen	mittel	medio	Hiratanenashi, Saijo	5
		long	long	lang	largo	Fudegaki, Zenjimaru	7
36.	**(d)**	**Fruit: thickness of stalk**	**Fruit: épaisseur du pédoncule**	**Frucht: Dicke des Stieles**	**Fruto: grosor del pedúnculo**		
QN		thin	fin	dünn	delgado	Saijo, Yotsumizo	3
		medium	moyen	mittel	medio	Nishimurawase	5
		thick	épais	dick	grueso	Fuyu, Jiro	7

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
37. (*) (+)	**(d)**	**<u>Varieties with astringency always absent or sometimes present only</u>: Fruit: color of skin**	**<u>Variétés toujours ou parfois non astringentes seulement</u>: Fruit: couleur de la peau**	**<u>Nur nie oder manchmal adstringierende Sorten</u>: Frucht: Farbe der Haut**	**<u>Sólo variedades que son siempre o a veces no astringentes</u>: Fruto: color de la epidermis**		
PQ		yellow orange	orange jaune	gelborange	naranja amarillento	Shogatsu	1
		orange	orange	orange	naranja	Hazegosho, Yamatogosho	2
		orange red	rouge orangé	orangerot	rojo anaranjado	Fuyu, Izu, Jiro, Nishimurawase	3
		dark purple	pourpre foncé	dunkelpurpurn	púrpura oscuro	Kurogaki	4
38. (*) (+)	**(d)**	**<u>Varieties with astringency always present only</u>: Fruit: color of skin**	**<u>Variétés toujours astringentes seulement</u>: Fruit: couleur de la peau**	**<u>Nur immer adstringierende Sorten</u>: Frucht: Farbe der Haut**	**<u>Sólo variedades que son siempre astringentes</u>: Fruto: color de la epidermis**		
PQ		yellow orange	orange jaune	gelborange	naranja amarillento	Gionbo, Saijo	1
		orange	orange	orange	naranja	Aizumishirazu, Hiratanenashi	2
		red orange	orange rouge	rotorange	naranja rojizo	Koshuhyakume	3
39. (*) (+)	**(d)**	**<u>Varieties with astringency always absent or sometimes present only</u>: Fruit: color of flesh**	**<u>Variétés toujours ou parfois non astringentes seulement</u>: Fruit: couleur de la chair**	**<u>Nur nie oder manchmal adstringierende Sorten</u>: Frucht: Farbe des Fleisches**	**<u>Sólo variedades que son siempre o a veces no astringentes</u>: Fruto: color de la pulpa**		
PQ		yellow	jaune	gelb	amarillo		1
		yellow orange	orange jaune	gelborange	naranja amarillento	Hana-fuyu	2
		orange	orange	orange	naranja	Fuyu, Jiro	3
		orange red	rouge orangé	orangerot	rojo anaranjado	Gosho, Izu, Suruga	4
		brown orange	orange brun	braunorange	naranja pardo	Tipo	5
		brown	brun	braun	marrón	Mercatelli	6

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
40. (*) (+)	(d)	**Varieties with astringency always present only: Fruit: color of flesh**	**Variétés toujours astringentes seulement: Fruit: couleur de la chair**	**Nur immer adstringierende Sorten: Frucht: Farbe des Fleisches**	**Sólo variedades que son siempre astrin-gentes: Fruto: color de la pulpa**		
PQ		yellow	jaune	gelb	amarillo	Damopan	1
		orange yellow	jaune orangé	orangegelb	amarillo anaranjado	Aizumishirazu, Atago, Costata, Saijo	2
		orange	orange	orange	naranja	Cicopersicon, Farmacista-honorati, Triumph, Yokono	3
		red orange	orange rouge	rotorange	naranja rojizo	Tamamoto, Yotsumizo	4
		brown	brun	braun	marrón		5
41. (+)	(d)	**Fruit: presence of brown specks in flesh**	**Fruit: présence de points bruns dans la chair**	**Frucht: Vorhanden-sein brauner Flecken im Fleisch**	**Fruto: presencia de manchas marrones en la pulpa**		
QL		always absent	toujours absents	immer fehlend	siempre ausentes	Atago, Saijo	1
		sometimes present	parfois présents	manchmal vorhanden	a veces presentes	Zenjimaru	2
		always present	toujours présents	immer vorhanden	siempre presentes	Fuyu, Jiro	3
42.	(d)	**Fruit: size of brown specks in flesh**	**Fruit: taille des points bruns dans la chair**	**Frucht: Größe der braunen Flecken im Fleisch**	**Fruto: tamaño de las manchas marrones en la pulpa**		
QN		small	petits	klein	pequeñas	Fuyu, Jiro	3
		medium	moyens	mittel	medias	Amahyakume, Shogatsu	5
		large	gros	groß	grandes	Nishimurawase, Zenjimaru	7
43.		**Seed: size**	**Pépin: taille**	**Samen: Größe**	**Semilla: tamaño**		
QN		small	petit	klein	pequeña	Gosho	3
		medium	moyen	mittel	media	Nishimurawase	5
		large	gros	groß	grande	Atago, Fuyu	7

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
44. **(+)**	**Seed: shape in lateral view**	**Pépin: forme en vue latérale**	**Samen: Form in der Seitenansicht**	**Semilla: forma en vista lateral**		
PQ	narrow elliptic	elliptique étroite	schmal elliptisch	elíptica estrecha	Atago, Mercatelli, Saijo	1
	ovate	ovale	eiförmig	oval	Hanagosho, Yokono	2
	broad ovate	ovale large	breit eiförmig	oval ancha	Maekawajiro	3
	semi broad elliptic	semi-elliptique large	halb breitelliptisch	semi elíptica ancha		4
	semi oblate	semi-aplatie	halb breitrund	semi oblata	Fuyu	5
45.	**Seed: color**	**Pépin: couleur**	**Samen: Farbe**	**Semilla: color**		
PQ	green brown	brun gris	grünbraun	marrón verdoso	Saijo	1
	medium brown	brun moyen	mittelbraun	marrón medio	Aizumishirazu, Akagaki	2
	dark brown	brun foncé	dunkelbraun	marrón oscuro	Fuyu, Jiro	3
46. **(*)**	**Time of flowering of female flower (80% open)**	**Époque de floraison de la fleur femelle (80% des fleurs épanouies)**	**Blühzeitpunkt der weiblichen Blüte (80% offen)**	**Época de floración de la flor femenina (80% de las flores abiertas)**		
QN	early	précoce	früh	temprana	Hiratanenashi, Nishimurawase	3
	medium	moyenne	mittel	media	Izu, Jiro	5
	late	tardive	spät	tardía	Fuyu, Gosho	7
47.	**Time of vegetative bud burst**	**Époque de débourrement**	**Zeitpunkt des Aufbruchs der vegetativen Knospe**	**Época de brotación de las yemas de madera**		
QN	early	précoce	früh	temprana	Hiratanenashi	3
	medium	moyenne	mittel	media	Koshuhyakume	5
	late	tardive	spät	tardía	Fuyu	7

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
48. **(*)** **(+)**	**Varieties with astringency always absent or sometimes present only: Time of ripeness for eating**	**Variétés toujours ou parfois non astringentes seulement: Époque de maturité pour la consommation**	**Nur nie oder manchmal adstringierende Sorten: Zeitpunkt der Genußreife**	**Sólo variedades que son siempre o a veces no astringentes: Época de madurez para el consumo**		
QN	early	précoce	früh	temprana	Izu, Nishimurawase	3
	medium	moyenne	mittel	media	Matsumotowase-fuyu, Mizushima	5
	late	tardive	spät	tardía	Amahyakume, Fuyu, Gosho	7
49. **(*)** **(+)**	**Varieties with astringency always present only: Time of ripeness for eating**	**Variétés toujours astringentes seulement: Époque de maturité pour la consommation**	**Nur immer adstringierende Sorten: Zeitpunkt der Genußreife**	**Sólo variedades que son siempre astringentes: Época de madurez para el consumo**		
QN	early	précoce	früh	temprana	Ichidagaki, Tonewase	3
	medium	moyenne	mittel	media	Hiratanenashi, Koshuhyakume	5
	late	tardive	spät	tardía	Aizumishirazu, Atago	7
50. **(+)**	**Fruit: astringency**	**Fruit: astringence**	**Frucht: Adstringenz**	**Fruto: astringencia**		
QL	always absent	toujours absente	immer fehlend	siempre ausente	Fuyu, Gosho, Jiro	1
	sometimes present	parfois présente	manchmal vorhanden	a veces presente	Nishimurawase, Shogatsu	2
	always present	toujours présente	immer vorhanden	siempre presente	Aizumishirazu, Atago, Koshuhyakume, Saijo	3

8. Explanations on the Table of Characteristics

8.1 Explanations covering several characteristics

Characteristics containing the following key in the second column of the Table of Characteristics should be examined as indicated below:

(a) Tree/One-year-old shoot: Observations on the tree and the one-year-old shoot should be made during the dormant season. Observations on the one-year-old shoot should be made on the middle third of the shoot.

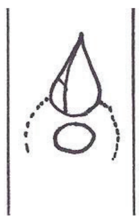
(b) Leaf: Observations on the leaf should be made in summer on fully developed leaves from the middle third of a current season's shoot.

(c) Flower: Observations on the flower should be made on fully developed flowers at full flowering.

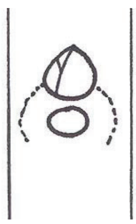
(d) Fruit: Observations on the fruit should be made on fruits at the time of harvest maturity.

8.2 Explanations for individual characteristics

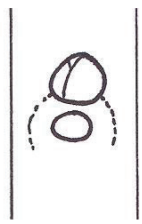
Ad. 10: One-year-old shoot: shape of bud in profile view



1
triangular

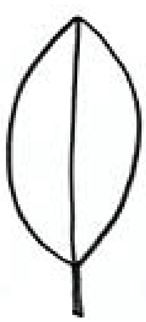


2
broad ovate

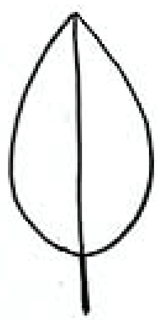


3
circular

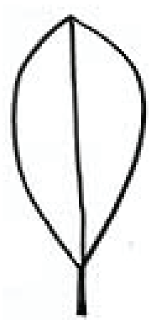
Ad. 13: Leaf blade: shape



1
elliptic

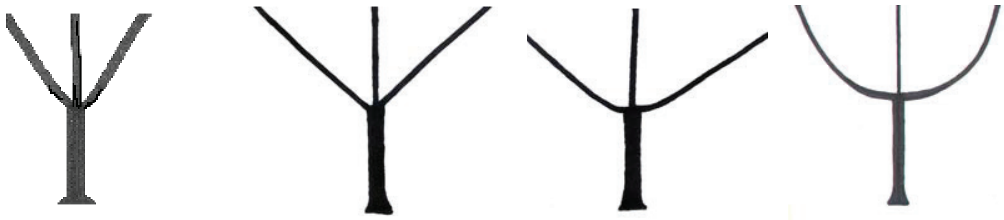


2
ovate



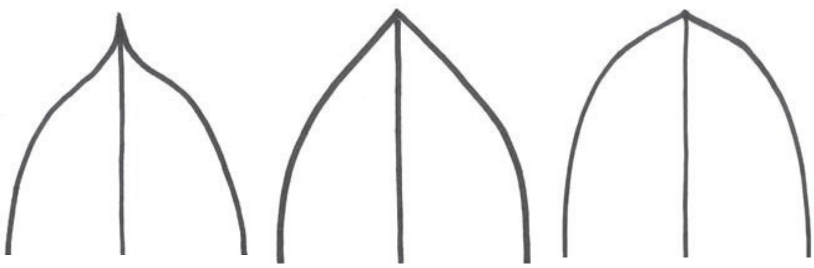
3
obovate

Ad. 14: Leaf blade: shape of base



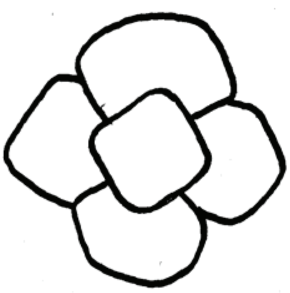
1	2	3	4
narrow acute	broad acute	obtuse	rounded

Ad. 15: Leaf blade: shape of apex

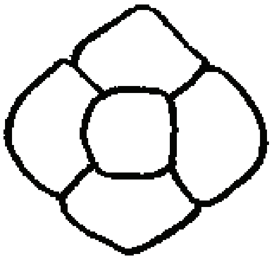


1	2	3
acuminate	acute	obtuse

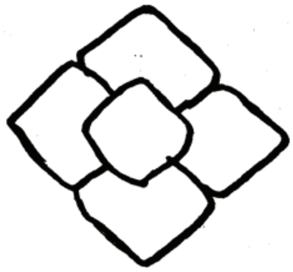
Ad. 18: Female flower: shape of calyx viewed from above



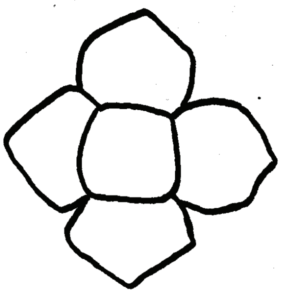
1
circular



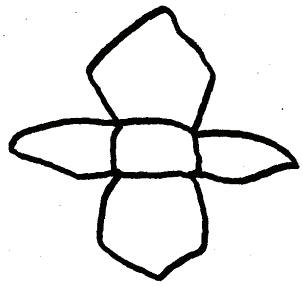
2
rounded rhombic



3
rhombic



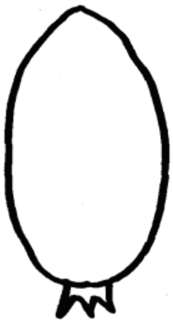
4
regular cruciform



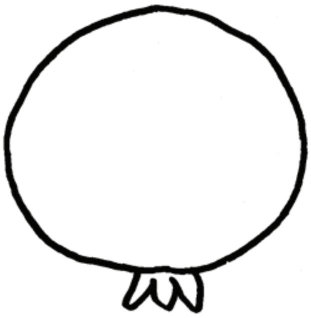
5
irregular cruciform

Ad. 21: Fruit: general shape in lateral view

1
narrow elliptic

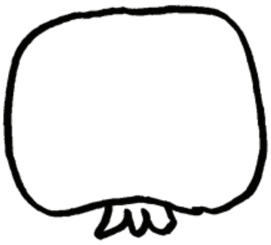


2
elliptic

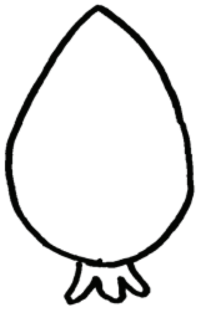


3
circular

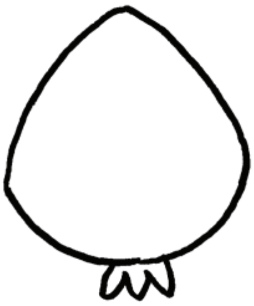
4
oblate



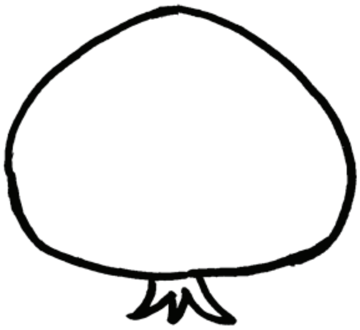
5
transverse broad oblong



6
ovate

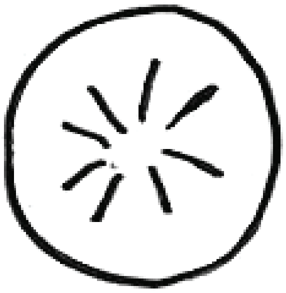


7
broad ovate



8
very broad ovate

Ad. 22: Fruit: general shape in cross section



1
circular

2
irregular rounded

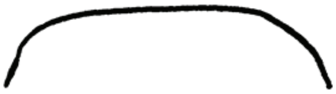
3
square

Ad. 23: Fruit: shape of apex in longitudinal section

1
acuminate

2
obtuse

3
rounded

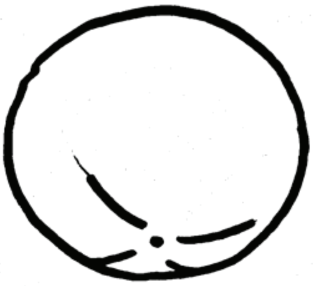


4
truncate

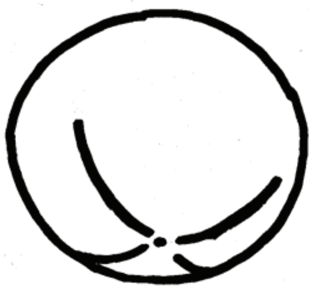
5
retuse

Ad. 24: Fruit: grooving at apex

1
absent or weak

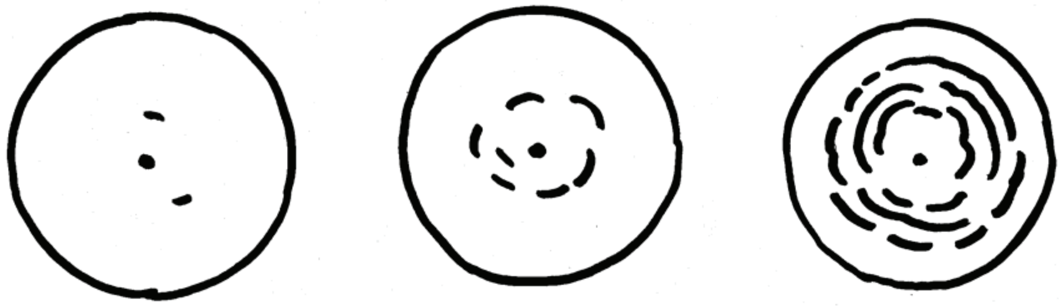


2
moderate



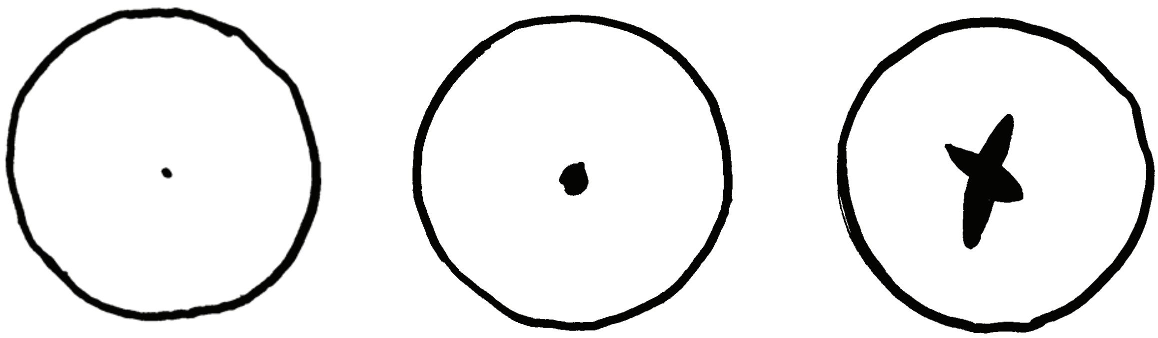
3
strong

Ad. 25: Fruit: shallow concentric cracking around apex



1	2	3
absent or weak	moderate	strong

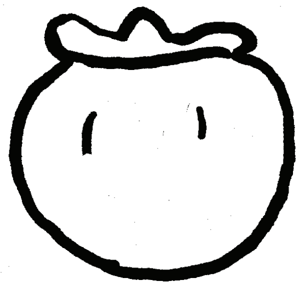
Ad. 26: Fruit: cracking of apex



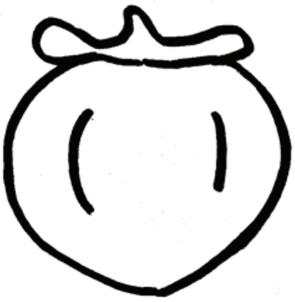
1	2	3
absent or weak	moderate	strong

Ad. 27: Fruit: longitudinal grooving

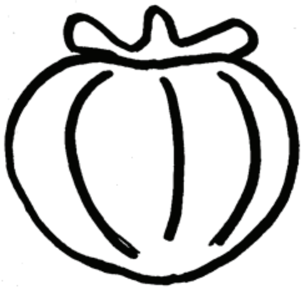
1
absent to very shallow



3
shallow



5
medium



7
deep

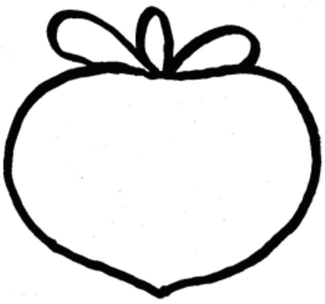
Ad. 29: Fruit: calyx attachment

1
level

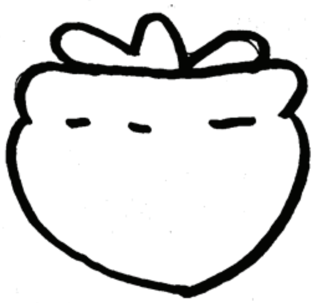
2
slightly depressed

3
strongly depressed

Ad. 30: Fruit: groove at calyx end

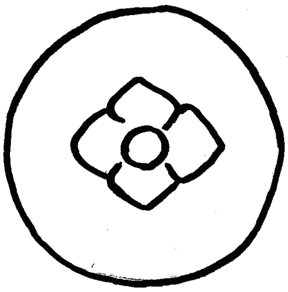


1
absent

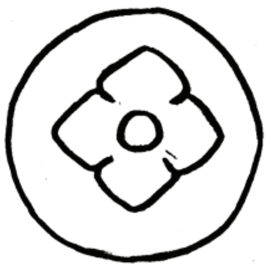


9
present

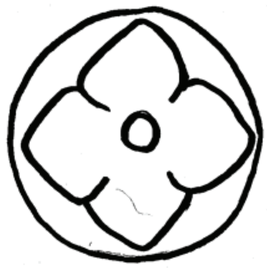
Ad. 32: Fruit: calyx size compared with fruit diameter



3
small

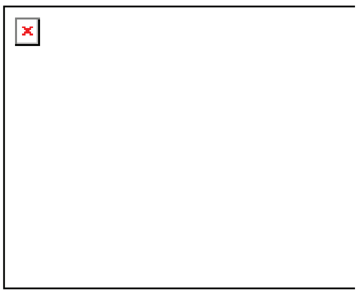


5
medium

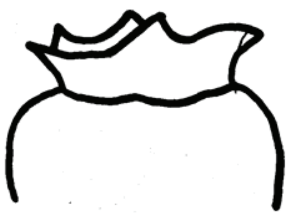


7
large

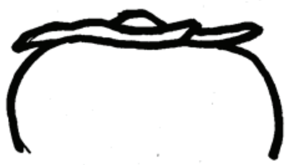
Ad. 33: Fruit: attitude of calyx



1
erect



2
semi-erect



3
horizontal

Ad. 34: Fruit: width of sepal

The width of sepal should be measured as the width of the broadest of the sepals.

Ad. 37; 39; 48: Varieties with astringency always absent or sometimes present only: Fruit: color of skin (37); Fruit: color of flesh (39); Time of ripeness for eating (48)

The time of ripeness for non-astringent varieties is reached when the flesh is still firm and the color of skin changes.

Ad. 38; 40; 49: Varieties with astringency always present only: Fruit: color of skin (38); Fruit: color of flesh (40); Time of ripeness for eating (49)

The time of ripeness for astringent varieties is reached when the flesh becomes soft after post harvest storage. The fruits should be stored at normal room temperature (about 15 ^{o}C), without any chemical or other treatments.

Ad. 41: Fruit: presence of brown specks in flesh

For some varieties, the presence of brown specks in the flesh is pollination variant (state 2). For those varieties, the presence and number of seeds influence the presence of brown specks (see also 8.3 Classification of Persimmon).

Ad. 44: Seed: shape in lateral view

1
narrow elliptic

2
ovate

3
broad ovate

4
semi broad elliptic

5
semi oblate

Ad. 50: Fruit: astringency

For some varieties, astringency is not consistent (state 2). For those varieties, the presence and number of seeds determine astringency (see also 8.3 Classification of Persimmon).

8.3 Classification of Persimmon

Varieties of Persimmon can be classified into Pollination Constant (PC) and Pollination Variant (PV) types, as follow:

(A = Astringent; NA = Non-Astringent)

PC (Pollination Constant) varieties:

- are always astringent or always not astringent;
- have brown specks always present in the flesh or always absent.

PV (Pollination Variant) varieties:

- are always astringent or sometimes astringent (depending on the presence and number of seeds);
- sometimes have brown specks in the flesh (depending on the presence and number of seeds). PV Astringent (PVA) varieties only have brown specks around the seed. PV Non Astringent (PVNA) varieties have brown specks around the seed and sometimes these extend over a wide area of flesh (depending on the number of seeds).

This classification is explained in relation to the states of expression of certain characteristics in the Table of Characteristics in Table 1. Table 2 presents a classification on the basis of a combination of pollination types (PC/PV) and astringency types (A/NA). Table 3 presents the example varieties according to the classification provided in Table 2.

Table1: Classification of Persimmon Varieties in Relation to States of Expression for Characteristics 41 and 50

	State 1 (always absent)	State 2 (sometimes present)	State 3 (always present)
Char. 41 Fruit: presence of brown speck	PCA	PVA PVNA	PCNA
Char. 50 Fruit: astringency	PCNA	PVNA	PVA PCA

Table 2: Classification of Persimmon Varieties on the Basis of a Combination of Pollination Types (PC/PV) and Astringency Types (A/NA)

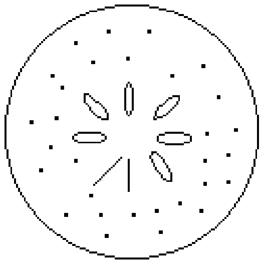
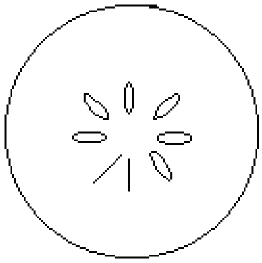
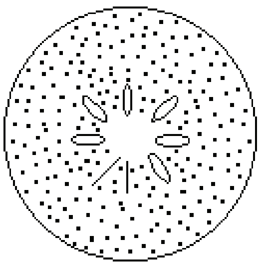
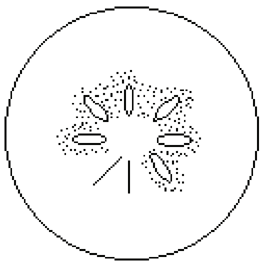
Class	Cross-section	Features
PCNA		Always non-astringent at maturity. Always have small number of brown specks in flesh.
PCA		Always astringent at maturity. Never have brown specks in flesh.
PVNA		Sometimes non-astringent at maturity. Brown specks around seeds and sometimes over a wide area of flesh (the area depends on numbers of seeds).
PVA		Always astringent at maturity. Brown specks around seeds.

Table 3: Classification of Example Varieties

Example Varieties	Type	Example Varieties	Type
Aizumishirazu	PVA	Meotogaki	PCA
Akagaki	PVNA	Marcatelli	PVNA
Akoumankaki	PVNA	Matsumotowase-fuyu	PCNA
Amahyakume	PVNA	Mercatelli	PVNA
Anzai	PVNA	Mikatanigosho	PVNA
Atago	PCA	Mizushima	PVNA
Costata	PCA	Moriya	PCA
Damopan	PCA	Naganogosho	PVNA
Dojohachiya	PCA	Nishimurawase	PVNA
Eboshi	PCA	Obishi	PVNA
Farmacista-honorati	PCA	Ogosho	PCNA
Fudegaki	PVNA	Okugosho	PCA
Fujiwaragosho	PCNA	Oshorokaki	PVNA
Fuyu	PCNA	Saijo	PCA
Gionbo	PCA	Sanja	PCA
Gosho	PCNA	Shakokushi	PCA
Hana–fuyu	PCNA	Shogatsu	PVNA
Hanagosho	PCNA	Square	PCA
Hazegosho	PCNA	Suruga	PCNA
Hiratanenashi	PVA	Takura	PCA
Hoshomaru	PVA	Tamamoto	PCA
Ichidagaki	PCA	Tonewase	PVA
Izu	PCNA	Tipo	PVNA
Jiro	PCNA	Toyoka	PVNA
Koshuhyakume	PVA	Tsurunohashi	PCA
Kubo	PVNA	Yamato	PCA
Kubogataobishi	PVNA	Yamatogosho	PCNA
Kurogaki	PVNA	Yokono	PCA
Lycopersicon	PCA	Yotsumizo	PCA
Maekawajiro	PCNA	Zenjimaru	PVNA

9. Literature

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10. Technical Questionnaire

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Application date: (not to be filled in by the applicant)

TECHNICAL QUESTIONNAIRE
to be completed in connection with an application for plant breeders' rights

1. Subject of the Technical Questionnaire

1.1 Latin Name	*Diospyros kaki* L.
1.2 Common Name	Persimmon

2. Applicant

Name	
Address	
Telephone No.	
Fax No.	
E-mail address	
Breeder (if different from applicant)	

3. Proposed denomination and breeder's reference

Proposed denomination (if available)	
Breeder's reference	

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

4. Information on the breeding scheme and propagation of the variety

4.1 Breeding scheme

Variety resulting from:

4.1.1 Crossing

(a) controlled cross [ ]
(please state parent varieties)
(b) partially unknown cross [ ]
(please state known parent variety(ies))
(c) unknown cross [ ]

4.1.2 Mutation [ ]
(please state parent variety)

4.1.3 Discovery and development [ ]
(please state where and when discovered
and how developed)

4.1.4 Other [ ]
(please provide details)

4.2 Method of propagating the variety

4.2.1 Vegetatively propagated varieties

(a) *in vitro* propagation [ ]

(b) other (e.g. leaf cutting, hardwood cutting, layer) [ ]
(state method)

4.2.2 Seed-propagated varieties [ ]

4.2.3 Other [ ]
(please provide details)

4.3 Virus status

4.3.1 The variety is free from all known viruses as follows: [ ]
(indicate from which viruses)

4.3.2 The plant material is virus tested: [ ]
(indicate against which viruses)

4.3.3 The virus status is unknown [ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

5. Characteristics of the variety to be indicated (the number in brackets refers to the corresponding characteristic in Test Guidelines; please mark the note which best corresponds).

	Characteristics	Example Varieties	Note
5.1 (21)	**Fruit: general shape in lateral view**		
	narrow elliptic		1[ ]
	elliptic	Saijo	2[ ]
	circular	Aizumishirazu, Amahyakume	3[ ]
	oblate	Fuyu, Izu, Jiro	4[ ]
	transverse broad oblong	Hiratanenashi	5[ ]
	ovate	Atago, Yotsumizo	6[ ]
	broad ovate	Koshuhyakume	7[ ]
	very broad ovate	Hanagosho	8[ ]
5.2 (37)	**<u>Varieties with astringency always absent or sometimes present only</u>: Fruit color of skin**		
	yellow orange	Shogatsu	1[ ]
	orange	Hazegosho, Yamatogosho	2[ ]
	orange red	Fuyu, Izu, Jiro, Nishimurawase	3[ ]
	dark purple	Kurogaki	4[ ]
5.3 (38)	**<u>Varieties with astringency always present only</u>: Fruit color of skin**		
	yellow orange	Gionbo, Saijo	1[ ]
	orange	Aizumishirazu, Hiratanenashi	2[ ]
	red orange	Koshuhyakume	3[ ]
5.4 (48)	**<u>Varieties with astringency always absent or sometimes present only</u>: Time of ripeness for eating**		
	early	Izu, Nishimurawase	3[ ]
	medium	Matsumotowase-fuyu, Mizushima	5[ ]
	late	Amahyakume, Fuyu, Gosho	7[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Characteristics	Example Varieties	Note
5.5 (49)	**<u>Varieties with astringency always present only</u>: Time of ripeness for eating**		
	early	Ichidagaki, Tonewase	3[ ]
	medium	Hiratanenashi, Koshuhyakume	5[ ]
	late	Aizumishirazu, Atago	7[ ]

6. Similar varieties and differences from these varieties

Please use the table, and space provided for comments, below to provide information on how your candidate variety differs from the variety (or varieties) which, to the best of your knowledge, is (or are) most similar. This information may help the examination authority to conduct its examination of distinctness in a more efficient way.

Denomination(s) of variety(ies) similar to your candidate variety	Characteristic(s) in which your candidate variety differs from the similar variety(ies)	Describe the expression of the characteristic(s) for the **similar** variety(ies)	Describe the expression of the characteristic(s) for **your** candidate variety
Example	*Fruit: general shape in lateral view*	*elliptic*	*circular*

Comments:

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

7. Additional information which may help in the examination of the variety

7.1 In addition to the information provided in sections 5 and 6, are there any additional characteristics which may help to distinguish the variety?

Yes [ ] No [ ]

(If yes, please provide details)

7.2 Special conditions for the examination of the variety

7.2.1 Are there any special conditions for growing the variety or conducting the examination?

Yes [ ] No [ ]

7.2.2 If yes, please give details:

7.3 Other information

A representative colour photograph of the variety should accompany the Technical Questionnaire

8. Authorization for release

(a) Does the variety require prior authorization for release under legislation concerning the protection of the environment, human and animal health?

Yes [ ] No [ ]

(b) Has such authorization been obtained?

Yes [ ] No [ ]

If the answer to (b) is yes, please attach a copy of the authorization.

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

9. Information on plant material to be examined.

9.1 The expression of a characteristic or several characteristics of a variety may be affected by factors, such as pests and disease, chemical treatment (e.g. growth retardants or pesticides), effects of tissue culture, different rootstocks, scions taken from different growth phases of a tree, etc.

9.2 The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If the plant material has undergone such treatment, full details of the treatment must be given. In this respect, please indicate below, to the best of your knowledge, if the plant material to be examined has been subjected to:

(a)	Microorganisms (e.g. virus, bacteria, phytoplasma)	Yes [ ]	No [ ]
(b)	Chemical treatment (e.g. growth retardant or pesticide)	Yes [ ]	No [ ]
(c)	Tissue culture	Yes [ ]	No [ ]
(d)	Other factors	Yes [ ]	No [ ]

Please provide details of where you have indicated “yes”:

…………………………………………………………

10. I hereby declare that, to the best of my knowledge, the information provided in this form is correct:

Applicant’s name

Signature   Date

[End of document]

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Short communication

Codification and description of growth stages in persimmon (*Diospyros kaki* Thunb.) using the extended BBCH scale

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ABSTRACT

Persimmon (*Diospyros kaki* Thunb.) is one of the most important fruit that is grown commercially worldwide including the East Asia and Mediterranean regions, and it has been cultivated for its fruit with high nutritional values. Phenology of fruits has attracted the interest of many breeders, growers, and researchers for accurately schedule timing of horticultural managements, but detailed and specific scale for persimmon, especially for the pollination-constant non-astringent (PCNA) and androecious persimmons, remain non-available. In this study, we characterized persimmon phenological growth stages in four persimmon cultivars containing two important morphological traits of sexuality and astringency using the BBCH (Biologische Bundesanstalt, Bundessortenamt Chemische Industrie) scale. The principal growth stages of persimmon were divided into the vegetative and reproductive phenology. We first investigated the vegetative phenology, including: bud development stage (0), leaf development stage (1), shoot development stage (3), and senescence and rest stage (9). The consequent reproductive phenology contained the four following stages, inflorescence emergence stage (5), flowering stage (6), fruit development stage (7), and fruit maturity stage (8). To better understand these phenological growth stages, we next provided illustrative photos with codification and description in persimmon. In addition, the phenological records over two growing seasons in the National Field Genebank for Persimmon (NFGP) were used to draw a schematic representation of principal growth stages. Correct identification of phenological stages is of great importance for the characterization and management in persimmon. Thus, this study will provide the dissemination of knowledge of persimmon cultivars among growers and researchers.

1. Introduction

The genus *Diospyros* is the most widely distributed and the multipurpose in the family Ebenaceae (Duangjai et al., 2009; Rauf et al., 2017), and is the only extant genus of Ebenaceae in China (Tang et al., 2018). Among this genus, *D. kaki*, *D. lotus*, *D. oleifera*, *D. virginiana*, *D. glaucifolia*, and *D. deyangensis* are also commercially utilized as fruit crops or timber woods (Wang et al., 1997; Jing et al., 2013; Zhang et al., 2016d; Guan et al., 2020a, 2020c). Persimmon (*D. kaki* Thunb.) has been considered as the most economically important species, originating from the southern China and then spreading out of the regions of East Asia, Mediterranean, Australia and South American (Luo and Wang, 2008; Kanzaki, 2016). There are more than 1000 cultivars or varieties that exist in different regions of China, which display various genetic diversity (Guan et al., 2019, 2020a, 2020c). In China, the persimmon cultivation area and yield account for more than 90 % and 67 % of the world, respectively (FAOSTAT, 2020, www.fao.org/faostat/en/). Persimmon contains high nutritional value as minerals, vitamins and antioxidants for human health, and is becoming a global fruit crop in many markets of the world.

D. kaki often bears perfect (hermaphrodite), male and female flowers to form cymose inflorescence (Zhang et al., 2016b, 2016c; Zhang et al., 2018). In persimmon, the male cyme produces three to five flowers (a central flower and 2–4 lateral flowers), while female cyme is usually present a central flower with degenerate lateral flowers (George et al., 1997; Zhang et al., 2018). The hermaphrodite flowers are usually derived from female flowers and generate much smaller fruits than that female flowers (George et al., 1997; Zhang et al., 2016c). Commercial

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cultivars are most female-flower-only types (gynoecious), and a minority of cultivars bear separated female and male flowers at one plant (monoecious); few are male-flower-only (androecious), which are found in the Dabieshan Mountain area with the junction area of Hubei, Henan and Anhui provinces (Xu et al., 2008; Zhang et al., 2009; Huang et al., 2013) and in the Jiangxi Province (Guan et al., 2020b). The female-flower-only (gynoecious) type is more desirable, however, the male persimmon is also necessary to be protected due to elimination of androecious resources in the long history of cultivation.

Based on whether it can be natural loss of astringency during growth stage and fruit maturity, persimmon is divided into four astringent types, pollination-constant non-astringent (PCNA), pollination-variant non-astringent (PVNA), pollination-variant astringent (PVA), and pollination constant astringent (PCA) (Akagi et al., 2011). The PCNA type is further classified into Japanese PCNA (J-PCNA) and Chinese PCNA (C-PCNA) (Chen et al., 2017; Yonemori et al., 2005). C-PCNA persimmon have rather distant phylogenetic relationships with J-PCNA type. Moreover, C-PCNA is controlled by a single locus and is dominant against J-PCNA (Ikegami et al., 2004, 2006). In persimmon, most cultivars are non-PCNA types (PVNA, PVA and PCA), few cultivars are reported as PCNA type (Yonemori et al., 2005; Sato and Yamada, 2016). The fruits of PCNA and PVNA types have the ability of natural astringency removal during the ripening stage, thus to justify their significant value as commercial products. While the PVA and PCA persimmons must be treated artificially for astringency removal before human consumption. In China, the main cultivars of persimmon are PCA type and few are desirable PCNA type. While, their phenological stages and morphological characteristics are still lacking and of great potential for breeding application in persimmon.

The correct codification and description for phenological stages is of great use for morphological characterization in persimmon. There was no uniform coding system to describe the development stages to meet the requirements for the fruit trees. Thus, the BBCH scale (Biologische Bundesanstalt, Bundessortenamt, Chemische Industrie) was proposed in crops and weeds (Lancashire et al., 1991) and posteriorly extended in advanced application of agriculture and forestry (Hack et al., 1992; Hess et al., 1997; Meier, 2001). Since then, BBCH scale has been widely applied in describing the phenological stages in various fruits, such as the loquat (Martínez-Calvo et al., 1999), persimmon (García-Carbonell et al., 2002), kiwifruit (Salinero et al., 2009), mango (Hernández Delgado et al., 2011), lychee (Wei et al., 2013), jujube (Hernández et al., 2015), sweet cherry (Fadón et al., 2015), longan (Pham et al., 2015), apple (Martínez et al., 2019) and almond (Sakar et al., 2019). Study on the phenological behavior will provide the understanding of characterization of varieties that were conserved in the germplasm banks, as well as the knowledge of the cultivars among farmers and researchers.

In this study, we focus on describing and codifying the phenological growth stages of the four persimmon accessions, including 'Male 8' (androecy), 'Taishuu' (monoecy, J-PCNA), 'Luotian Tianshi' (gynoecy, C-PCNA) and 'Mopanshi' (gynoecy, PCA), according to the BBCH scale. To describe persimmon phenology, García-Carbonell et al. (2002) has established a phenological scale in European climate zone. This scale is still of great use for recording the persimmon phenology, however, it lacks some detail information as it describes only the main stages in two female non-PCNA cultivars 'Rojo Brillante' and 'Sharon'. Hence, it is necessary for accurate and detailed phenological record that covers the whole persimmon life cycle in different sexual and astringent types. Thus, our work aims: (a) to describe and codify the completely reproductive and vegetative phenological growth stages in persimmon, (b) to define the chronological progression of principal growth stages in four persimmon samples including three commercial cultivars and an androecious germplasm, (c) select the potential cultivars with the variety of blooming and growth stages based on the BBCH scale.

2. Materials and methods

The data for BBCH scale were obtained from adult trees 10 years old or more of four *D. kaki* cultivars, 'Male 8' bearing only male flowers and carrying out *C-PCNA* locus (Zhang et al., 2016a), 'Taishuu' (monoecy, J-PCNA), 'Luotian Tianshi' (gynoecy, C-PCNA) and 'Mopanshi' (gynoecy, PCA), which are grafted on *D. lotus* and located at the National Field Genebank for Persimmon (NFGP) in Yangling, Shaanxi, China, at latitude 34°17′52.55″N and longitude 108°04′05.58″E. Climate records from the past 50 years for this region show an average annual temperature of 13.3 °C, an average maximum temperature of 26.4 °C in July and an average minimum temperature of -0.9 °C in January, with 572 mm average annual rainfall.

Data gathering of vegetative and reproductive stages were carried out during two annual growing seasons (2018–2019), additionally described by the other years. Measurements were performed every three days or once per week that depends on the developmental stage. In this work, the BBCH scale described for persimmon was conducted by previous reports for an extended BBCH scale (Meier, 2001) and description of persimmon (García-Carbonell et al., 2002) with minor modifications.

3. Results

3.1. *Principal growth stage 0: bud development (Fig. 1)*

00: Dormancy. Leaf and flower buds, closed and covered by brown scales.

01: Beginning of leaf bud swelling. Buds began to elongate.

03: End of leaf bud swelling: brown scales slightly separated.

07: Beginning of bud burst: first green leaf tips just visible.

09: Green leaf tips visible: green leaf tip around 5–10 mm above bud scales.

3.2. *Principal growth stage 1: leaf development (Fig. 2)*

10: Separating first leaves: green leaf tips around 10 mm above the bud scales. First leave was separated.

11: The first young leaves unfolded.

15: More leaves unfolded.

19: All leaves completely unfolded and expanded.

3.3. *Principal growth stage 3: shoot development (Fig. 3)*

31: Shoot growth initiation: the shoot grows, it is light green in color; around 10 % of final length.

33: Shoots about 30 % of final length.

35: Shoots about 50 % of final length.

3.4. *Principal growth stage 5: inflorescence emergence (Fig. 4)*

51: Inflorescence buds swelling: Buds are stipules clinging to flower buds, sepals tightly closed, and swollen.

53: Inflorescence buds swelling further: stipules open obviously, and sepals begin to open.

55: Petals visible: flower buds are observed.

57: Green petal stage: the petal color is green.

59: Light yellow petal stage: petal color changed from green to light yellow.

3.5. *Principal growth stage 6: flowering (Fig. 5)*

60: First flowers open: flowers are light yellow.

62: Beginning of flowering: about 20 % of flowers are open.

64: Early flowering: about 40 % of flowers are open.

65: Full flowering: 50 % of flowers are open.

67: Flower fading. Most petals falling or dry.

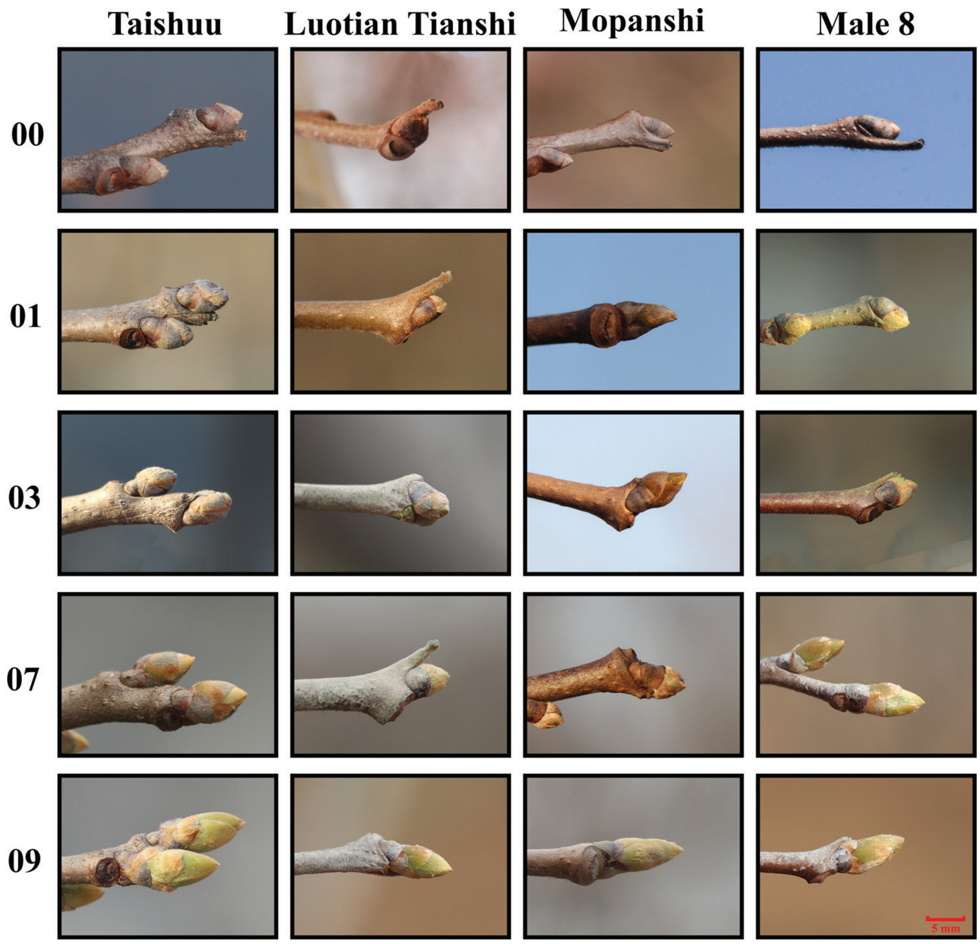

Fig. 1. Stages of bud development for persimmon according to the BBCH scale.

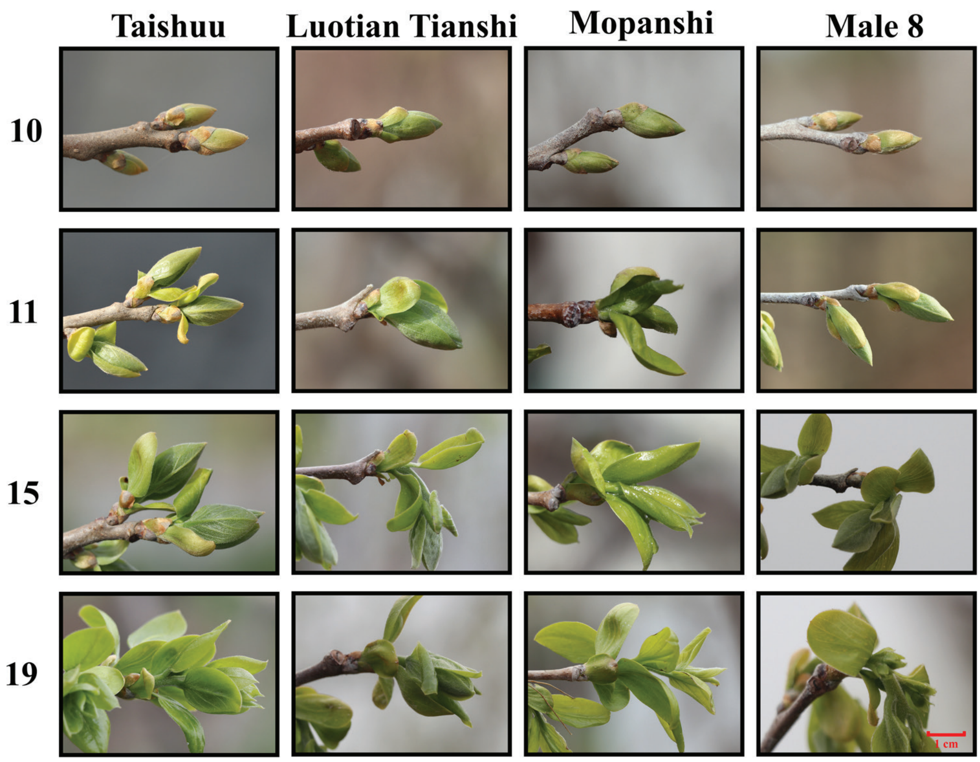

Fig. 2. Stages of leaf development for persimmon according to the BBCH scale.

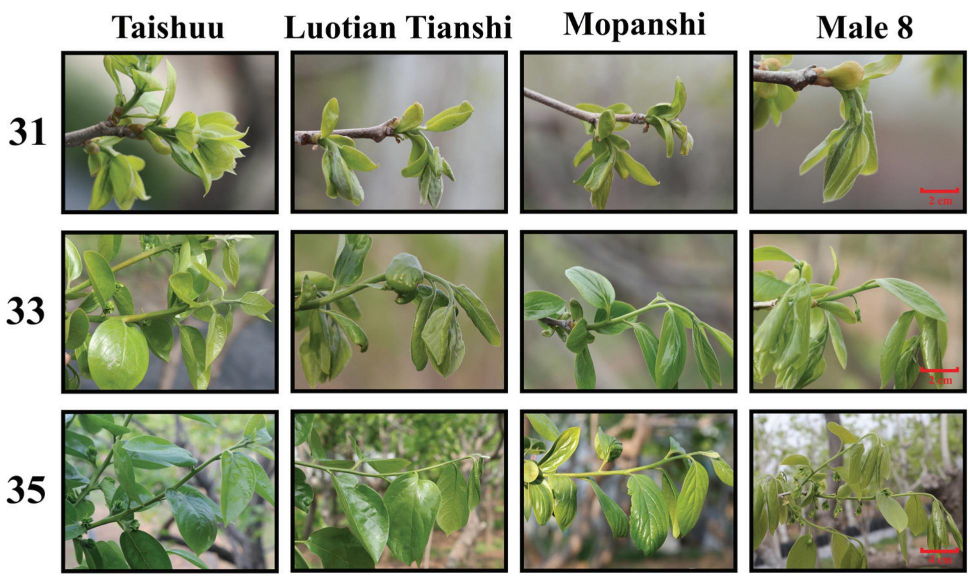

Fig. 3. Stages of shoot development for persimmon according to the BBCH scale.

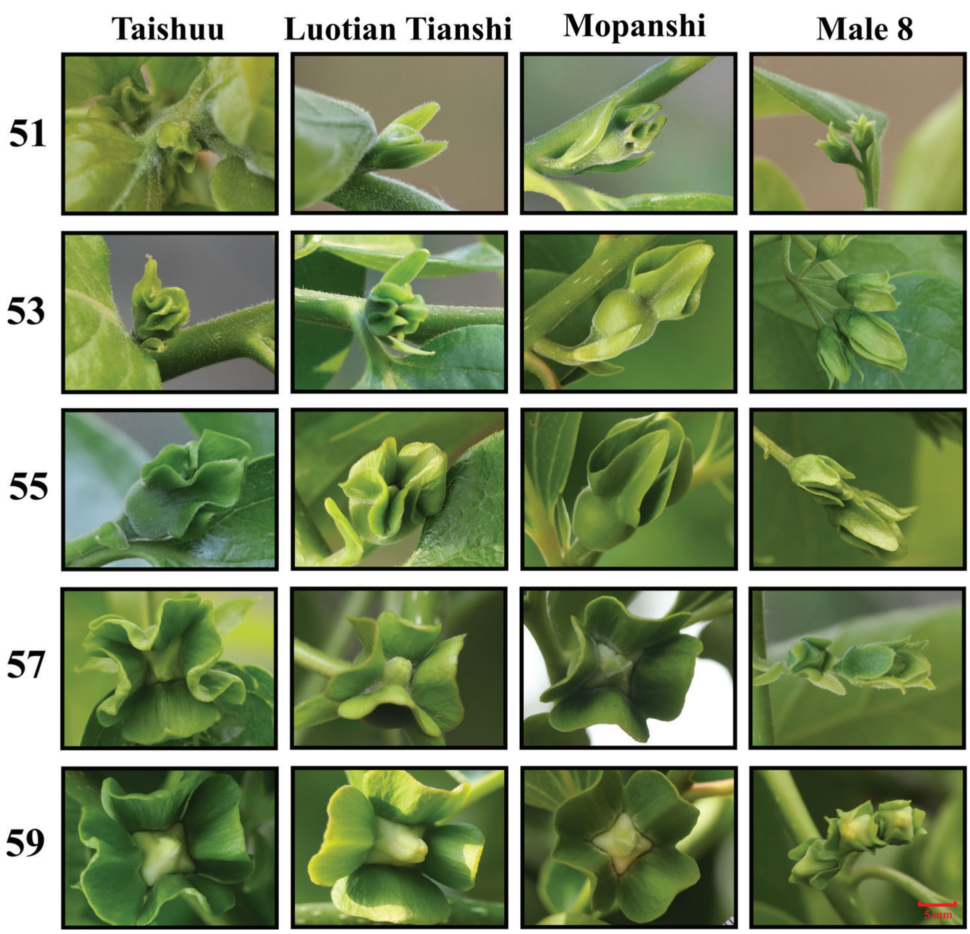

Fig. 4. Stages of inflorescence emergence for persimmon according to the BBCH scale.

69: End of flowering. All petals are fallen or dry. Fruit set.

3.6. *Principal growth stage 7: fruit development (Fig. 6)*

71: Fruit set: The fruit diameter is about 10 mm; the dying petal crown have fallen.

72: Fruit has reached 20 % of final size.
74: Fruit has reached 40 % of final size.
75: Fruit reach about 50 % of final size.
77: Fruit reach about 70 % of final size.
79: Fruit reach about 90 % of final size.

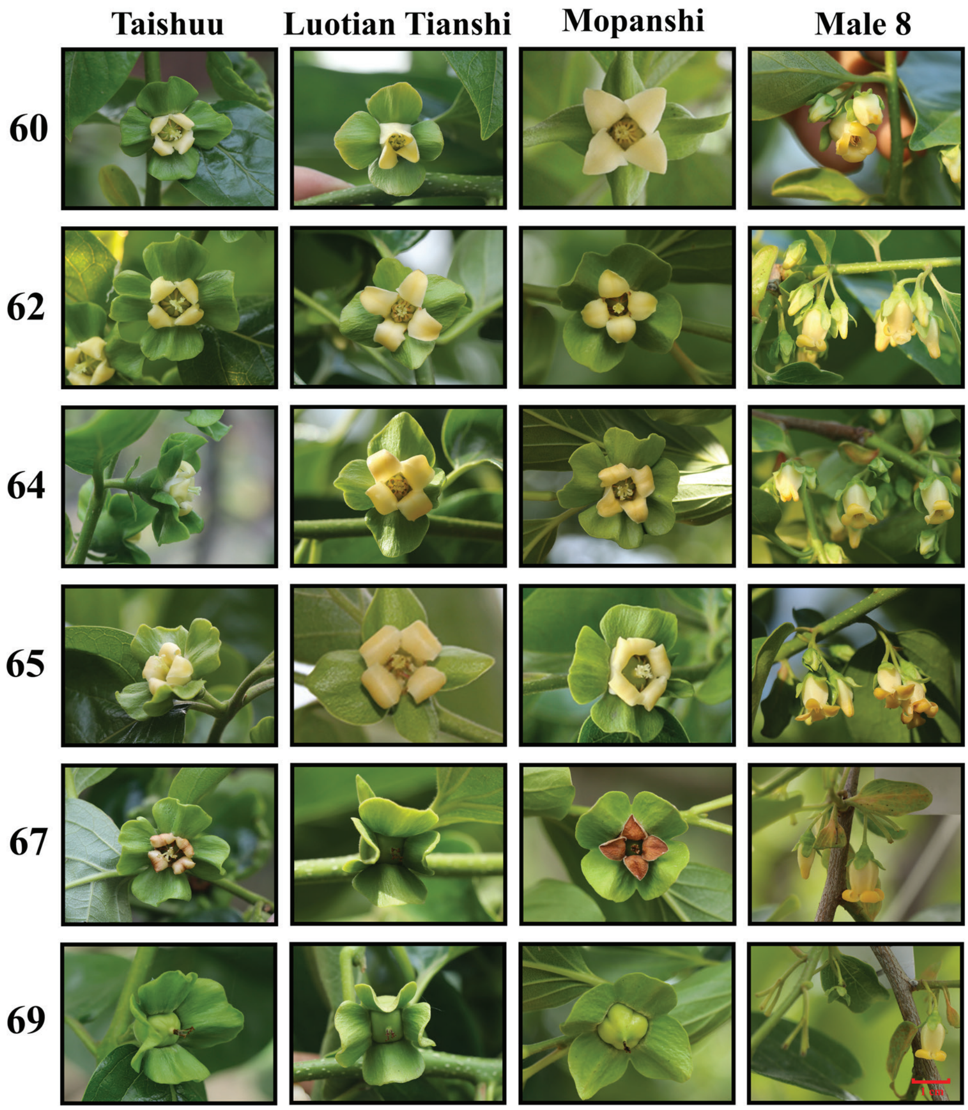

Fig. 5. Flowering stages for persimmon according to the BBCH scale.

3.7. *Principal growth stage 8: maturity of fruit (Fig. 7)*

81: Initiation of skin color change. The color is typical of the variety that begins to show.

85: Advanced ripening; increase in intensity of variety-specific color.

87: Fruit ripe for picking.

89: Fruit color fully developed, and fruit ripe for consumption (only for PCNA and PVNA persimmons).

3.8. *Principal growth stage 9: senescence and beginning of the rest period (Fig. 8)*

95: 50 % of leaves fallen.

97: Winter rest period. All leaves fallen.

Together, we then draw a schematic figure representing the chronological progression of the principal growth stages for four persimmon types (Fig. 9). In the 0 stage, the 'Mopanshi' bud developed earlier than others persimmon. In the flower development (5 and 6) stage, the inflorescence emergences of 'Taishuu' and 'Male 8' started on about the April 1st and April 2nd in 2018 respectively, and both of them represent the earlier inflorescence buds swelling and flowering. Furthermore, the 'Male 8' had the longest flowering period that these characteristics are more conducive to artificial or natural crossing as a parent. 'Mopanshi' persimmon fruit development period (7 and 8 stages) has the shortest time, the colouring time of 'Taishuu' persimmon was earlier than that of 'Mopanshi' and 'Luotian Tianshi' persimmons. In the 9 stage, 'Mopanshi' persimmon was the longest for 125 days, and 'Luotian Tianshi' had the shortest time for 110 days.

4. Discussion

To program various agronomic practices (crop protection, irrigation, fertilization, pollination, pruning, harvesting), it is crucial to understand the timing and chronology in different growth stages using BBCH scale. As a way of standardizing work carried out under various climatic and experimental water regimes application of the BBCH scale is highly recommended (Leather, 2010). Similar growth stages were revealed for some species belonging to other deciduous fruits trees sweet cherry (Fadón et al., 2015), apple (Martínez et al., 2019) and almond (Sakar et al., 2019), our study described and codified the phenological growth stages of the four persimmon accessions according to the BBCH scale. The established scale specific to persimmon was similar to the previous description (García-Carbonell et al., 2002), except the inflorescence emergence stage (Stage 5). In addition to our measurements and observations of the vegetative and reproductive phenology in the four persimmon cultivars over two growing seasons in the NFGP of China, we

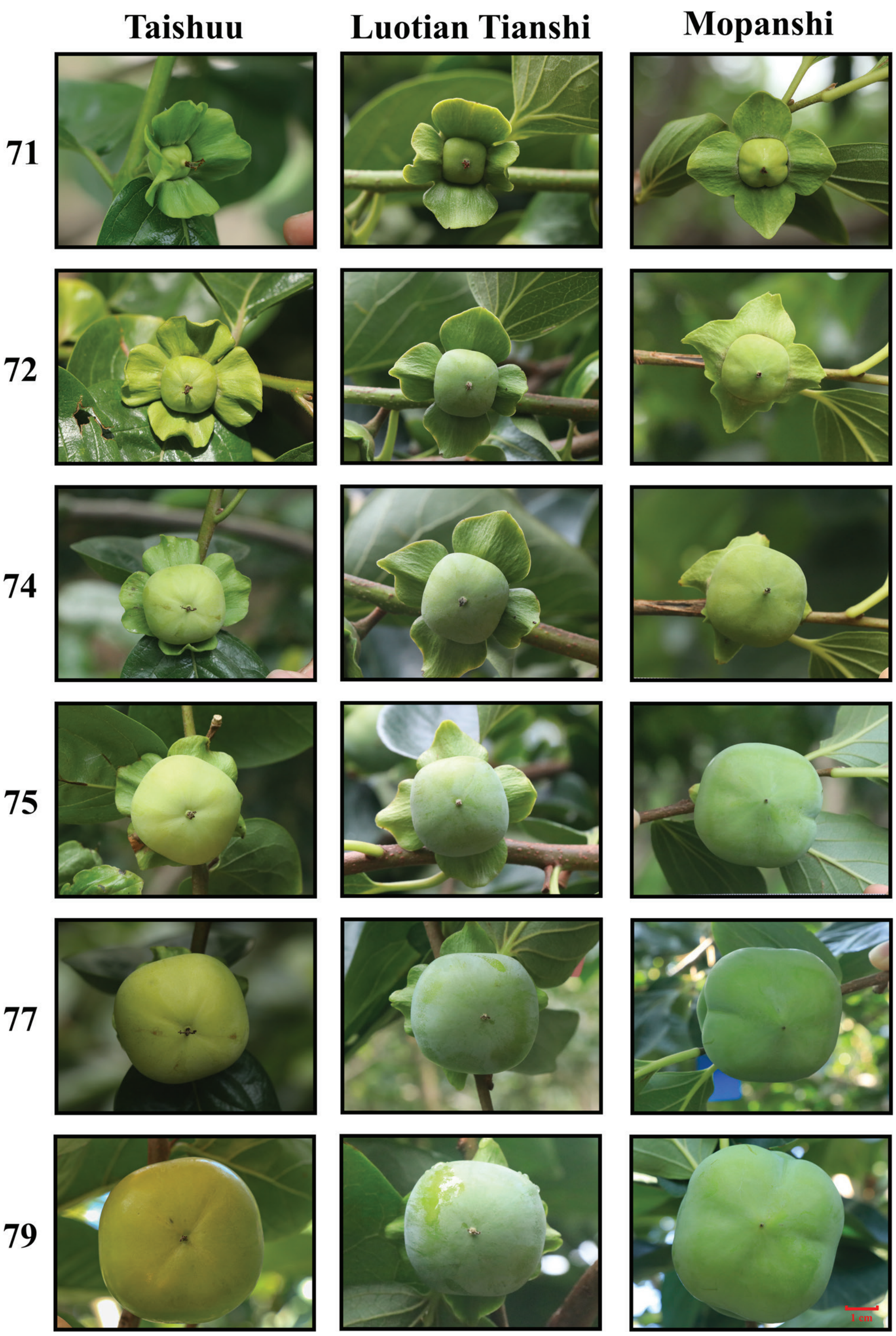

Fig. 6. Stages of fruit development for persimmon according to the BBCH scale.

have developed an extended BBCH scale specific to persimmon. Thus, our study reveals that the BBCH scale specific to persimmon has numerous advantages focusing on reproductive phenology, as well detailed description of vegetative phenology including development of vegetative bud and leaf, shoot growth and senescence.

Sexuality and astringency are the important characters for persimmon production and cross breeding. Persimmon exhibits polygamous sexuality in the species level, which can bear male, female and hermaphrodite flowers (Zhang et al., 2016c, 2018), and can be further classified as two main types, the PCNA (C-PCNA and J-PCNA) and non-PCNA (PVNA, PVA and PCA) according to whether the persimmon fruit can be naturally astringent on the tree (Luo and Wang, 2008; Akagi et al., 2011; Yamada et al., 2012; Sato and Yamada, 2016). The persimmon bearing staminate flowers are the relatively rare and essential germplasms for breeding PCNA persimmon. Compared with two PVA persimmon BBCH scale previously reported (García-Carbonell et al., 2002), we investigated four persimmon cultivars for phenological records over the period of two growing seasons in the NFGP that allowed the phenological calendar establishment. These four cultivars mainly contained two important morphological traits, sexuality and astringency. 'Male 8', originates in China, carries the dominant gene locus of the CPCNA non-astringent trait has a great potential to be used as pollen

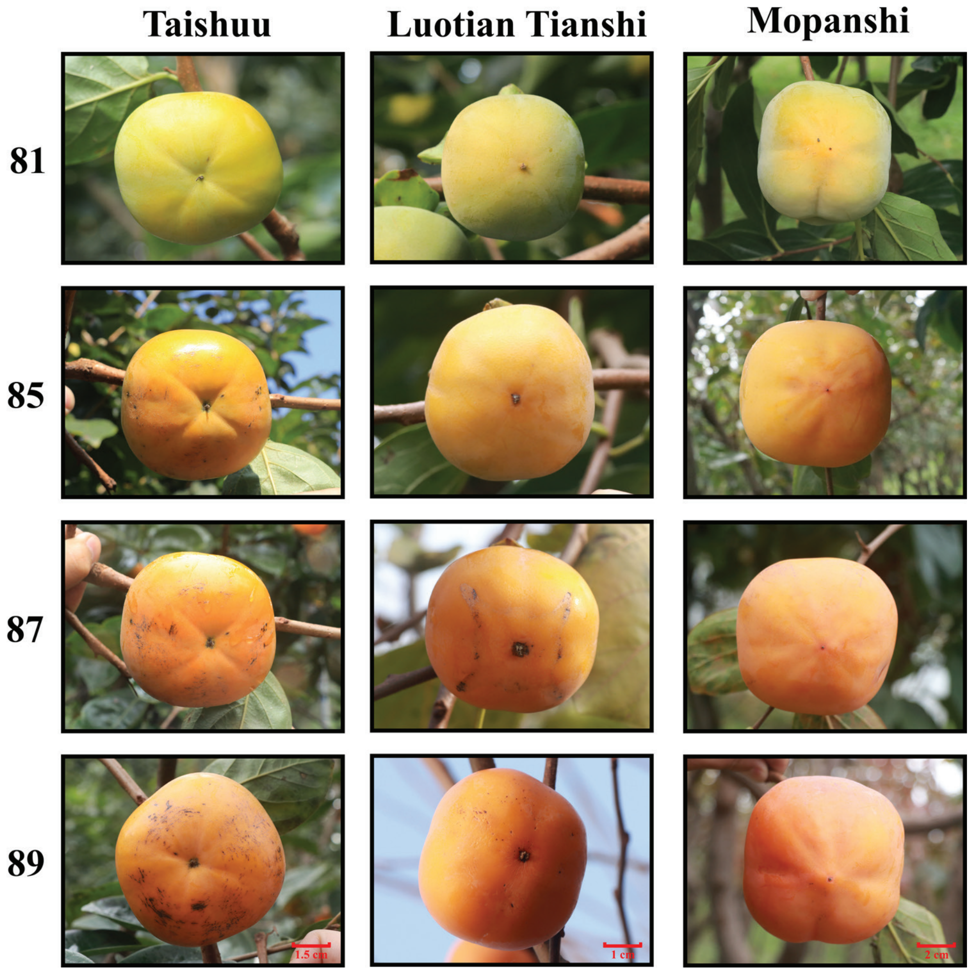

Fig. 7. Maturity of persimmon fruit according to the BBCH scale.

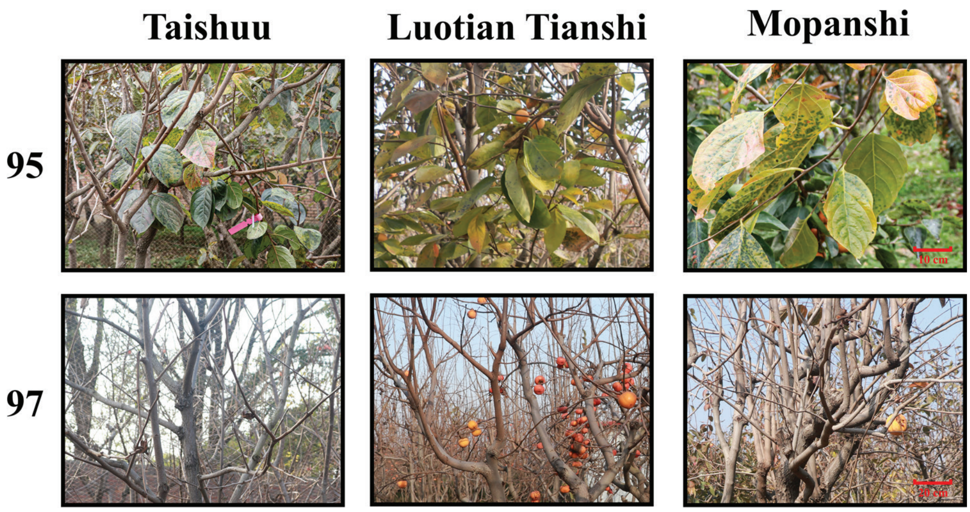

Fig. 8. Senescence and beginning of the rest period for persimmon according to the BBCH scale.

donor for the PCNA persimmon breeding (Zhang et al., 2016a; Guan et al., 2020b). The 'Taishuu' is J-PCNA type as an important commercial cultivar that bears both female and male flowers on a tree. Its male flowers, generally growing on weaker branches, bloom about 2 days earlier than the female flowers. Hence, the male flowers of 'Taishuu' have great potential as pollen donors for PCNA persimmon breeding. While 'Luotian Tianshi', a gynoecy as typical C-PCNA type (Yonemori et al., 2005) with great breeding value and research interest. Due to C-PCNA and J-PCNA differ in their genetic characteristics of natural deastringency: C-PCNA is controlled by a single locus and is dominant against J-PCNA (Ikegami et al., 2004, 2006). In China, 'Mopanshi' (female-flower only, PCA) is a historical cultivars since there exists records of persimmon cultivation (Luo and Wang, 2008), and inherits astringent locus require for artificial de-astringency after harvesting.

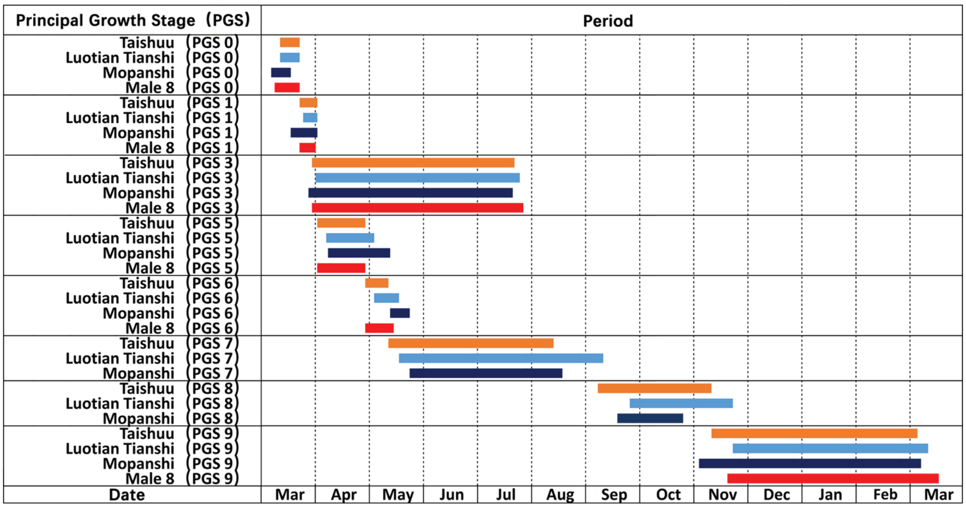

Fig. 9. Schematic representation of the growth stages for four persimmons (data gathered from 2018 to 2019).

Thus, this study investigated phenological stages of four cultivars that contained two important morphological traits, sexuality and astringency, which may have great significance for the cultivation and breeding application of persimmons.

Through years of observation, the four varieties grown in the NFGP with uniform growth climate showed significant difference in morphological characteristics and phenological stages (Table S1). For example, 'Taishuu' has the earliest flowering period, while 'Mopanshi' persimmon has the latest. The average fruit weight of 'Taishuu', 'Luotian Tianshi' and 'Mopanshi' are the 193.7 g, 68.8 g and 265.1 g respectively. Furthermore, we investigated the data of three primary phenological growth stages (leaf-spreading, flowering stage, fruit maturity period) for four persimmon cultivars in different regions of China, *i.e.*, Guangxi Academy of Specialty Crops (Guilin city, Guangxi province), Huazhong Agricultural University (Wuhan city, Hubei province), Yantai Academy of Agricultural Sciences (Yantai city, Shandong province) (Table S2). Those three phenological stages are closely related with persimmon cultivation for growers and researcher. Among different regions of China, the phenological period of persimmon in Guilin was 15–20 days earlier than that of Yangling, and phenological period of persimmon in Yangling was 10–15 days earlier than that of Yantai (Table S2). In conclusion, we reported the accurate and detailed phenological record that covers the whole persimmon life cycle in different sexual and astringent types using the BBCH scale. The descriptions of the variety's phenology in different areas are of great significance for breeding and production application in persimmon.

CRediT authorship contribution statement

Changfei Guan: Conceptualization, Investigation, Writing - original draft. **Qinghui Che:** Investigation, Methodology, Software. **Pingxian Zhang:** Methodology, Writing - original draft. **Jinmeng Huang:** Resources, Validation. **Sadaruddin Chachar:** Writing - review & editing. **Xiaofeng Ruan:** Writing - review & editing, Software. **Renzi Wang:** Software, Validation, Supervision. **Yong Yang:** Project administration, Conceptualization, Validation, Writing - review & editing.

Declaration of Competing Interest

The authors report no declarations of interest.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.scienta.2021.109895.

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UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

ACTINIDIA

UPOV Code: ACTIN

Actinidia Lindl. *

GUIDELINES

FOR THE CONDUCT OF TESTS

FOR DISTINCTNESS, UNIFORMITY AND STABILITY

Alternative Names:*

Botanical name	*English*	*French*	*German*	*Spanish*
Actinidia Lindl.	Actinidia, Kiwifruit	Actinidia, Kiwi	Strahlengriffel, Kiwi	Actinidia, Kiwi

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.

* These names were correct at the time of the introduction of these Test Guidelines but may be revised or updated. [Readers are advised to consult the UPOV Code, which can be found on the UPOV Website (www.upov.int), for the latest information.]

TABLE OF CONTENTS PAGE

1. Subject of these Test Guidelines

These Test Guidelines apply to all varieties of *Actinidia* Lindl..

2. Material Required

2.1 The competent authorities decide on the quantity and quality of the plant material required for testing the variety and when and where it is to be delivered. Applicants submitting material from a State other than that in which the testing takes place must ensure that all customs formalities and phytosanitary requirements are complied with.

2.2 The material is to be supplied in the form of plants on their own roots or plants on a clonal rootstock. The competent authorities should specify the form of material to be supplied and select the most appropriate rootstock.

2.3 The minimum quantity of plant material, to be supplied by the applicant, should be:

5 plants on their own roots or,
5 plants on the clonal rootstock as specified by the authority.

2.4 The plant material supplied should be visibly healthy, not lacking in vigor, nor affected by any important pest or disease.

2.5 The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If it has been treated, full details of the treatment must be given.

3. Method of Examination

3.1 Number of Growing Cycles

3.1.1 The minimum duration of tests should normally be two independent growing cycles. In particular, it is essential that the plants produce a satisfactory crop of fruit in each of the two growing cycles.

3.1.2 The growing cycle is considered to be the duration of a single growing season, beginning with vegetative bud burst, flowering and fruit harvest and concluding when the following dormant period ends with the swelling of new season buds.

3.2 Testing Place

Tests are normally conducted at one place. In the case of tests conducted at more than one place, guidance is provided in TGP/9 “Examining Distinctness”.

3.3 Conditions for Conducting the Examination

3.3.1 The tests should be carried out under conditions ensuring satisfactory growth for the expression of the relevant characteristics of the variety and for the conduct of the examination.

3.3.2 For female varieties, the competent authorities should ensure that an appropriate male variety is available for adequate pollination.

3.4 Test Design

3.4.1 Each test should be designed to result in a total of at least 5 plants.

3.4.2 The design of the tests should be such that plants or parts of plants may be removed for measurement or counting without prejudice to the observations which must be made up to the end of the growing cycle.

3.5 Additional Tests

Additional tests, for examining relevant characteristics, may be established.

4. Assessment of Distinctness, Uniformity and Stability

4.1 Distinctness

4.1.1 General Recommendations

It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding distinctness. However, the following points are provided for elaboration or emphasis in these Test Guidelines.

4.1.2 Consistent Differences

The differences observed between varieties may be so clear that more than one growing cycle is not necessary. In addition, in some circumstances, the influence of the environment is not such that more than a single growing cycle is required to provide assurance that the differences observed between varieties are sufficiently consistent. One means of ensuring that a difference in a characteristic, observed in a growing trial, is sufficiently consistent is to examine the characteristic in at least two independent growing cycles.

4.1.3 Clear Differences

Determining whether a difference between two varieties is clear depends on many factors, and should consider, in particular, the type of expression of the characteristic being examined, i.e. whether it is expressed in a qualitative, quantitative, or pseudo-qualitative manner. Therefore, it is important that users of these Test Guidelines are familiar with the recommendations contained in the General Introduction prior to making decisions regarding distinctness.

4.1.4 Number of Plants / Parts of Plants to be Examined

Unless otherwise indicated, for the purposes of distinctness, all observations should be made on 5 plants or parts taken from each of 5 plants. In the case of observations of parts taken from single plants, the number of parts to be taken from each of the plants should be 2.

4.1.5 Method of observation

The recommended method of observing the characteristic for the purposes of distinctness is indicated by the following key in the second column of the Table of Characteristics (see document TGP/9 "Examining Distinctness", Section 4 "Observation of characteristics"):

MG: single measurement 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 observation of individual plants or parts of plants

Type of observation: visual (V) or measurement (M)

"Visual" observation (V) is an observation made on the basis of the expert's judgment. For the purposes of this document, "visual" observation refers to the sensory observations of the experts and, therefore, also includes smell, taste and touch. Visual observation includes observations where the expert uses reference points (e.g. diagrams, example varieties, side-by-side comparison) or non-linear charts (e.g. color charts). Measurement (M) is an objective observation against a calibrated, linear scale e.g. using a ruler, weighing scales, colorimeter, dates, counts, etc.

Type of record: for a group of plants (G) or for single, individual plants (S)

For the purposes of distinctness, observations may be recorded as a single record for a group of plants or parts of plants (G), or may be recorded as records for a number of single, individual plants or parts of plants (S). In most cases, "G" provides a single record per variety and it is not possible or necessary to apply statistical methods in a plant-by-plant analysis for the assessment of distinctness.

In cases where more than one method of observing the characteristic is indicated in the Table of Characteristics (e.g. VG/MG), guidance on selecting an appropriate method is provided in document TGP/9, Section 4.2.

4.2 Uniformity

4.2.1 It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding uniformity. However, the following points are provided for elaboration or emphasis in these Test Guidelines:

4.2.2 For the assessment of uniformity, a population standard of 1 % and an acceptance probability of at least 95 % should be applied. In the case of a sample size of 5 plants, no off-type is allowed.

4.3 Stability

4.3.1 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, experience has demonstrated that, for many types of variety, when a variety has been shown to be uniform, it can also be considered to be stable.

4.3.2 Where appropriate, or in cases of doubt, stability may be further examined by testing a new plant stock to ensure that it exhibits the same characteristics as those shown by the initial material supplied.

5. Grouping of Varieties and Organization of the Growing Trial

5.1 The selection of varieties of common knowledge to be grown in the trial with the candidate varieties and the way in which these varieties are divided into groups to facilitate the assessment of distinctness are aided by the use of grouping characteristics.

5.2 Grouping characteristics are those in which the documented states of expression, even where produced at different locations, can be used, either individually or in combination with other such characteristics: (a) to select varieties of common knowledge that can be excluded from the growing trial used for examination of distinctness; and (b) to organize the growing trial so that similar varieties are grouped together.

5.3 The following have been agreed as useful grouping characteristics:

For male varieties

(a) Time of beginning of flowering (characteristic 76)

For female and hermaphrodite varieties (fruiting varieties)

(a) Fruit: weight (characteristic 47)
(b) Fruit: shape (characteristic 51)
(c) Fruit: stylar end (characteristic 53)
(d) Fruit: hairiness of skin (characteristic 60)
(e) Fruit: color of outer pericarp (characteristic 66)
(f) Fruit: color of locules (characteristic 67)
(g) Time of maturity for harvest (characteristic 77)

5.4 Guidance for the use of grouping characteristics, in the process of examining distinctness, is provided through the General Introduction and document TGP/9 "Examining Distinctness".

6. Introduction to the Table of Characteristics

6.1 Categories of Characteristics

6.1.1 Standard Test Guidelines Characteristics

Standard Test Guidelines characteristics are those which are approved by UPOV for examination of DUS and from which members of the Union can select those suitable for their particular circumstances.

6.1.2 Asterisked Characteristics

Asterisked characteristics (denoted by *) are those included in the Test Guidelines which are important for the international harmonization of variety descriptions and should always be examined for DUS and included in the variety description by all members of the Union, except when the state of expression of a preceding characteristic or regional environmental conditions render this inappropriate.

6.2 States of Expression and Corresponding Notes

6.2.1 States of expression are given for each characteristic to define the characteristic and to harmonize descriptions. Each state of expression is allocated a corresponding numerical note for ease of recording of data and for the production and exchange of the description.

6.2.2 In the case of qualitative and pseudo-qualitative characteristics (see Chapter 6.3), all relevant states of expression are presented in the characteristic. However, in the case of quantitative characteristics with 5 or more states, an abbreviated scale may be used to minimize the size of the Table of Characteristics. For example, in the case of a quantitative characteristic with 9 states, the presentation of states of expression in the Test Guidelines may be abbreviated as follows:

State	Note
small	3
medium	5
large	7

However, it should be noted that all of the following 9 states of expression exist to describe varieties and should be used as appropriate:

State	Note
very small	1
very small to small	2
small	3
small to medium	4
medium	5
medium to large	6
large	7
large to very large	8
very large	9

6.2.3 Further explanation of the presentation of states of expression and notes is provided in document TGP/7 “Development of Test Guidelines”.

6.3 Types of Expression

An explanation of the types of expression of characteristics (qualitative, quantitative and pseudo-qualitative) is provided in the General Introduction.

6.4 Example Varieties

Where appropriate, example varieties are provided to clarify the states of expression of each characteristic. The varieties have particular relevance to *Actinidia arguta*, *A. chinensis*, *A. deliciosa*, *A. melanandra*, *A. kolomikta*, *A. eriantha*, *A. rufa, A. polygama* and interspecific hybrids of these species.

Example varieties are separated into two groups:

Group A: All varieties belonging to *A. deliciosa, A. chinensis, A. kolomikta*, *A. eriantha*, *A. rufa*

Group B: All varieties belonging to *A. arguta, A. polygama, A. melanandra, A. macrosperma*

6.5 Legend

(*) Asterisked characteristic – see Chapter 6.1.2

QL Qualitative characteristic – see Chapter 6.3
QN Quantitative characteristic – see Chapter 6.3
PQ Pseudo-qualitative characteristic – see Chapter 6.3

MG, MS, VG, VS – see Chapter 4.1.5

(a)-(h) See Explanations on the Table of Characteristics in Chapter 8.1

(1) The characteristic only applies to varieties in Group A
(2) The characteristic only applies to varieties in Group B
See Chapter 6.4 and explanations on the Table of Characteristics in Chapter 8.1

(+) See Explanations on the Table of Characteristics in Chapter 8.2

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

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
1. **(*)** **(+)**	**VG**	**Plant: sex**	**Plante : sexe**	**Pflanze: Geschlecht**	**Planta: sexo**		
QL		female	femelle	weiblich	femenino	Hayward (A), Shinzan (B)	1
		male	mâle	männlich	masculino	a-Awaji (B), Matua (A)	2
		hermaphrodite	hermaphrodite	zwittrig	hermafrodita	Jenny (A)	3
2. **(+)**	**VG**	**Plant: self fruit setting**	**Plante : autonouaison**	**Pflanze: Fruchtbildung nach Selbstfruchtung**	**Planta: autofructificación**		
QL		absent	absente	fehlend	ausente		1
		present	présente	vorhanden	presente		9
3. **(+)**	**VG**	**Plant: vigor**	**Plante : vigueur**	**Pflanze: Wuchsstärke**	**Planta: vigor**		
QN		weak	faible	gering	débil		3
		medium	moyenne	mittel	medio	Hayward (A)	5
		strong	forte	stark	fuerte	Bruce (A)	7
		very strong	très forte	sehr stark	muy fuerte		9
4. **(*)**	**VG**	**Young shoot: density of hairs**	**Jeune pousse : densité de la pilosité**	**Junger Trieb: Dichte der Behaarung**	**Tallo joven: densidad de la vellosidad**		
QN	**(a)**	very sparse	très faible	sehr locker	muy escasa		1
		sparse	faible	locker	escasa	a-Awaji (B), Kuimi (A)	3
		medium	dense	mittel	media	Hayward (A), Shinzan (B)	5
		dense	dense	dicht	densa	King (A), Mitsukou (B)	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
5. (*)	**VG**	**Young shoot: anthocyanin coloration of growing tip**	**Jeune pousse : pigmentation anthocyanique du sommet de croissance**	**Junger Trieb: Anthocyanfärbung der wachsenden Spitze**	**Tallo joven: pigmentación antociánica del ápice de crecimiento**		
QN	**(a)**	absent or very weak	absente ou très faible	fehlend oder sehr gering	ausente o muy débil	Hort16A (A), Mitsukou (B)	1
	(e)	weak	faible	gering	débil	King (A), Shinzan (B)	3
		medium	moyenne	mittel	media	Kousui (B), Tomua (A)	5
		strong	forte	stark	fuerte	Houkou (B), Koryoku (A)	7
6. (*)	**VG**	**Stem: thickness**	**Tige : épaisseur**	**Trieb: Dicke**	**Tallo: grosor**		
QN	**(b)**	thin	mince	dünn	fino	a-Gassan (B), Sparkler (A)	1
		medium	moyenne	mittel	medio	a-Awaji (B), Hayward (A)	2
		thick	épaisse	dick	grueso	Bruno (A), Shinzan (B)	3
7. (*)	**VG**	**Stem: color of shoot on sunny side**	**Tige : couleur de la pousse sur le côté ensoleillé**	**Trieb: Farbe des Triebs auf der Sonnenseite**	**Tallo: color del tallo en la parte soleada**		
PQ	**(b)**	green white	blanc vert	grünweiß	blanco verdoso		1
		grey brown	brun gris	graubraun	marrón grisáceo	King (A), Mitsukou (B)	2
		yellow brown	brun jaune	gelbbraun	marrón amarillento	Sparkler (A)	3
		light brown	brun clair	hellbraun	marrón claro	a-Hirano (B), Hort16A (A)	4
		red brown	brun rouge	rotbraun	marrón rojizo	Ranger (A)	5
		purple brown	brun pourpre	purpurbraun	marrón violáceo	Bruno (A)	6
		dark brown	brun foncé	dunkelbraun	marrón oscuro	Kousui (B)	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
8.	**VG**	**Stem: texture of bark**	**Tige : texture de l'écorce**	**Trieb: Beschaffenheit der Rinde**	**Tallo: textura de la corteza**		
QN	**(b)**	smooth	lisse	glatt	lisa	Shinzan (B), Sparkler (A)	1
		moderately rough	modérément grossière	mäßig rauh	moderadamente rugosa	a-Gassan (B), Meteor (A)	2
		very rough	très grossière	sehr rauh	muy rugosa	a-Awaji (B), Hayward (A)	3
9.	**VG**	**Stem: density of hairs**	**Tige : densité de la pilosité**	**Trieb: Dichte der Behaarung**	**Tallo: densidad de la vellosidad**		
QN	**(b)**	absent or sparse	absente ou peu dense	fehlend oder locker	ausente o escasa	Meteor (A)	1
	(1)	medium	moyenne	mittel	media	Hayward (A)	2
		dense	dense	dicht	densa		3
10. (*)	**VG**	**Stem: size of lenticels**	**Tige : taille des lenticelles**	**Trieb: Größe der Lentizellen**	**Tallo: tamaño de las lenticelas**		
QN	**(b)**	very small	très petite	sehr klein	muy pequeño	Kaimai (A)	1
		small	petite	klein	pequeño	Monty (A), Shinzan (B)	2
		medium	moyenne	mittel	medio	Hayward (A), r-Gassan (B)	3
		large	grande	groß	grande	Hort16A (A)	4
11. (*)	**VG**	**Stem: number of lenticels**	**Tige : nombre de lenticelles**	**Trieb: Anzahl der Lentizellen**	**Tallo: número de lenticelas**		
QN	**(b)**	few	rares	wenige	bajo	Meteor (A), Shigemidori (B)	3
		medium	moyen	mittel	medio	Hayward (A), Shinzan (B)	5
		many	nombreuses	viele	alto	Bruno (A), Mitsukou (B)	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
12. **(*)** **(+)**	**VG**	**Stem: prominence of bud support**	**Tige : proéminence du support des bourgeons**	**Trieb: Hervortreten des Knospenwulstes**	**Tallo: prominencia del soporte de la yema**		
QN	**(b)**	very weak	très faible	sehr gering	muy débil	Sparkler (A)	1
		weak	faible	gering	débil	Hayward (A)	2
		medium	moyenne	mittel	media	a-Awaji (B), King (A)	3
		strong	forte	stark	fuerte	Kaimai (A) Shinzan (B)	4
		very strong	très forte	sehr stark	muy fuerte	Kuimi (A)	5
13. **(*)** **(+)**	**VG**	**Stem: presence of bud cover**	**Tige : présence de l'opercule du bourgeon**	**Trieb: Vorhandensein einer Knospenhülle**	**Tallo: presencia de opérculo**		
QL	**(b)**	absent	absente	fehlend	ausente	Hort16A (A), Kousui (B)	1
		present	présente	vorhanden	presente	Hayward (A) Mitsukou (B)	9
14. **(*)** **(+)**	**VG**	**Stem: size of hole in bud cover**	**Tige : taille de l'ouverture de l'opercule du bourgeon**	**Trieb: Größe der Öffnung in der Knospenhülle**	**Tallo: tamaño del orificio del opérculo**		
QN	**(b)**	small	petite	klein	pequeño	Abbott (A) Mitsukou (B)	1
		medium	moyenne	mittel	medio	Hayward (A), r-Awaji (B)	2
		large	grande	groß	grande	Elmwood (A), r-Nagano (B)	3
15. **(+)**	**VG**	**Stem: leaf scar**	**Tige : cicatrice pétiolaire**	**Trieb: Blattnarbe**	**Tallo: cicatriz foliar**		
QN	**(b)**	flat	plate	flach	plana	Meteor (A), Shinzan (B)	1
		moderately depressed	modérément déprimée	mäßig eingesenkt	moderadamente deprimida	Hort16A (A), r-Nagano (B)	2
		strongly depressed	fortement déprimée	stark eingesenkt	fuertemente deprimida	Kousui (B), Monty (A)	3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
16. (*) (+)	**VG**	**Stem: pith**	**Tige : moelle**	**Trieb: Mark**	**Tallo: médula**		
PQ		absent	absente	fehlend	ausente		1
		lamellate	lamellaire	lamellenartig	laminada	Hayward (A)	2
		solid	solide	ganzflächig	maciza		3
17. (*) (+)	**VG**	**Leaf blade: shape**	**Limbe : forme**	**Blattspreite: Form**	**Limbo: forma**		
PQ	**(c)**	lanceolate	lancéolée	lanzettlich	lanceolado	Kaimai (A)	1
	(d)	ovate	ovale	eiförmig	oval	Hayward (A)	2
		obovate	obovale	verkehrt eiförmig	oboval	Bruno (A)	3
18. (*)	**VG/ MG**	**Leaf blade: ratio length/width**	**Limbe : rapport longueur/largeur**	**Blattspreite: Verhältnis Länge/Breite**	**Limbo: relación entre la longitud y la anchura**		
QN	**(c)**	very low	très bas	sehr klein	muy baja		1
	(d)	very low to low	très bas à bas	sehr klein bis klein	muy baja a baja		2
		low	bas	klein	baja	Matua (A)	3
		low to medium	bas à moyen	klein bis mittel	baja a media	Hayward (A)	4
		medium	moyen	mittel	media	Bruno (A), Zesy002(A)	5
		medium to high	moyen à élevé	mittel bis groß	media a alta	Jintao (A), SkeltonA19 (A)	6
		high	élevé	groß	alta	Wuzhi5 (A)	7
		high to very high	élevé à très élevé	groß bis sehr groß	alta a muy alta		8
		very high	très élevé	sehr groß	muy alta		9

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
19. **(*)** **(+)**	**VG**	**Leaf blade: shape of apex**	**Limbe : forme du sommet**	**Blattspreite: Form der Spitze**	**Limbo: forma del ápice**		
PQ	**(c)**	caudate	en forme de queue	geschwänzt	caudado	Hortgem Tahi (B)	1
	(d)	acuminate	acuminée	zugespitzt	acuminado	Kaimai (A), Yukimusume (B)	2
		acute	aigue	spitz	agudo	Hayward (A)	3
		emarginate with cuspidate	émargé avec cuspidé	eingekerbt mit längerer aufgesetzter Spitze	emarginado cuspidado		4
		rounded	arrondie	abgerundet	redondeado	Satoizumi (B)	5
		retuse	échancrée	eingedrückt	retuso	Shinzan (B)	6
		emarginate	émargée	eingekerbt	emarginado	Kuimi (A)	7
20. **(*)** **(+)**	**VG**	**Leaf blade: basal lobes**	**Limbe : disposition des lobes**	**Blattspreite: Basallappen**	**Limbo: lóbulos basales**		
QN	**(c)**	none	aucun	keine	ninguno		1
	(d)	far apart	très éloignés	weit auseinanderstehend	muy alejados	Kaimai (A)	2
	(1)	slightly apart	légèrement éloignés	leicht auseinanderstehend	ligeramente alejados	Matua (A)	3
		touching each other	en contact l’un avec l’autre	sich berührend	en contacto uno con otro	Hort16A (A)	4
		slightly overlapping	légèrement chevauchants	leicht überlappend	ligeramente solapados	Hayward (A)	5
		strongly overlapping	très chevauchants	stark überlappend	muy solapados		6
21. **(+)**	**VG**	**Leaf blade: number of ciliate serrations**	**Limbe : nombre de denticulations ciliées**	**Blattspreite: Anzahl der bewimperten Zähne**	**Limbo: número de dientes ciliados**		
QN	**(c)**	few	faible	gering	bajo	a-Shouwa (B)	3
	(d)	medium	moyen	mittel	medio	a-Gassan (B)	5
	(2)	many	élevé	groß	alto	Mitsukou (B)	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
22.	**VG**	**Leaf blade: density of hairs on upper side**	**Limbe : densité de la pilosité sur la face supérieure**	**Blattspreite: Dichte der Behaarung der Oberseite**	**Limbo: densidad de la vellosidad en el haz**		
QN	**(c)**	absent or very sparse	absente ou très lâche	fehlend oder sehr locker	ausente o muy escasa	Hort16A (A)	1
	(d)	sparse	lâche	locker	escasa	Kaimai (A)	3
	(1)	medium	moyenne	mittel	media	Bruno (A)	5
		dense	dense	dicht	densa	Meteor (A)	7
23.	**VG**	**Leaf blade: density of hairs on lower side**	**Limbe : densité de la pilosité sur la face inférieure**	**Blattspreite: Dichte der Behaarung der Unterseite**	**Limbo: densidad de la vellosidad en el envés**		
QN	**(c)**	absent or very sparse	absente ou très lâche	fehlend oder sehr locker	ausente o muy escasa	Hortgem Tahi (B), Kousui (B)	1
	(d)	sparse	lâche	locker	escasa	a-Gassan (B), Kuimi (A)	3
		medium	moyenne	mittel	media	a-Shouwa (B), Hayward (A)	5
		dense	dense	dicht	densa	Ranger (A), Shinzan (B)	7
24. (*)	**VG**	**Leaf blade: intensity of green color of upper side**	**Limbe : intensité de la couleur verte de la face supérieure**	**Blattspreite: Intensität der Grünfärbung der Oberseite**	**Limbo: intensidad del color verde del haz**		
QN	**(c)**	light	claire	gering	claro	a- Gassan (B)	3
	(d)	medium	moyenne	mittel	medio	Hayward (A), Satoizumi (B)	5
		dark	foncée	stark	oscuro	Bruno (A), Shinzan (B)	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
25. (*) (+)	**VG**	**Leaf blade: color of <u>lower</u> side**	**Limbe : couleur de la face <u>inférieure</u>**	**Blattspreite: Farbe der <u>Unter</u>seite**	**Limbo: color del <u>envés</u>**		
PQ	**(c)**	whitish	blanchâtre	weißlich	blanquecino	Shinzan (B)	1
	(d)	light green	vert clair	hellgrün	verde claro	a-Awaji (B), Hortgem Tahi (B)	2
		medium green	vert moyen	mittelgrün	verde medio	Bruno (A)	3
		yellow green	vert jaune	gelbgrün	verde amarillento	Hayward (A)	4
		yellow brown	brun jaune	gelbbraun	marrón amarillento		5
26.	**VG**	**Leaf blade: variegation**	**Limbe : panachure**	**Blattspreite: Panaschierung**	**Limbo: variegación**		
QL	**(c)**	absent	absente	fehlend	ausente		1
	(d)	present	présente	vorhanden	presente		9
27.	**VG**	**Leaf blade: color of variegation**	**Limbe : couleur de la panachure**	**Blattspreite: Farbe der Panaschierung**	**Limbo: color de la variegación**		
PQ	**(c)**	white only	blanc seulement	nur weiß	sólo blanco		1
	(d)	white and yellow	blanc et jaune	weiß und gelb	blanco y amarillo		2
		yellow only	jaune seulement	nur gelb	sólo amarillo		3
28. (*)	**VG**	**Leaf: length of petiole relative to blade**	**Feuille : longueur du pétiole par rapport au limbe**	**Blatt: Länge des Blattstiels im Verhältnis zur Spreite**	**Hoja: longitud del peciolo respecto del limbo**		
QN	**(c)**	very small	très petite	sehr kurz	muy pequeño	Kaimai (A)	1
	(d)	small	petite	kurz	pequeño	Gracie (A)	3
		medium	moyenne	mittel	medio	Kousui (B), Meteor (A)	5
		large	grande	lang	grande	Hayward (A), Satoizumi (B)	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
29.	**VG**	**Petiole: density of pubescence**	**Pétiole : densité de la pilosité**	**Blattstiel: Dichte der Behaarung**	**Peciolo: densidad de la pubescencia**		
QN	**(c)**	absent or sparse	absente ou lâche	fehlend oder locker	ausente o laxa	Hayward (A), Hort 16A (A), Sparkler (A)	1
	(d)	medium	moyenne	mittel	media	Russell (A), Meris (A)	2
		dense	dense	dicht	densa	Meteor (A), Minkigold (A)	3
30.	**VG**	**Petiole: anthocyanin coloration of <u>upper side</u>**	**Pétiole : pigmentation anthocyanique de la <u>face supérieure</u>**	**Blattstiel: Anthocyanfärbung der <u>Oberseite</u>**	**Peciolo: pigmentación antociánica de <u>la cara superior</u>**		
QN	**(c)**	absent or very weak	absente ou très faible	fehlend oder sehr gering	ausente o muy débil	Kaimai (A), Mitsukou (B)	1
	(d)	weak	faible	gering	débil	Houkou (B), Sparkler (A)	3
	(e)	medium	moyenne	mittel	media	Hayward (A), Shinzan (B)	5
		strong	forte	stark	fuerte	a-Hirano (B), Tomua (A)	7
31. (+)	**VG**	**Inflorescence: type**	**Inflorescence : type**	**Blütenstand: Typ**	**Inflorescencia: tipo**		
QL		solitary	solitaire	einzeln	aislada	Jinkui	1
		dichasium	dichasium	Dichasium	dicasio	Jinyan	2
		pleiochasium	pleiochasium	Pleiochasium	pleiocasio	Moshan No.4	3
32. (+)	**VG/ MG**	**Inflorescence: number of flowers**	**Inflorescence : nombre de fleurs**	**Blütenstand: Anzahl der Blüten**	**Inflorescencia: número de flores**		
QN		very few	très rares	sehr gering	muy bajo	Hayward (A), Hortgem Rua (B)	1
		few	rares	gering	bajo	Matua (A)	2
		medium	moyen	mittel	medio	Hort22D (A)	3
		many	nombreuses	groß	alto		4

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
33. **(+)**	**VG**	**Flower bud: position of first spike**	**Bouton floral : position du premier épi**	**Blütenknospe: Position der ersten Dolde**	**Botón floral: posición de la primera espiga**		
QN	**(2)**	low	bas	gering	baja		1
		medium	moyen	mittel	media	a-Shouwa (B)	2
		high	haut	hoch	alta	a-Gassan (B)	3
34.	**VG**	**Flower: number of sepals**	**Fleur : nombre de sépales**	**Blüte: Anzahl der Kelchblätter**	**Flor: número de sépalos**		
QN	**(f)**	few	rares	gering	bajo	Skelton (A)	1
		medium	moyen	mittel	medio	Hortgem Tahi (B)	2
		many	nombreux	groß	alto	Bruce (A)	3
35. **(*)** **(+)**	**VG**	**Flower: main color of sepals**	**Fleur : couleur principale des sépales**	**Blüte: Hauptfarbe der Kelchblätter**	**Flor: color principal de los sépalos**		
PQ	**(f)**	white	blanche	weiß	blanco	Yukimusume (B)	1
		green	verte	grün	verde	Hort16A (A), Mitsukou (B)	2
		brown	brune	braun	marrón	Shinzan (B), Tomua (A)	3
		reddish brown	brune rougeâtre	rötlichbraun	marrón rojizo	a-Awaji (B), Hortgem Tahi (B)	4
36.	**VG**	**Flower: density of sepal hairs**	**Fleur : densité de la pilosité des sépales**	**Blüte: Dichte der Behaarung der Kelchblätter**	**Flor: densidad de la vellosidad de los sépalos**		
QN	**(f)**	absent or sparse	absente ou peu dense	fehlend oder locker	ausentes o escasa		1
	(1)	medium	moyenne	mittel	media		2
		dense	dense	dicht	densa	Bruce (A)	3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
37. (*)	**MG/ MS**	**Flower: diameter**	**Fleur : diamètre**	**Blüte: Durchmesser**	**Flor: diámetro**		
QN	**(f)**	small	petit	klein	pequeño	a-Gassan (B), Sparkler (A)	3
		medium	moyen	mittel	medio	Matua (A), Satoizumi (B)	5
		large	grand	groß	grande	Hort51-1785 (A), Shinzan (B)	7
		very large	très grand	sehr groß	muy grande	Hayward (A)	9
38. (*) (+)	**VG**	**Flower: arrangement of petals**	**Fleur : disposition des pétales**	**Blüte: Anordnung der Blütenblätter**	**Flor: disposición de los pétalos**		
QN	**(f)**	free	libres	auseinanderstehend	separados	Abbott (A), a-Shouwa (B)	1
		touching	tangents	sich berührend	en contacto	Matua (A), Satoizumi (B)	2
		overlapping	chevauchants	überlappend	solapados	Hayward (A) Shinzan (B)	3
39.	**VG**	**Flower: shape in profile**	**Fleur : forme de profil**	**Blüte: Form im Profil**	**Flor: forma de perfil**		
PQ	**(f)**	concave	concave	konkav	cóncava	Hayward (A)	1
		flat	plate	flach	plana	Bruno (A)	2
		convex	convexe	konvex	convexa	Tamara (A)	3
40.	**VG**	**Flower: number of styles**	**Fleur : nombre de styles**	**Blüte: Anzahl Griffel**	**Flor: número de estilos**		
QN	**(f)**	few	petit	gering	bajo	Yamagatamusume (B)	1
		medium	moyen	mittel	medio	Hort16A (A), Satoizumi (B)	2
		many	grand	groß	alto	Hayward (A), Shinzan (B)	3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
41. **(*)** **(+)**	**VG**	**Flower: attitude of styles**	**Fleur : port des styles**	**Blüte: Stellung der Griffel**	**Flor: porte del estilo**		
PQ	**(f)**	erect	dressé	aufrecht	erecto		1
		semi-erect	demi-dressé	halbaufrecht	semierecto	Houkou (B)	2
		horizontal	horizontal	waagrecht	horizontal	Bruno (A), Shinzan (B)	3
		irregular	irrégulier	unregelmäßig	irregular	Hayward (A)	4
42. **(+)**	**VG**	**Petal: main color on adaxial side**	**Pétale : couleur principale de la face ventrale**	**Blütenblatt: Hauptfarbe der adaxialen Seite**	**Pétalo: color principal en el lado adaxial**		
PQ		white	blanc	weiß	blanco	Hayward (A), Shinzan (B)	1
		greenish white	blanc verdâtre	grünlichweiß	blanco verdoso	Hortgem Tahi (B), Satoizumi (B)	2
		yellowish white	blanc jaunâtre	gelblichweiß	blanco amarillento	Bruce (A), Mitsukou (B)	3
		yellowish green	vert jaunâtre	gelblichgrün	verde amarillento		4
		yellow	jaune	gelb	amarillo		5
		light pink	rose clair	hellrosa	rosa claro		6
		red pink	rose rouge	rotrosa	rosa rojizo		7
		red	rouge	rot	rojo		8
43. **(+)**	**VG**	**Petal: shading of main color**	**Pétale : dégradé de la couleur principale**	**Blütenblatt: Schattierung der Hauptfarbe**	**Pétalo: sombreado del color principal**		
QN	**(f)**	lighter towards base	plus claire vers la base	heller zur Basis hin	más claro hacia la base		1
		even	régulier	gleichmäßig	uniforme	Hort16A (A)	2
		lighter towards apex	plus claire vers le sommet	heller zur Spitze hin	más claro hacia el ápice		3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
44. (+)	**VG**	**Petal: second color on adaxial side**	**Pétale : couleur secondaire de la face ventrale**	**Blütenblatt: Sekundärfarbe der adaxialen Seite**	**Pétalo: segundo color en el lado adaxial**		
PQ	**(f)**	none	aucune	keine	ninguno		1
		white	blanche	weiß	blanco		2
		green	verte	grün	verde	Hayward (A)	3
		light pink	rose clair	hellrosa	rosa claro		4
		dark pink	rose foncé	dunkelrosa	rosa oscuro	Meteor (A)	5
45. (+)	**VG**	**Petal: distribution of second color**	**Pétale : répartition de la couleur secondaire**	**Blütenblatt: Verteilung der Sekundärfarbe**	**Pétalo: distribución del segundo color**		
PQ	**(f)**	marginal only	marginale seulement	nur am Rand	sólo en el borde		1
		irregular spotted	moucheté irrégulier	unregelmäßig gepunktet	manchado irregular	Meteor (A)	2
		basal spot only	tache à la base seulement	nur Basalfleck	sólo mancha basal	Hayward (A)	3
46.	**VG**	**Anther: color**	**Anthère : couleur**	**Anthere: Farbe**	**Antera: color**		
PQ	**(f)**	yellow	jaune	gelb	amarillo	r-Nagano (B)	1
		yellow orange	jaune orangé	gelborange	naranja amarillento	Bruce (A)	2
		grey	gris	grau	gris		3
		dark purple	pourpre foncé	dunkelpurpurn	púrpura oscuro	Mitsukou (B)	4
		black	noir	schwarz	negro	a-Shouwa (B)	5

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
47. (*) (+)	**MG**	**Fruit: weight**	**Fruit : poids**	**Frucht: Gewicht**	**Fruto: peso**		
QN	**(g)**	very low	très bas	sehr gering	muy bajo		1
		low	bas	gering	bajo	Huaguang2 (A)	3
		medium	moyen	mittel	medio	Hort16A (A), Hortgem Tahi (B), Tomua (A)	5
		high	élevé	hoch	elevado	Hayward (A), Jin Feng (A)	7
		very high	très élevé	sehr hoch	muy elevado	Jade Moon (A)	9
48. (*) (+)	**VG/ MS**	**Fruit: length**	**Fruit : longueur**	**Frucht: Länge**	**Fruto: longitud**		
QN	**(g)**	short	petit	kurz	corto	Kuimi (A), Hortgem Tahi (B)	3
		medium	moyen	mittel	medio	Hayward (A)	5
		long	long	lang	largo	Bruno (A), Hortgem Toru (B)	7
49. (*) (+)	**VG/ MS**	**Fruit: width**	**Fruit : largeur**	**Frucht: Breite**	**Fruto: anchura**		
QN	**(g)**	narrow	étroit	schmal	estrecho	Bruno (A)	3
		medium	moyen	mittel	medio	Hayward (A)	5
		broad	large	breit	ancho	Kuimi (A)	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
50. (*) (+)	**VG/ MG**	**Fruit: ratio length/width**	**Fruit : rapport longueur/largeur**	**Frucht: Verhältnis Länge/Breite**	**Fruto: relación entre la longitud y la anchura**		
QN	**(g)**	very low	très bas	sehr klein	muy baja		1
		very low to low	très bas à bas	sehr klein bis klein	muy baja a baja		2
		low	bas	klein	baja	Hort22D (A)	3
		low to medium	bas à moyen	klein bis mittel	baja a media	Tsechelidis (A), Wuzhi5 (A)	4
		medium	moyen	mittel	medio	Hayward (A), Zesy002 (A)	5
		medium to high	moyen à élevé	mittel bis groß	media a alta	Alison (A)	6
		high	élevé	groß	alta	Bruno (A)	7
		high to very high	élevé à très élevé	groß bis sehr groß	alta a muy alta		8
		very high	très élevé	sehr groß	muy alta		9
51. (*) (+)	**VG**	**Fruit: shape**	**Fruit : forme**	**Frucht: Form**	**Fruto: forma**		
PQ	**(g)**	ovate	ovale	eiförmig	oval	Hort16A (A), Jecy Gold (A), Yamagatamusume (B)	1
		oblong	oblongue	breitrund	oblongo	Hortgem Toru (B), Wilkins Super (A)	2
		elliptic	elliptique	elliptisch	elíptico	Hayward (A), Mitsukou (B)	3
		circular	circulaire	rund	circular	Hort51-1785 (A)	4
		oblate	aplatie	breitrund	oblato	Kuimi (A), Shinzan (B)	5
		obovate	obovale	verkehrt eiförmig	oboval	Monty (A)	6

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
52. **(*)** **(+)**	**VG**	**Fruit: shape in cross section (at median)**	**Fruit : forme en section transversale (au milieu)**	**Frucht: Form im Querschnitt (in der Mitte)**	**Fruto: forma en la sección transversal (en el medio)**		
PQ	**(g)**	circular	circulaire	rund	circular	Bruno (A), Mitsukou (B)	1
		oblate	aplatie	breitrund	oblata	Hortgem Tahi (B), Kousui (B), Wilkins Super (A)	2
		transverse elliptic	elliptique transverse	quer elliptisch	elíptica transversal	Hayward (A)	3
53. **(*)** **(+)**	**VG**	**Fruit: stylar end**	**Fruit : extrémité stylaire**	**Frucht: Griffelende**	**Fruto: extremo estilar**		
PQ	**(g)**	strongly depressed	fortement déprimée	stark eingesenkt	muy deprimido		1
		weakly depressed	légèrement déprimée	leicht eingesenkt	levemente deprimido	Jade Moon (A)	2
		flat	plate	flach	plano	Hayward (A), Satoizumi (B)	3
		rounded	arrondie	abgerundet	redondeado	Kousui (B), Tomua (A)	4
		weakly blunt protruding	saillante légèrement tronquée	leicht stumpf herausragend	saliente levemente truncado	Skelton (A)	5
		strongly blunt protruding	saillante fortement tronquée	stark stumpf herausragend	saliente muy truncado	Hort16A (A)	6
		pointed protrusion	fortement saillante	spitz herausragend	protusión puntiaguda	Hortgem Toru (B)	7
54. **(+)**	**VG**	**Fruit: degree of pointed protusion**	**Fruit : degré de protubérance pointue**	**Frucht: Grad der spitzen Vorwölbung**	**Fruto: grado de la protusión puntiaguda**		
QN	**(g)**	weak	faible	schwach	débil		1
	(2)	medium	moyen	mittel	medio		2
		strong	fort	stark	fuerte		3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
55. **(+)**	**VG**	**Fruit: presence of calyx ring**	**Fruit : présence de l'anneau du calice**	**Frucht: Vorhandensein eines Kelchrings**	**Fruto: presencia del anillo del cáliz**		
QN	**(g)**	absent or weakly expressed	absente ou faiblement exprimée	fehlend oder schwach ausgeprägt	ausente o débilmente expresada	Bruno (A)	1
	(1)	medium expressed	moyennement exprimée	mittel ausgeprägt	intensidad de expresión media	Hayward (A)	2
		strongly expressed	fortement exprimée	stark ausgeprägt	fuertemente expresada	Hort16A (A), Qinmei (A)	3
56. **(*)** **(+)**	**VG**	**Fruit: shape of shoulder at stalk end**	**Fruit : forme de l'épaulement à l'extrémité pédonculaire**	**Frucht: Form der Schulter am Stielende**	**Fruto: forma del hombro en el extremo peduncular**		
PQ	**(g)**	truncate	tronquée	stumpf	truncado	Hortgem Tahi (B), Mitsukou (B)	1
		weakly sloping	faiblement inclinée	leicht zugespitzt	levemente inclinado	Hayward (A), Kousui (B)	2
		strongly sloping	fortement inclinée	stark zugespitzt	muy inclinado	Skelton (A)	3
57. **(*)**	**VG/ MS**	**Fruit: length of stalk**	**Fruit : longueur du pédoncule**	**Frucht: Länge des Stiels**	**Fruto: longitud del pedúnculo**		
QN	**(g)**	short	court	kurz	corto	Hortgem Tahi (B), Houmitu (A)	3
		medium	moyen	mittel	medio	Sanuki Gold (A), Shinzan (B)	5
		long	long	lang	largo	Hayward (A)	7
58. **(*)** **(+)**	**VG/ MS**	**Fruit: length of stalk relative to length of fruit**	**Fruit : longueur du pédoncule par rapport à celle du fruit**	**Frucht: Länge des Stiels im Verhältnis zur Länge der Frucht**	**Fruto: longitud del pedúnculo respecto de la longitud del fruto**		
QN	**(g)**	very short	très court	sehr kurz	muy corta	Wuzhi3 (A)	1
		short	court	kurz	corta	Bruno (A), Kousui (B)	3
		medium	moyen	mittel	media	Allison (A), Shinzan (B)	5
		long	long	lang	larga	Hayward (A)	7
		very long	très long	sehr lang	muy larga	Jade Moon (A)	9

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
59.	**VG**	**Fruit: conspicuousness of lenticels on skin**	**Fruit : netteté des lenticelles sur l'épiderme**	**Frucht: Ausprägung der Lentizellen auf der Schale**	**Fruto: notabilidad de las lenticelas en la epidermis**		
QN	**(g)**	weak	faible	gering	débil	Hort16A (A), Mitsukou (B)	1
		medium	moyenne	mittel	media	Hayward (A)	2
		strong	forte	stark	fuerte	Kousui (B), Topstar Vantini (A)	3
60. (*)	**VG**	**Fruit: hairiness of skin**	**Fruit : pilosité de l'épiderme**	**Frucht: Behaarung der Schale**	**Fruto: vellosidad de la epidermis**		
QL	**(g)**	absent	absente	fehlend	ausente	Shinzan (B), a-Shouwa (B)	1
		present	présente	vorhanden	presente	Hayward (A)	9
61. (*) (+)	**VG**	**Fruit: density of hairs**	**Fruit : densité de la pilosité**	**Frucht: Dichte der Behaarung**	**Fruto: densidad de la vellosidad**		
QN	**(g)**	very sparse	très faible	sehr locker	muy escasa	Topstar Vantini (A)	1
	(1)	sparse	faible	locker	escasa	Hort16A (A)	3
		medium	moyenne	mittel	media	Hayward (A)	5
		dense	dense	dicht	densa	Bruno (A)	7
62.	**VG**	**Fruit: color of hairs**	**Fruit : couleur des poils**	**Frucht: Farbe der Haare**	**Fruto: color del vello**		
PQ	**(g)**	white	blanc	weiß	blanco		1
	(1)	yellow	jaune	gelb	amarillo		2
		yellow brown	jaune brun	gelbbraun	marrón amarillento	Hort16A (A)	3
		reddish brown	brun rougeâtre	rötlichbraun	marrón rojizo		4
		medium brown	brun moyen	mittelbraun	marrón medio	Hayward (A)	5
		dark brown	brun foncé	dunkelbraun	marrón oscuro	Bruno (A)	6

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
63. **(*)** **(+)**	**VG**	**Fruit: adherence of hairs to skin**	**Fruit : adhérence des poils à l'épiderme**	**Frucht: Anhaften der Haare an der Schale**	**Fruto: adherencia del vello a la epidermis**		
QN	**(g)**	very weak	très faible	sehr schwach	muy débil	Tomua (A)	1
	(1)	weak	faible	schwach	débil	Hort16A (A)	3
		medium	moyenne	mittel	medio	Abbott (A)	5
		strong	forte	stark	fuerte	Hayward (A)	7
64. **(*)** **(+)**	**VG**	**Fruit: color of skin**	**Fruit : couleur de l'épiderme**	**Frucht: Farbe der Schale**	**Fruto: color de la piel**		
PQ	**(h)**	light green	vert clair	hellgrün	verde claro	Hortgem Rua (B)	1
		medium green	vert moyen	mittelgrün	verde medio	Hortgem Tahi (B), Mitsukou (B)	2
		reddish green	vert rougeâtre	rötlichgrün	verde rojizo		3
		yellow	jaune	gelb	amarillo		4
		greenish brown	brun verdâtre	grünlichbraun	marrón verdoso	Hayward (A), Shinzan (B)	5
		reddish brown	brun rougrâtre	rötlichbraun	marrón rojizo		6
		light brown	brun clair	hellbraun	marrón claro	Hort16A (A)	7
		medium brown	brun moyen	mittelbraun	marrón medio	Sanuki Gold (A)	8
		dark brown	brun foncé	dunkelbraun	marrón oscuro	Kousui (B), Tomua (A)	9
		purple red	rouge pourpre	purpurrot	rojo púrpura		10
65.	**VG**	**Fruit: adherence of skin to flesh**	**Fruit: adhérence de l'épiderme à la chair**	**Frucht: Anhaften der Schale am Fleisch**	**Fruto: adherencia de la epidermis a la pulpa**		
QN	**(h)**	weak	faible	schwach	débil		1
	(2)	medium	moyenne	mittel	media	Hortgem Tahi (B)	2
		strong	forte	stark	fuerte	Hortgem Toru (B)	3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
66. (*) (+)	VG	**Fruit: color of outer pericarp**	**Fruit : couleur du péricarpe externe**	**Frucht: Farbe des äußeren Perikarps**	**Fruto: color del pericarpio exterior**		
PQ	(h)	light green	vert clair	hellgrün	verde claro	Shinzan (B)	1
		medium green	vert moyen	mittelgrün	verde medio	Hayward (A)	2
		dark green	vert foncé	dunkelgrün	verde oscuro	Hortgem Toru (B)	3
		greenish yellow	jaune verdâtre	grünlichgelb	amarillo verdoso	Hort22D (A), Satoizumi (B)	4
		medium yellow	jaune moyen	mittelgelb	amarillo medio	Hort16A (A), Kousui (B)	5
		dark yellow	jaune foncé	dunkelgelb	amarillo oscuro	Hort51-1785 (A)	6
		yellowish orange	orange jaunâtre	gelblichorange	anaranjado amarillento		7
		orange	orangé	orange	anaranjado		8
		red	rouge	rot	rojo		9
		red purple	rouge pourpre	rotpurpurn	púrpura rojizo		10
67. (*) (+)	VG	**Fruit: color of locules**	**Fruit : couleur des loges**	**Frucht: Farbe der Kammern**	**Fruto: color de los lóculos**		
PQ	(h)	light green	vert clair	hellgrün	verde claro	Shinzan (B)	1
		medium green	vert moyen	mittelgrün	verde medio	Hayward (A), Hortgem Tahi (B)	2
		dark green	vert foncé	dunkelgrün	verde oscuro	Hortgem Toru (B)	3
		greenish yellow	jaune verdâtre	grünlichgelb	amarillo verdoso	Satoizumi (B)	4
		medium yellow	jaune moyen	mittelgelb	amarillo medio	Hort16A (A), Kousui (B)	5
		dark yellow	jaune foncé	dunkelgelb	amarillo oscuro	Hort51-1785 (A)	6
		red	rouge	rot	rojo	Hort22D (A), Hortgem Rua (B)	7
		red purple	rouge pourpre	rotpurpurn	púrpura rojizo		8

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
68. **(+)**	**VG**	**Fruit: spread of reddish color along locules**	**Fruit : distribution de la couleur rougeâtre le long des loges**	**Frucht: Ausbreitung der rötlichen Farbe entlang der Kammern**	**Fruto: distribución del color rojizo a lo largo de los lóculos**		
QN	**(h)**	very weak	très faible	sehr gering	muy débil	Red Princess (A)	1
		weak	faible	gering	débil	Honghua (A)	2
		medium	moyenne	mittel	medio	Chuhong (A)	3
		strong	forte	groß	fuerte		4
		very strong	très forte	sehr groß	muy fuerte	Hort22D (A)	5
69.	**VG**	**Fruit: intensity of reddish color in locules**	**Fruit : intensité de la couleur rougeâtre dans les loges**	**Frucht: Intensität der rötlichen Farbe in den Kammern**	**Fruto: intensidad del color rojizo en los lóculos**		
QN	**(h)**	light	légère	hell	claro	Red Princess (A)	3
		medium	moyenne	mittel	medio		5
		dark	foncée	dunkel	oscuro	Hort22D (A)	7
70. **(*)** **(+)**	**VG**	**Fruit: width of core relative to fruit**	**Fruit : largeur du cœur par rapport au fruit**	**Frucht: Breite der Mittelzone im Verhältnis zur Frucht**	**Fruto: anchura del corazón respecto del fruto**		
QN	**(h)**	small	petite	klein	pequeña	Hort16A (A)	3
		small to medium	petite à moyenne	klein bis mittel	pequeña a media		4
		medium	moyenne	mittel	media	Bruno (A)	5
		medium to large	moyenne à large	mittel bis groß	media a grande	Tomua (A)	6
		large	large	groß	grande	Hayward (A)	7
71. **(*)** **(+)**	**VG**	**Fruit: general shape of core in cross section**	**Fruit : forme générale du cœur en section transversale**	**Frucht: allgemeine Form der Mittelzone im Querschnitt**	**Fruto: forma general del corazón en la sección transversal**		
PQ	**(h)**	circular	circulaire	rund	circular	Jintao (A), Yukimusume (B)	1
		oblate	aplatie	breitrund	oblata	Hort22D (A), Hortgem Tahi (B), Shinzan (B)	2
		transverse elliptic	elliptique transverse	quer elliptisch	elíptica transversal	Hort16A (A), Mitsukou (B)	3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
72. **(*)**	**VG**	**Fruit: color of core**	**Fruit : couleur du cœur**	**Frucht: Farbe der Mittelzone**	**Fruto: color del corazón**		
PQ	**(h)**	white	blanc	weiß	blanco	Hort22D (A)	1
		greenish white	blanc verdâtre	grünlichweiß	blanco verdoso	Hayward (A), Hortgem Tahi (B)	2
		yellow white	blanc jaunâtre	gelbweiß	blanco amarillento	Hort16A (A), Shinzan (B)	3
		red purple	rouge pourpre	rotpurpurn	púrpura rojizo		4
73. **(+)**	**MS**	**Fruit: sweetness**	**Fruit : goût sucré**	**Frucht: Süße**	**Fruto: dulzura**		
QN	**(h)**	very low	très faible	sehr gering	muy baja	Jade Moon (A)	1
		low	faible	gering	baja	Hayward (A), Satoizumi (B)	3
		medium	moyen	mittel	media	Tomua (A), Yukimusume (B)	5
		high	élevé	hoch	alta	Hort16A (A), Kousui (B)	7
74. **(+)**	**MG**	**Fruit: acidity**	**Fruit : acidité**	**Frucht: Säure**	**Fruto: acidez**		
QN	**(h)**	low	faible	gering	baja	Sanuki Gold (A), Satoizumi (B)	3
		medium	moyenne	mittel	media	Hayward (A), Yamagatamusume (B)	5
		high	élevé	hoch	alta	a-Gassan (B), Bruno (A)	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
75. (*)	**VG/ MG**	**Time of vegetative bud burst**	**Époque du début du débourrement**	**Zeitpunkt des vegetativen Knospenaufbruchs**	**Época de brotación de las yemas de madera**		
QN		very early	très précoce	sehr früh	muy temprana	Hort16A (A), Hortgem Rua (B)	1
		early	précoce	früh	temprana	Tomua (A), Yukimusume (B)	3
		medium	moyenne	mittel	media	Hayward (A), Shinzan (B)	5
		late	tardive	spät	tardía	Mitsukou (B)	7
76. (*) (+)	**VG/ MG**	**Time of beginning of flowering**	**Époque du début de la floraison**	**Zeitpunkt des Blühbeginns**	**Época del inicio de la floración**		
QN		early	précoce	früh	temprana	Hort16A (A), Yukimusume (B)	3
		medium	moyenne	mittel	media	Abbott (A), Kousui (B)	5
		late	tardive	spät	tardía	Hayward (A)	7
77. (*) (+)	**VG/ MG**	**Time of maturity for harvest**	**Époque de la maturité pour la récolte**	**Zeitpunkt der Pflückreife**	**Época de madurez para la cosecha**		
QN	**(g)**	very early	très précoce	sehr früh	muy temprana	Hortgem Rua (B)	1
		early	précoce	früh	temprana	Hort22D (A), Hortgem Tahi (B), Yamagatamusume (B)	3
		medium	moyenne	mittel	media	Kousui (B), Tomua (A)	5
		late	tardive	spät	tardía	Hayward (A), Yukimusume (B)	7

8. Explanations on the Table of Characteristics

8.1 Explanations covering several characteristics

Characteristics containing the following key in the second column of the Table of Characteristics should be examined as indicated below:

(1) Applies to Group A type varieties only

(2) Applies to Group B type varieties only

(a) All observations on the young shoot should be made during active vegetative growth. Observation of hairs should be made on internodes from the middle third of growing shoots.

(b) All observations on the stem (including observations on the buds and bud support) should be made in the middle third of the replacement stem after leaf fall.

(c) The shape, size and hairiness of leaves can vary greatly according to the type and vigor of the shoot on which they are borne. Unless specified, the shoots should be replacement canes, i.e., those that will be tied down and retained for the following season's flowering.

(d) All observations on the leaf should be made near the middle of the current season's growth on sufficiently mature, but not old leaves. The most basal leaves of a shoot should be excluded since they do not usually attain full size or typical shape.

(e) All observations on the presence or absence of anthocyanin coloration in vegetative organs refer to the general appearance of the organ, irrespective of whether red pigments are present in hairs or in the underlying surface.

(f) All observations on the flower should be made on recently fully-opened terminal (king) flowers.

(g) Observations on fruit characteristics should be made at harvest maturity.

(h) Observations on fruit characteristics should be made when ripe for eating.

8.2 Explanations for individual characteristics

Ad. 1: Plant: sex

A hermaphrodite variety has flowers with stigmas and anthers with pollen.

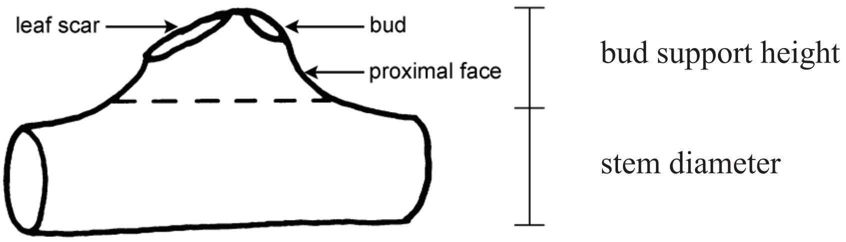
Ad. 2: Plant: self fruit setting

A self fruiting variety will set viable fruit without the presence of polleniser male plants or if flowers are bagged to prevent cross pollination.

Ad. 3: Plant: vigor

Plant vigor is determined by the evaluation of the overall abundance of vegetative growth.

Ad. 12: Stem: prominence of bud support
Ad. 15: Stem: leaf scar



The prominence of the bud support is determined by the bud support height/stem diameter contrast.

Ad. 13: Stem: presence of bud cover

1
absent

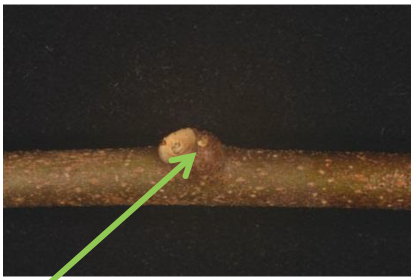
9
present

The absence or presence of the bud cover is indicated by the visibility of the bud. A variety with no bud cover has a strongly protruding bud which is clearly visible. A variety with a bud cover has an almost invisible bud that appears sunk into the stem.

Ad. 14: Stem: size of hole in bud cover

1
small

bud cover



2
medium

3
large

Ad. 16: Stem: pith

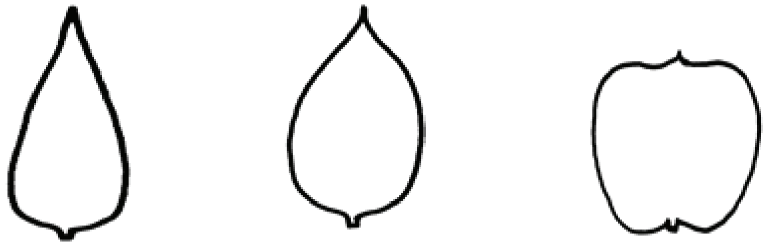
The stem is cut in longitudinal section and the inner part is observed from above.

1 absent: The inner part is empty or hollow.

2 lamellate: The pith consists of layers of thin plates, one against another.

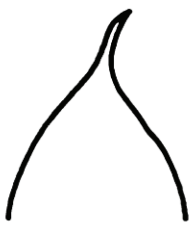
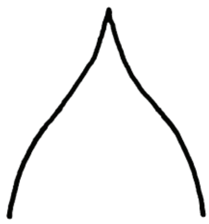
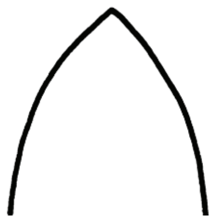
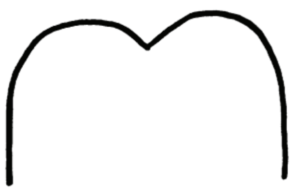
3 solid: The pith consists of a dense mass.

Ad. 17: Leaf blade: shape



1 lanceolate — 2 ovate — 3 obovate

Ad. 19: Leaf blade: shape of apex

pointed				
	1 caudate	2 acuminate	3 acute	4 emarginate with cuspidate
rounded				
	5 rounded			
notched				
	6 retuse	7 emarginate		

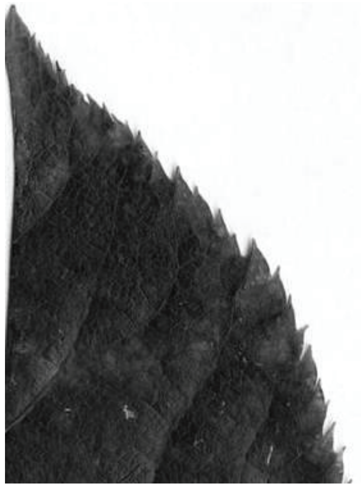
Ad. 20: Leaf blade: basal lobes

		
1 none	2 far apart	3 slightly apart
		
4 touching each other	5 slightly overlapping	6 strongly overlapping

Ad. 21: Leaf blade: number of ciliate serrations

3
few

5
medium



7
many

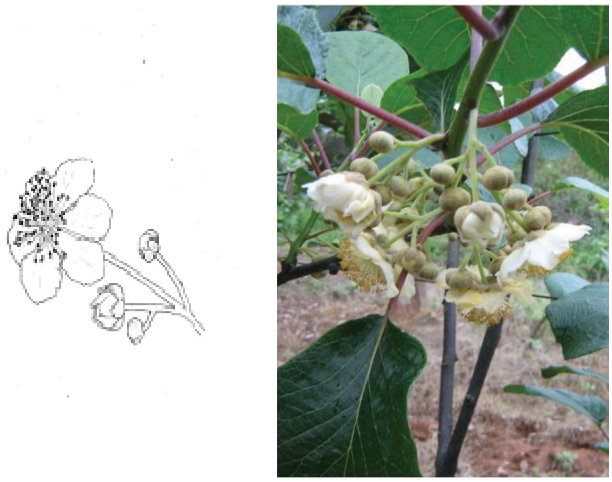
Ad. 25: Leaf blade: color of lower side

The observation on the lower side of the leaf is an overall visual impression. The observation includes hairs and leaf surface.

Ad. 31: Inflorescence: type

1
solitary

2
dichasium



3
pleiochasium

Ad. 32: Inflorescence: number of flowers

Flowers occur on the first 1-6 nodes on a current season's shoot. The observation should be made immediately before flower opening, when at least 2 nodes have developed. The number of flowers present at each node is recorded. It is recommended that at least two shoots are observed per plant.

Ad. 33: Flower bud: position of first spike

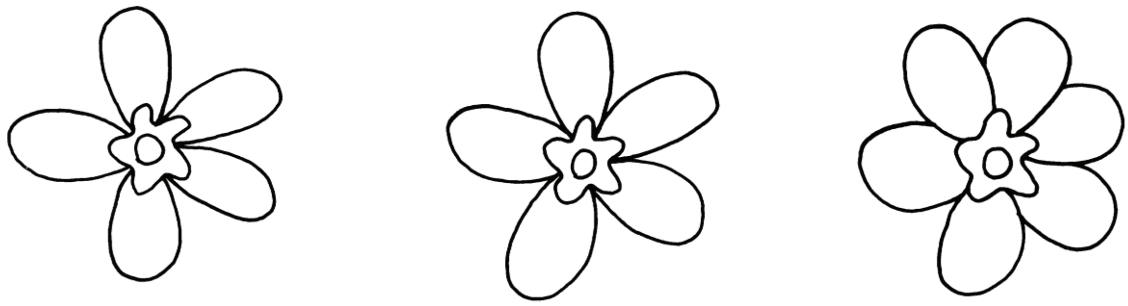
The position of the first spike is determined by node order, of which the first spike is set, from the base. Some varieties set the first spike at the lowest node from the base.

Ad. 35: Flower: main color of sepals

The sepal may have more than one color. The main color is the color with the largest surface area on the organ

Ad. 38: Flower: arrangement of petals

Flowers are viewed from beneath as shown in the diagrams.



1	2	3
free	touching	overlapping

Ad. 41: Flower: attitude of styles

State 4 irregular: The attitude of the styles is a mixture of erect, semi erect and horizontal in any combination of two of three different attitudes. The general impression of the flowers is one of no consistency of style attitude or a single predominant style attitude.

Ad. 42: Petal: main color on adaxial side
Ad. 43: Petal: shading of main color

The main color is the color with the largest surface area on the petal. The main color may be shaded, being darker or lighter from base to apex. This is also referred to as a different intensity of color or color gradient on an organ.

The adaxial side is facing the axis of the flower, the upper side. Note that the upper side may be facing downwards when observed on the plant.

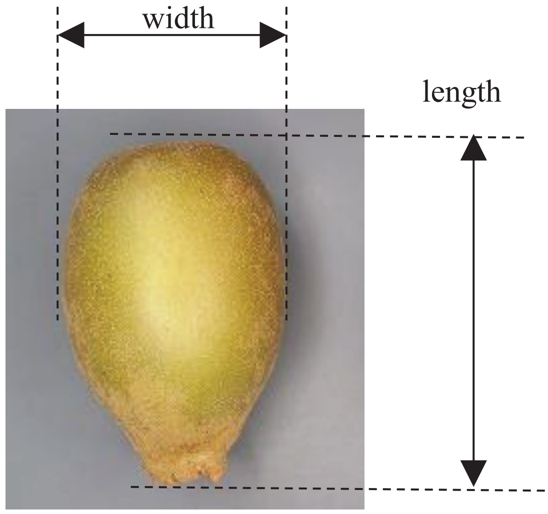
Ad. 44: Petal: second color on adaxial side
Ad. 45: Petal: distribution of second color

The secondary color is identified as the color with the second largest surface area on the organ. The second color occurs as a single basal spot, irregular spotting over the entire petal or solid coloration on or near the margin.

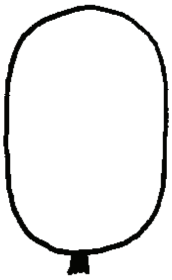
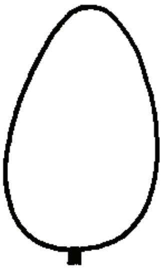
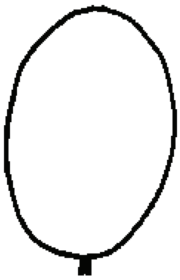
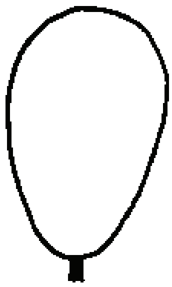
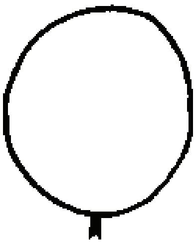
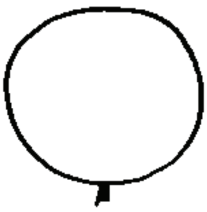
Ad. 47: Fruit: weight

Fruit weight should be determined by a sample size of 25 harvested fruits, 5 each from 5 plants.

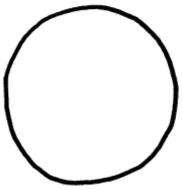
Ad 48: Fruit: length
Ad 49: Fruit: width



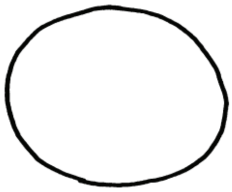
Ad. 50: Fruit: ratio length/width
Ad. 51: Fruit: shape

	← broadest part →		
	below the middle	at middle	above middle
high		 2 oblong	
← length/width ratio →	 1 ovate	 3 elliptic	 6 obovate
		 4 circular	
low		 5 oblate	

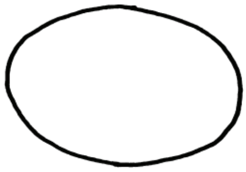
Ad. 52: Fruit: shape in cross section (at median)



1
circular



2
oblate



3
transverse elliptic

Ad. 53: Fruit: stylar end

1
strongly depressed

2
weakly depressed

3
flat

4
rounded

5
weakly blunt protruding

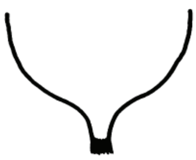
6
strongly blunt protruding

7
pointed protrusion

Ad. 54: Fruit: degree of pointed protrusion

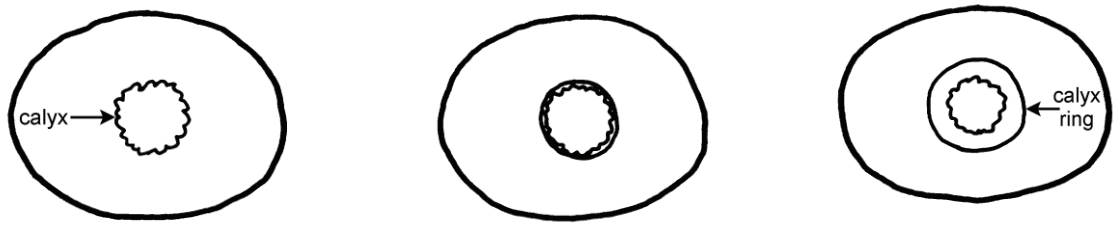
1
weak

2
medium



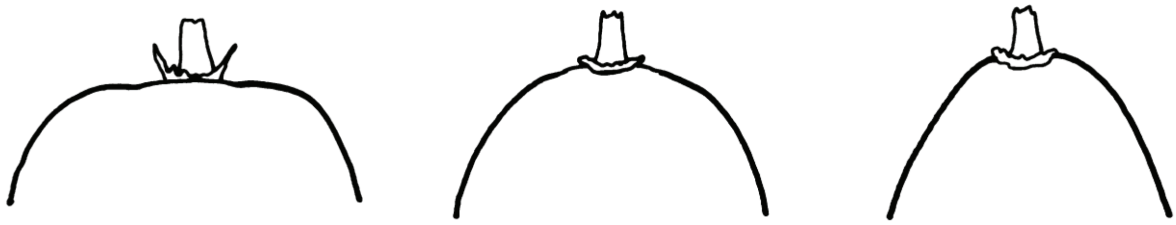
3
strong

Ad. 55: Fruit: presence of calyx ring



1	2	3
absent or weakly expressed	medium expressed	strongly expressed

Ad. 56: Fruit: shape of shoulder at stalk end



1	2	3
truncate	weakly sloping	strongly sloping

Ad. 58: Fruit: length of stalk relative to length of fruit

The relativity is determined by the size of the difference between the length of the stalk and the length of the fruit.

short means moderately shorter stalk to length of fruit
medium means similar stalk length to fruit length
long means moderately longer stalk to length of fruit

Ad. 59: Fruit: conspicuousness of lenticels on skin

The conspicuousness of lenticels is determined by the size and number on the skin

Ad. 61: Fruit: density of hairs

The density is determined by the combination of the number of hairs and length of individual hairs

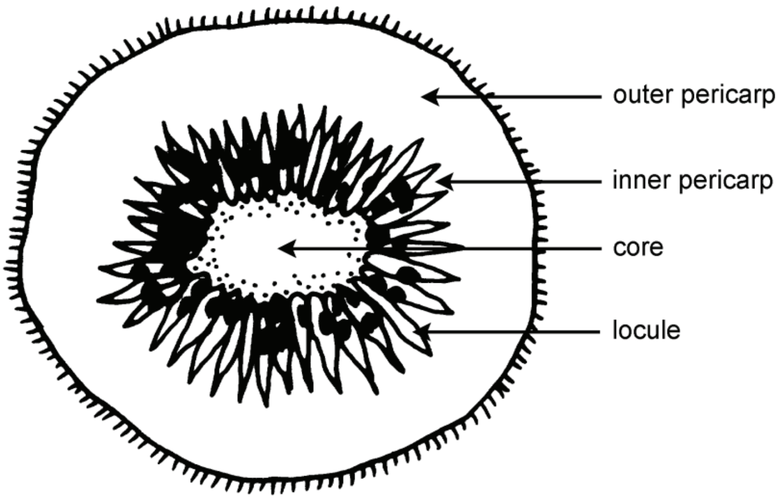
Ad. 63: Fruit: adherence of hairs to skin

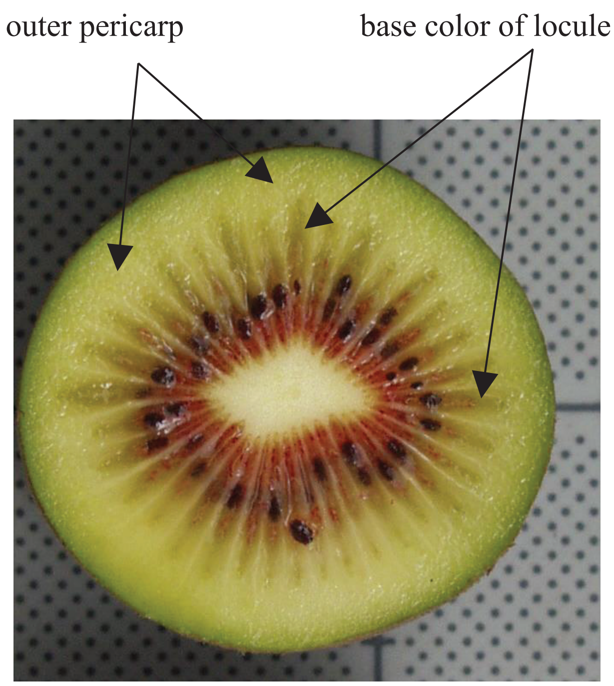
Observation is made by rubbing a finger across the fruit surface and determining the ease or difficulty of hair removal.

Ad. 64: Fruit: color of skin

The color of skin is assessed at harvest after removal of as much hair as practical. The color of the skin does not include coloration from hair.

Ad. 66: Fruit: color of outer pericarp
Ad. 67: Fruit: color of locules





Ad. 68: Fruit: spread of reddish color along locules

1
very weak

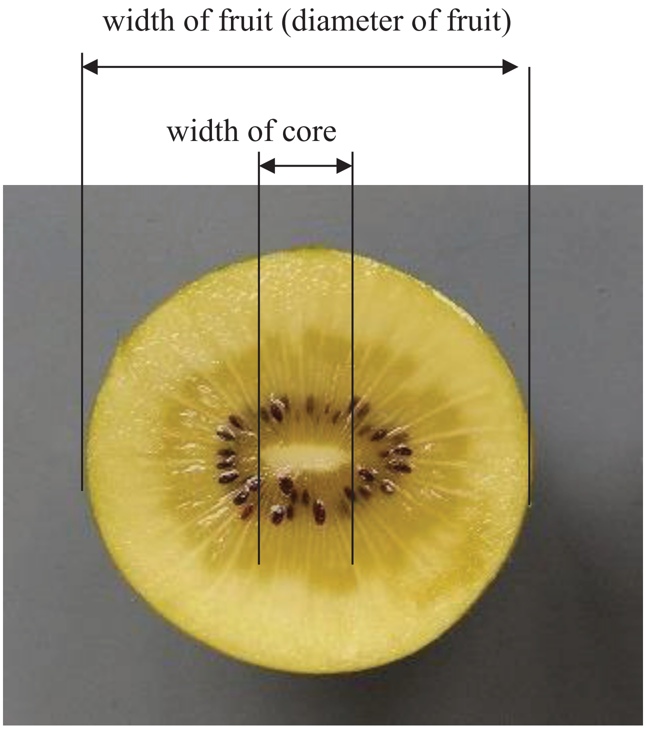
2
weak

3
medium

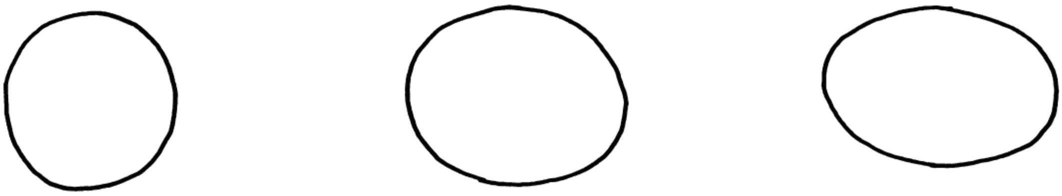
4
strong

5
very strong

<u>Ad. 70: Fruit: width of core relative to fruit</u>



<u>Ad. 71: Fruit: general shape of core in cross section</u>



1 circular	2 oblate	3 transverse elliptic

<u>Ad. 73: Fruit: sweetness</u>

The total soluble solids content is measured by refractometer.

<u>Ad. 74: Fruit: acidity</u>

Acidity is determined by titration of titrateable acids.

Ad. 75: Time of vegetative bud burst

When 10% of buds are showing green shoots.

Ad. 76: Time of beginning of flowering

When 10% of flower buds have fully opened.

Ad. 77: Time of maturity for harvest

It is recommended that harvest occur when the total soluble solids content is at the level determined by national or regional harvest requirements. The total soluble solids can be measured by Brix test.

9. Literature

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Valmori, I., 1991: *Nuove varieta in frutticoltura.* Bologna: Edizioni Agricole.

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10. Technical Questionnaire

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Application date: (not to be filled in by the applicant)

TECHNICAL QUESTIONNAIRE
to be completed in connection with an application for plant breeders' rights

1. Subject of the Technical Questionnaire

1.1 Genus	
1.2 Botanical name	*Actinidia* Lindl.
1.3 Common name	Actinidia, Kiwifruit, Kiwi, Mihoutao
1.4 Species (please complete)	
1.5 Common name (please complete)	

2. Applicant

Name	
Address	
Telephone No.	
Fax No.	
E-mail address	
Breeder (if different from applicant)	

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

3. Proposed denomination and breeder's reference

Proposed denomination (if available)	
Breeder's reference	

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

#4. Information on the breeding scheme and propagation of the variety

4.1 Breeding scheme

Variety resulting from:

4.1.1 Crossing

(a) controlled cross [ ]
(please state parent varieties)

(…………………..……………..…) x (……………..……………………..…)
female parent male parent

(b) partially known cross [ ]
(please state known parent variety(ies))

(…………………..……………..…) x (……………..……………………..…)
female parent male parent

(c) unknown cross [ ]

4.1.2 Mutation [ ]
(please state parent variety)

4.1.3 Discovery and development [ ]
(please state where and when discovered and how developed)

4.1.4 Other [ ]
(please provide details)

Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire.

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

4.2 Method of propagating the variety

4.2.1 Vegetative propagation

(a)	cuttings	[ ]
(b)	grafting (budding) indicate usual rootstock	[ ]
(c)	*in vitro* propagation	[ ]
(d)	other (state method)	[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

5. Characteristics of the variety to be indicated (the number in brackets refers to the corresponding characteristic in Test Guidelines; please mark the note which best corresponds).

	Characteristics	Example Varieties	Note
5.1 (76)	**Time of beginning of flowering (for all varieties)**		
	very early		1[ ]
	very early to early		2[ ]
	early	Hort16A (A), Yukimusume (B)	3[ ]
	early to medium		4[ ]
	medium	Abbott (A), Kousui (B)	5[ ]
	medium to late		6[ ]
	late	Hayward (A)	7[ ]
	late to very late		8[ ]
	very late		9[ ]
5.2 (13)	**Stem: presence of bud cover (for all varieties)**		
	absent	Hort16A (A), Kousui (B)	1[ ]
	present	Hayward (A), Mitsukou (B)	9[ ]
5.3 (14)	**Stem: size of hole in bud cover (for all varieties)**		
	small	Abbott (A), Mitsukou (B)	1[ ]
	medium	Hayward (A), r-Awaji (B)	2[ ]
	large	Elmwood (A), r-Nagano (B)	3[ ]
5.4 (17)	**Leaf blade: shape (for all varieties)**		
	lanceolate	Kaimai (A)	1[ ]
	ovate	Hayward (A)	2[ ]
	obovate	Bruno (A)	3[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Characteristics	Example Varieties	Note
5.5 (19)	**Leaf blade: shape of apex (for all varieties)**		
	caudate	Hortgem Tahi (B)	1[ ]
	acuminate	Kaimai (A), Yukimusume (B)	2[ ]
	acute	Hayward (A)	3[ ]
	emarginate with cuspidate		4[ ]
	rounded	Satoizumi (B)	5[ ]
	retuse	Shinzan (B)	6[ ]
	emarginate	Kuimi (A)	7[ ]
5.6 (42)	**Petal: main color on adaxial side (for all varieties)**		
	white	Hayward (A), Shinzan (B)	1[ ]
	greenish white	Hortgem Tahi (B), Satoizumi (B)	2[ ]
	yellowish white	Bruce (A), Mitsukou (B)	3[ ]
	yellowish green		4[ ]
	yellow		5[ ]
	light pink		6[ ]
	red pink		7[ ]
	red		8[ ]
5.7 (46)	**Anther: color (for all varieties)**		
	yellow	r-Nagano (B)	1[ ]
	yellow orange	Bruce (A)	2[ ]
	grey		3[ ]
	dark purple	Mitsukou (B)	4[ ]
	black	a-Shouwa (B)	5[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Characteristics	Example Varieties	Note
5.8 (47)	**Fruit: weight (for female and hermaphrodite varieties)**		
	very low		1[ ]
	very low to low		2[ ]
	low	Huaguang2 (A)	3[ ]
	low to medium		4[ ]
	medium	Hort16A (A), Hortgem Tahi (B), Tomua (A)	5[ ]
	medium to high		6[ ]
	high	Hayward (A), Jin Feng (A)	7[ ]
	high to very high		8[ ]
	very high	Jade Moon (A)	9[ ]
	not applicable		[ ]
5.9 (51)	**Fruit: shape (for female and hermaphrodite varieties)**		
	ovate	Hort16A (A), Jecy Gold (A), Yamagatamusume (B)	1[ ]
	oblong	Hortgem Toru (B), Wilkins Super (A)	2[ ]
	elliptic	Hayward (A), Mitsukou (B)	3[ ]
	circular	Hort51-1785 (A)	4[ ]
	oblate	Kuimi (A), Shinzan (B)	5[ ]
	obovate	Monty (A)	6[ ]
	not applicable		[ ]
5.10 (52)	**Fruit: shape in cross section (at median) (for female and hermaphrodite varieties)**		
	circular	Bruno (A), Mitsukou (B)	1[ ]
	oblate	Hortgem Tahi (B), Kousui (B), Wilkins Super (A)	2[ ]
	transverse elliptic	Hayward (A)	3[ ]
	not applicable		[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Characteristics	Example Varieties	Note
5.11 (53)	**Fruit: stylar end (for female and hermaphrodite varieties)**		
	strongly depressed		1[ ]
	weakly depressed	Jade Moon (A)	2[ ]
	flat	Hayward (A), Satoizumi (B)	3[ ]
	rounded	Kousui (B), Tomua (A)	4[ ]
	weakly blunt protruding	Skelton (A)	5[ ]
	strongly blunt protruding	Hort16A (A)	6[ ]
	pointed protrusion	Hortgem Toru (B)	7[ ]
	not applicable		[ ]
5.12 (56)	**Fruit: shape of shoulder at stalk end (for female and hermaphrodite varieties)**		
	truncate	Hortgem Tahi (B), Mitsukou (B)	1[ ]
	weakly sloping	Hayward (A), Kousui (B)	2[ ]
	strongly sloping	Skelton (A)	3[ ]
	not applicable		[ ]
5.13 (60)	**Fruit: hairiness of skin (for female and hermaphrodite varieties)**		
	absent	Shinzan (B), a-Shouwa (B)	1[ ]
	present	Hayward (A)	9[ ]
	not applicable		[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Characteristics	Example Varieties	Note
5.14 (64)	**Fruit: color of skin(for female and hermaphrodite varieties)**		
	light green	Hortgem Rua (B)	1[ ]
	medium green	Hortgem Tahi (B), Mitsukou (B)	2[ ]
	reddish green		3[ ]
	yellow		4[ ]
	greenish brown	Hayward (A), Shinzan (B)	5[ ]
	reddish brown		6[ ]
	light brown	Hort16A (A)	7[ ]
	medium brown	Sanuki Gold (A)	8[ ]
	dark brown	Kousui (B), Tomua (A)	9[ ]
	purple red		10[ ]
	not applicable		[ ]
5.15 (66)	**Fruit: color of outer pericarp (for female and hermaphrodite varieties)**		
	light green	Shinzan (B)	1[ ]
	medium green	Hayward (A)	2[ ]
	dark green	Hortgem Toru (B)	3[ ]
	greenish yellow	Hort22D (A), Satoizumi (B)	4[ ]
	medium yellow	Hort16A (A), Kousui (B)	5[ ]
	dark yellow	Hort51-1785 (A)	6[ ]
	yellowish orange		7[ ]
	orange		8[ ]
	red		9[ ]
	red purple		10[ ]
	not applicable		[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Characteristics	Example Varieties	Note
5.16 (67)	**Fruit: color of locules (for female and hermaphrodite varieties)**		
	light green	Shinzan (B)	1[ ]
	medium green	Hayward (A), Hortgem Tahi (B)	2[ ]
	dark green	Hortgem Toru (B)	3[ ]
	greenish yellow	Satoizumi (B)	4[ ]
	medium yellow	Hort16A (A), Kousui (B)	5[ ]
	dark yellow	Hort51-1785 (A)	6[ ]
	red	Hort22D (A), Hortgem Rua (B)	7[ ]
	red purple		8[ ]
	not applicable		[ ]
5.17 (72)	**Fruit: color of core (for female and hermaphrodite varieties)**		
	white	Hort22D (A)	1[ ]
	greenish white	Hayward (A), Hortgem Tahi (B)	2[ ]
	yellow white	Hort16A (A), Shinzan (B)	3[ ]
	red purple		4[ ]
	not applicable		[ ]
5.18 (75)	**Time of vegetative bud burst (for all varieties)**		
	very early	Hort16A (A), Hortgem Rua (B)	1[ ]
	very early to early		2[ ]
	early	Tomua (A), Yukimusume (B)	3[ ]
	early to medium		4[ ]
	medium	Hayward (A), Shinzan (B)	5[ ]
	medium to late		6[ ]
	late	Mitsukou (B)	7[ ]
	late to very late		8[ ]
	very late		9[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Characteristics	Example Varieties	Note
5.19 (77)	**Time of maturity for harvest (for female and hermaphrodite varieties)**		
	very early	Hortgem Rua (B)	1[ ]
	very early to early		2[ ]
	early	Hort 22D (A), Hortgem Tahi (B), Yamagatamusume (B)	3[ ]
	early to medium		4[ ]
	medium	Kousui (B), Tomua (A)	5[ ]
	medium to late		6[ ]
	late	Hayward (A), Yukimusume (B)	7[ ]
	late to very late		8[ ]
	very late		9[ ]
	not applicable		[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

6. Similar varieties and differences from these varieties

Please use the following table and box for comments to provide information on how your candidate variety differs from the variety (or varieties) which, to the best of your knowledge, is (or are) most similar. This information may help the examination authority to conduct its examination of distinctness in a more efficient way.

Denomination(s) of variety(ies) similar to your candidate variety	Characteristic(s) in which your candidate variety differs from the similar variety(ies)	Describe the expression of the characteristic(s) for the **similar** variety(ies)	Describe the expression of the characteristic(s) for **your** candidate variety
Example	*Fruit: weight*	*low*	*medium*

Comments:

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

#7. Additional information which may help in the examination of the variety

7.1 In addition to the information provided in sections 5 and 6, please provide information concerning: Plant: ploidy:

Plant: ploidy		
diploid	Hort16A (A), Kousui (B)	2[ ]
triploid		3[ ]
tetraploid	Hortgem Tahi (B), Kuimi(A)	4[ ]
pentaploid	Shinzan (B)	5[ ]
hexaploid	Hayward (A), Mitsukou (B)	6[ ]
octoploid		8[ ]

7.2 Are there any special conditions for growing the variety or conducting the examination?

Yes [ ] No [ ]

(If yes, please provide details)

7.3 Other information

A representative color photograph of the variety should accompany the Technical Questionnaire.

8. Authorization for release

(a) Does the variety require prior authorization for release under legislation concerning the protection of the environment, human and animal health?

Yes [ ] No [ ]

(b) Has such authorization been obtained?

Yes [ ] No [ ]

If the answer to (b) is yes, please attach a copy of the authorization.

Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire.

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

9. Information on plant material to be examined or submitted for examination.

9.1 The expression of a characteristic or several characteristics of a variety may be affected by factors, such as pests and disease, chemical treatment (e.g. growth retardants or pesticides), effects of tissue culture, different rootstocks, scions taken from different growth phases of a tree, etc.

9.2 The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If the plant material has undergone such treatment, full details of the treatment must be given. In this respect, please indicate below, to the best of your knowledge, if the plant material to be examined has been subjected to:

(a)	Microorganisms (e.g. virus, bacteria, phytoplasma)	Yes [ ]	No [ ]
(b)	Chemical treatment (e.g. growth retardant, pesticide)	Yes [ ]	No [ ]
(c)	Tissue culture	Yes [ ]	No [ ]
(d)	Other factors	Yes [ ]	No [ ]

Please provide details for where you have indicated “yes”.

……………………………………………………………

9.3 Has the plant material to be examined been tested for the presence of virus or other pathogens?

Yes [ ]

(please provide details as specified by the Authority)

No [ ]

10. I hereby declare that, to the best of my knowledge, the information provided in this form is correct:

Applicant’s name

Signature Date

KIWIFRUIT (ACTINIDIA SPP.) PHENOLOGICAL GROWTH STAGES IN SOUTHERN ROMANIAN CLIMATE ACCORDING TO THE BBCH SCALE

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KIWIFRUIT *(ACTINIDIA* SPP.) PHENOLOGICAL GROWTH STAGES IN SOUTHERN ROMANIAN CLIMATE ACCORDING TO THE BBCH SCALE

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Abstract

The aim of this paper is to present the phenological growth stages of two kiwifruit cultivars (Hayward and Bruno) and some Romanian intra and interspecific Actinidia hybrids. The experimental field was established in 2000. The plants were grown on a T-bar trellis system, under an organic orchard management. The inter row surface was covered with a mixture of perennial grasses and along the row, the soil was kept clean. Drip irrigation and micro spray irrigation system was provided. The phenological growth stages were described in the environmental conditions of Romanian plain (Bucharest area), according to the BBCH General Scale (Meier, 2001) and the nomenclature that has been used for Actinidia deliciosa 'Hayward' (Salinero et al., 2009). Data were recorded during two consecutive growing seasons (2018-2019). Kiwi is a relative new fruit specie in Romania and the descriptions of principal growth stages for bud, leaf and shoot development, inflorescence emergence, flowering, fruit development, fruit maturity and plant senescence can improve some horticultural practices and operations on kiwifruit orchard management (such as pruning, girdling, pollination techniques, frost protection, fertilization, irrigation etc.).

***Key words**: phenology, hybrids, A. arguta, A. chinensis, A. deliciosa.*

INTRODUCTION

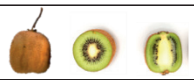
Domesticated from wild populations located on Yangtze River basin from China, kiwifruit is a recently developed crop, due to its nutritional properties, high vitamin C content, as well as its taste and flavour (Biao et. al., 2018; Litz 2005; Yang, 2010; Young et al., 1995).
Actinidia genus belongs to the family *Actinidiaceae* and according to the latest revision (Huang et al., 2007) has over 75 species and about 125 known taxa worldwide. Current commercial cultivation is almost entirely based on *A. deliciosa* and *A. chinensis* (Huang, 2016; Zhang et al., 2010). Lesser extent, in colder regions, *A. arguta* commercial potential started to be recognised, in the early 20th century (Ferguson and Huang, 2007).
Kiwifruit is widely distributed in Asia ranging from the tropics (latitude 0°) to cold temperate regions (50°N) (Huang et al., 2007). According with Cui (1993), *Actinidia* species are found from India to Japan, and from Siberia to Indonesia. In different climates and geographical environments, *Actinidia* species exhibit tremendous biological variation (Huang et al., 2007).
The study of periodic biological events was called phenology (Hernández et al., 2014). Throughout the time a large number of studies are reported in the literature concerning descriptions of principal growth stages in different horticultural crop (Aydin et al., 2019; Bratu et al., 2019; Mușat et al., 2019; Panchev et al., 2019; Stănică, 2019a; Stănică, 2019b; Stroe et Cojanu, 2019).
In 1945, using a combination of letters and numbers, Fleckinger defined 'phenological stages' (Fleckinger, 1948). Adopting the same codes, Zadoks et al. (1974) published the first decimal code to standardise the description for the growth stages of different crops. Based upon these descriptions of cereals (Zadokset al.,1974), a uniform decimal code, known as the BBCH - scale (Biologische Bundesanstalt, Bundessortenamt, Chemische Industrie), was proposed by Lancashire et al. (1991) and Bleiholder et al. (1991). Hack et al. (1992) and Hess et al. (1997) proposed a more advanced scale, the extended BBCH and later, the

'BBCH-Monograph' (representing a group of 27 crops and weeds) was published (Meier, 1997). BBCH-scale (Meier, 2001) it is used now by many researchers for describing the growth stages of different fruit trees (Hernández et al., 2014).
For kiwifruit, first phenological growth stages according BBCH scale, have been described by Salinero et al. (2009), for *Actinidia deliciosa* 'Hayward', in Pontevedra region, from northern-vest of Spain. Important contributions to the study of the phenology of *Actinidia deliciosa* 'Hayward' were made also by Brundell (1975a; 1975b). He proposed six stages for bud development after winter dormancy, and six stages for the development of flower buds until full bloom. To describe these stages, he used the initials of a few words that briefly described each stage (for example 'bb' for bud burst). Regarding fruit development, Hopping (1976) established a growth curve divided on three stages (namely I, II and III), based on fruit weight and growth rate. Later, Beever and Hopkirk (1990) revised the characteristics of Hayward fruit development and physiology, but without presenting a phenological scale.
In Romania kiwifruit research and culture started in 1993 (Peticilă et al., 2002; Stănică, 2009). The first orchards with *Actinidia deliciosa* were planted at Ostrov (Constanța County), on the border of the Danube River (Stănică & Cepoiu, 1996; Stănică, 2009). The most important studies were conducted in a common Italian-Romanian kiwifruit breeding program, initiated at the Faculty of Horticulture within the University of Agronomic Sciences and Veterinary Medicine of Bucharest (Stănică & Zuccherelli, 2007; Stănică & Zuccherelli, 2009).
Taking into consideration that *Actinidia* is a new fruit specie in Romania, the descriptions of principal growth stages can improve some horticultural practices and operations on kiwifruit orchard management (such as pruning, girdling, pollination techniques, frost protection, fertilization, irrigation or pest control).
In this context, the aim of this research was to define the phenological stages of two kiwifruit varieties ('Hayward' and 'Bruno') and some Romanian intra and interspecific *Actinidia* hybrids, in Bucharest area. This study can improve the cultivation of this new crop in Romania, can contribute in Romanian breeding program and also in zoning of the main *Actinidia* species on our country climatic conditions.

MATERIALS AND METHODS

The study was conducted during two consecutive growing seasons (2018 and 2019), in the Experimental Field at the Faculty of Horticulture, within the University of Agronomic Sciences and Veterinary Medicine of Bucharest, for two kiwifruit varieties and eight Romanian intra and interspecific *Actinidia* hybrids. The plant material is presented in Table 1.

Table 1. Plant material description

Variety/Hybrid		Species
Hayward		*A. deliciosa*
Bruno		*A. deliciosa*
R0P10		*A. chinensis* intraspecific hybrid
R0P13		*A. deliciosa* and *A. chinensis* interspecific hybrid
R1P8		*A. deliciosa* and *A. chinensis* interspecific hybrid
R1P9		*A. deliciosa* and *A. chinensis* interspecific hybrid
R1P12		*A. deliciosa* and *A. chinensis* interspecific hybrid
R2P6		*A. chinensis* and *A. arguta* interspecific hybrid
R8P1		*A. arguta* intraspecific hybrid
R10P20		*A. arguta* intraspecific hybrid

The climate in the experimental area is typically temperate-continental, with cold winter and warm, sometimes torrid, summer, with frequent droughts (Asănică, 2010).
The annual mean temperature is between 10.5ºC in the peripheral areas, and 12ºC in the center, caused by the high concentration of constructions, the street traffic and the industrial activities. The annual precipitation between 550 and 600 mm was recorded, mostly falling between May and July. The dominant air

circulation is east and northeast during the winter and from west to the rest of the year, with the maximum wind speed of 3.5-4 m/sec (Asănică, 2010; Asănică, 2011).
The plants were grown in a preluvosoil, on a T-bar trellis system, under an organic orchard management. The inter row surface was covered with a mixture of perennial grasses and along the row, the soil was kept clean. Drip irrigation and micro spray irrigation system was provided.
The phenological growth stages were described in the environmental conditions of Romanian Plain, Vlăsiei Plain subdivision, between winter dormancy and leaf fall, according to the BBCH General Scale (Meier, 2001) and the nomenclature that has been used for *Actinidia deliciosa* 'Hayward' (Salinero et al., 2009). The extended BBCH scale considered 10 principal growth stages, numbered from 0 to 9. This study handled 8 of the 10 principal stages - bud, leaf and shoot development, inflorescence emergence, flowering, fruit development, fruit maturity and plant senescence, described in Table 2.

RESULTS AND DISCUSSIONS

The evolution of growth stages, according to BBCH scale (Meier, 2001), provides an accurate description of kiwifruit plants phenology. The scale is based on a two-digit code where the first digit describes the principal growth stages such as bud development, leaf development, flowering etc., while the second digit gives a more precise timing event of the principal stage. Some of the primary and secondary phenological growth stages of kiwifruit according to BBCH scale (described in Table 2), are represented with photographs for the most cultivated *Actinidia* species - *A. deliciosa* (Figure 1), *A. chinensis* (Figure 2) and *A. arguta* (Figure 3).
During the experimental period, for a better description of the climatic conditions of Bucharest area were noted in Table 3 - the minimum, maximum and mean temperature registered on 2018 and 2019 for every month. Also, was noted the number of days of precipitation and total mm, per every month. These data are very important for correlating the environmental conditions with the phenological growth stage and the main horticultural practices for orchard management.
The lowest temperatures were recorded mainly in winter period, but also in late autumn, -12°C in November 2018 and early spring, -22°C in March 2018.
The kiwifruit species stayed in dormancy until March, when the mean temperature registered are higher than 3.5°C.
Higher temperature differences between night and day were recorded in the months February to April and September to November, in every year. When warmer temperatures in late winter encourage early bud break, these young buds are highly frost - susceptible (Debersaques et al., 2019).
The highest temperatures, between 33-36°C, were recorded in the summer and autumn begging. For reduce drought effect, that can cause considerable damage on kiwifruit orchards, it is necessary to improve atmospheric humidity with sprinkler irrigation.
Annual rainfall averaged in 2018 was 661.1 mm, respectively 636.2 mm in 2019. The rainy period was as usual in this area, occurring during end of spring and middle of summer (Table 3).
The optimal amount of precipitation for kiwifruit is between 1200-1500 mm/year, eventually distributed over the growing season (Hennion, 2003; Debersaques et al., 2019). Thus, water supply by irrigation was provided.
Actinidia cultivation requires a wide range of horticultural practices such as pruning, girdling, frost protection, pollination techniques, flower and fruit thinning, fertilization, irrigation or pest control and harvest (Salinero et al., 2009). To properly manage kiwifruit orchards, an accurate tree phenology must be scheduled.
The phenophases from bud development to fruit maturity and senescence were presented in Table 4, for two kiwifruit varieties ('Hayward' and 'Bruno') and eight Romanian intra and interspecific *Actinidia* hybrids (R0P10, R0P13, R1P8, R1P9, R1P12, R2P6, R8P1, R10P20), in two observational years (2018 and 2019). In Table 5 the main operations on kiwifruit orchard management were presented.

Table 2. Proposal of principal kiwifruit phenological growth stages adapted according to the BBCH scale

BBCH code	Growth stage description
	Principal growth stage 0: Bud development
00	Dormant buds grown in the previous crop-year are completely closed. A small ostiole (less than 2 mm in diameter) is visible (Figures 1, 2, 3).
01	Beginning of bud swelling; scales just visible (Figures 1, 2, 3). For *A. deliciosa* and *A. chinensis* they are covered by white trichomes.
03	End of bud swelling; scales protruded through the corky tissue of the stem. For *A. deliciosa* and *A. chinensis*, scales are densely covered by brown trichomes on their abaxial surface (Figures 1, 2); for *A. arguta* scales tips joined apically (Figure 3).
07	Beginning of bud burst. For *A. deliciosa* and *A. chinensis*, leaf and inflorescence buds enclosed by scales covered by brown trichomes (Figures 1, 2); for *A. arguta* scales tips dispersed along bud axis (Figure 3).
09	Scales separate and green leaf tips are visible. For *A. deliciosa* and *A. chinensis* they are covered by brown trichomes (Figures 1, 2); for *A. arguta* they are covered abaxially by white ones (Figure 3).
	Principal growth stage 1: Leaf development
10	The bud develops into an open cluster containing a few visible leaves (Figures 1, 2, 3).
11	Visible leaves unfolded and start spreading away from the shoot (Figures 1, 2, 3).
12-18	Two to eight or more leaves unfolded, but not yet at full size (Figures 1, 2, 3).
19	First leaves completely developed (Figures 1, 2, 3).
	Principal growth stage 3: Shoot development
31	Shoots reach about 10% of final length.
32	Shoots reach about 20% of final length.
35	Shoots reach about 50% of final length.
39	Shoots reach about 90% of final length.
	Principal growth stage 5: Inflorescence emergence
51	Inflorescence bud swelling (flowers borne as singlets or triplets in the leaf axils). Buds closed, with no peduncle, greenish sepals visible covered by trichomes (Figures 1, 2, 3).
53	Flower buds growing, they still closed, reddish peduncles elongating (Figures 1, 2, 3).
55	Sepals begin to separate. A white-greenish corolla starts to be visible, reddish peduncles continue to elongate (Figures 1, 2, 3).
56	Sepals continue to separate, and peduncles to elongate and thicken. Corolla clearly visible, longer than calyx, changes colour from white-greenish to white (Figures 1, 2, 3).
57	Corolla at balloon stage, first flowers with white petals forming a hollow ball. One of the petals separates from the rest (Figures 1, 2, 3).
59	Several petals separate, pistils still not visible longer than calyx (Figures 1, 2, 3).
	Principal growth stage 6: Flowering
60	First flowers open, corolla bell-shaped, pistil visible (Figures 1, 2, 3).
61	Beginning of flowering: 10% of flowers open.
65	Full flowering: at least 50% of flowers open (Figures 1, 2, 3).
67	First petals fading or falling. Some pistils still fertile (Figures 1, 2, 3).
68	Most petals dry or fallen. All pistils dry and no longer functional.
69	End of flowering, fruit set visible (Figures 1, 2, 3).
	Principal growth stage 7: Fruit development
71	Fruit about 10% of final size, showing the typical characteristic of the cultivar (Figures 1, 2, 3).
73	Fruit about 30% of final size (Figures 1, 2, 3).
75	Fruit about 50% of final size.
79	Fruit about 90% of final size: fruit suitable for commercial picking (Figures 1, 2, 3).
	Principal growth stage 8: Maturity of fruit
81	Seeds reach their full size, harden and change colour from white to brown, progressing through tan to dark brown.
85	Fruit ripe for commercial picking, solids content higher than 6.2%. Seed colour becomes black. Fruit at physiological maturity (still not suitable for consumption), begins to soften (Figures 1, 3).
89	Fruit fully ripe for consumption: fruit has typical taste, flavor and firmness. Soluble solids about 14–16% (Figure 2).
	Principal growth stage 9: Senescence. Beginning of dormancy
91	Shoot growth complete; foliage fully dark green.
93	Beginning of senescence of old leaves; leaves fall (Figures 1, 2).
97	All leaves fallen. Winter rest period (Figures 1, 2, 3).

(According with Meier, 2001; Salinero et al., 2009; Labeke et al., 2015)

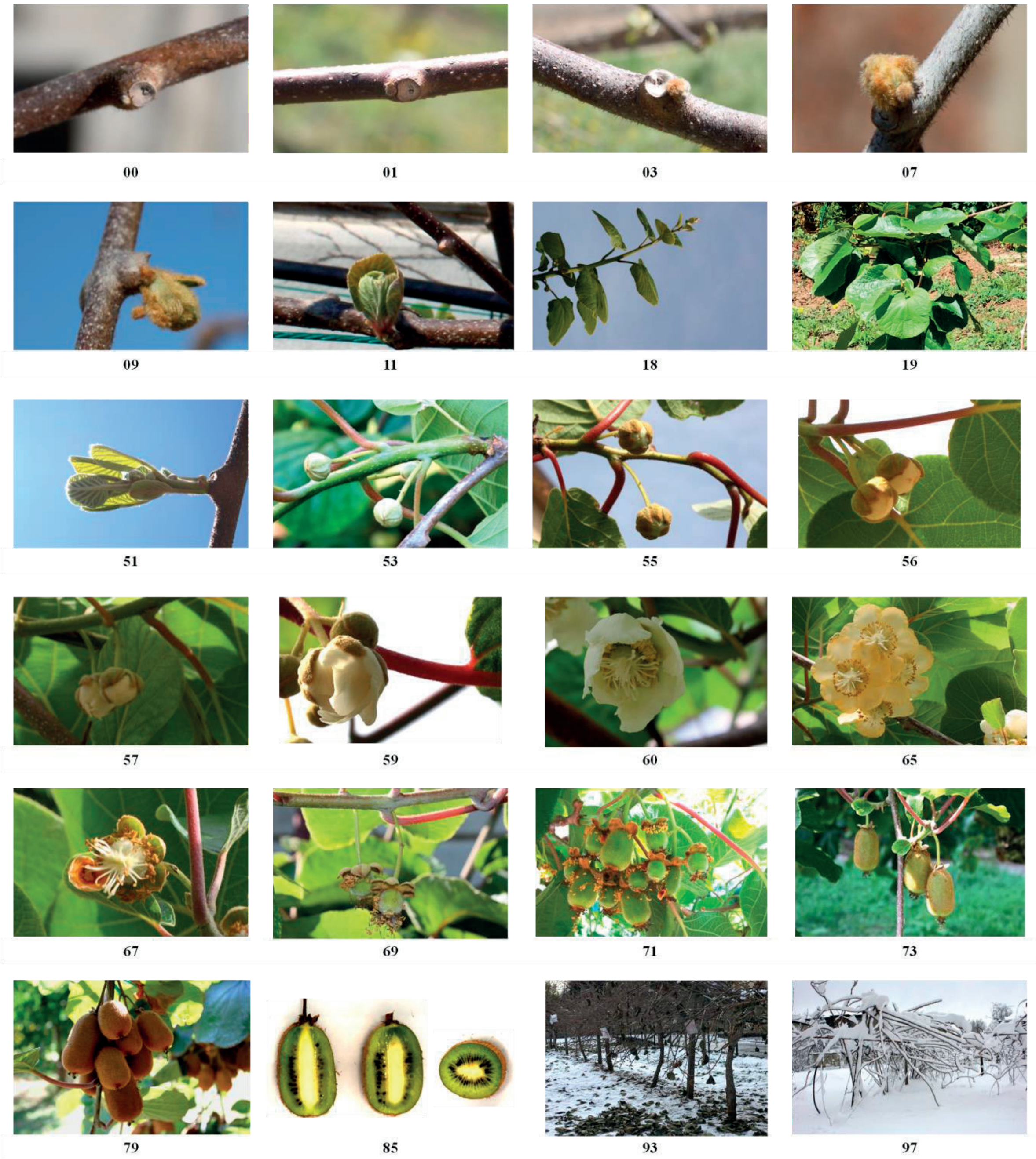


Figure 1. Some phenological growth stages of 'Bruno' variety (*A. deliciosa*), according to BBCH scale

The different stages of bud development mostly took place in the beginning to mid-March, for all three studied species, when the mean temperature registered was higher than 3.5°C.

Leaf development and emergence/development of the inflorescences occurred from the last weeks of March till beginning April.

Full flowering ensued from early May for *A. chinensis* and *A. arguta* through middle of May, for *A. deliciosa*, when the mean temperature registered was higher than 15°C.

Phenological stage and temperature monitoring are very important, because cultivars that have a lower basal temperature for bud and flower development might be more susceptible to spring frost especially if no frost protection is present (Labeke et al., 2015).

According Spano et al. (1997), temperature initiates all biological processes that result in the occurrence of a certain phenological stage and also, temperature affects the morphological and quality characteristics of fruits.

Fruit maturity has been reached in the first weeks of September for *A. arguta*, at the last weeks of October for *A. chinensis* and at the beginning of November for *A. deliciosa*.

Figure 2. Some phenological growth stages of R0P10 intraspecific hybrid (*A. chinensis*), according to BBCH scale

Studying the hybrids of the different species of *Actinidia*, it is clear that differences between the developments of the phenological stages exist.

The growing season for kiwifruit is long: up to 240 days. This begins with vine pruning in winter, which follows the previous year's harvest (Baker et al., 2018). During the winter months (December to February) the vines lay dormant, allowing growers the opportunity to remove last season's fruiting canes and to select and tie down new canes which form the foundations for new growth (Baker et al., 2018).

According to Costa et al. (1996), in established kiwifruit vines, pruning and girdling practices are carried out to renew fruiting wood, to achieve a good balance between vegetative growth and fruit production, and to improve light interception and air penetration through the canopy. Each year the winter pruning is initiated at the end of autumn, when all leaves are fallen (BBCH stage 97), and is continued meanwhile vines remain dormant (stage 00).

Figure 3. Some phenological growth stages of R8P1 intraspecific hybrid (*A. arguta*), according to BBCH scale

Springtime (March to May) sees the kiwifruit vines begin to grow again. New shoots appear on the canes along with the first flower buds.

Especially important for kiwifruit production is the recognition of phenological stages during the development of the floral bud, because they are key for flower and fruit thinning and to increase the success of pollination (Salinero et al., 2009).

Flower and fruit thinning are done to reduce excessive fruit load, thus diminishing the competence among fruits for carbohydrates and obtaining a final higher fruit size, and to eliminate lateral and misshapen fruits (Salinero et al., 2009). Considering the BBCH scale, flower thinning should be done from stage 55 to stage 60, whereas fruit thinning is advised from stage 71 to stage 73 (Salinero et al., 2009). These operations that increase fruits quality are achieved especially for *A. deliciosa* and *A. chinensis*.

During the spring–summer period, fertirrigation is commonly applied at orchards to provide necessary nutrients, macro and microelements like N, P, K, Ca, Mg etc. (Salinero et al., 2007; Salinero et al., 2009).

Table 3. Monthly maximum, minimum and mean air temperatures (°C); total precipitation (mm) and days per month, for 2018 and 2019 growing seasons

Month	2018					2019				
	Temperature (°C)			Total precipitation		Temperature (°C)			Total precipitation	
	Max.	Min.	Mean	mm	days	Max.	Min.	Mean	mm	days
Jan	14	-11	1.01±6.21*	46.6	10	9	-16	-1.69±5.30*	57.3	16
Feb	17	-13	1.08±6.18*	94.3	19	19	-8	3.42±7.26*	7.6	4
Mar	24	-22	3.59±8.56*	68.8	15	25	-4	8.74±8.70*	33.3	5
Apr	30	0	15.43±8.83*	4.9	4	26	-2	10.96±7.35*	75.3	12
May	31	6	18.62±8.01*	7.1	8	28	4	16.59±7.32*	153.3	16
Jun	34	9	21.91±7.55*	166.5	16	33	12	22.75±7.22*	72.9	10
Jul	32	11	22.53±6.75*	90.2	17	36	10	22.10±8.11*	70.7	9
Aug	35	12	23.62±8.30*	8.7	2	36	10	23.38±9.13*	24.1	5
Sep	34	-1	18.68±9.10*	33.6	5	34	2	18.80±9.35*	8.2	4
Oct	28	0	13.45±8.39*	15	4	30	1	13.32±8.33*	44.1	10
Nov	20	-12	4.83±6.83*	65.6	11	25	-2	9.61±7.14*	76.7	15
Dec	10	-13	-0.51±5.10*	59.8	4	17	-7	3.71±6.22*	12.7	10
	Temperature average 12.07 °C			**Total precipitation 661.1 mm/year**		**Temperature average 12.69 °C**			**Total precipitation 636.2 mm/year**	

* Standard deviation

Table 4. Comparison of phenological stages between *A. deliciosa*, *A. chinensis* and *A. arguta* Romanian hybrids, in two growing seasons (2018-2019)

BBCH CODE	Bud development (01)	Leaf development (11)	Inflorescence emergence (51)	Flowering (61)	Fruit development (71)	Fruit maturity (85)	Senescence (93)
Variety			**2018**				
			Actinidia chinensis				
R0P10	06.03	17.03	27.03	03.05	22.05	24.10	19.11
			Actinidia deliciosa				
Hayward	08.03	24.03	07.04	18.05	04.06	07.11	29.11
Bruno	06.03	21.03	05.04	13.05	28.05	07.11	25.11
			***A. chinensis* and *A. deliciosa* interspecific hybrid**				
R0P13	08.03	24.03	07.04	13.05	28.05	07.11	25.11
R1P8	08.03	24.03	07.04	15.05	04.06	07.11	29.11
R1P9	08.03	24.03	07.04	15.05	04.06	07.11	29.11
R1P12	08.03	24.03	07.04	15.05	04.06	02.11	29.11
			***A. chinensis* and *A. arguta* interspecific hybrid**				
R2P6	06.03	17.03	01.04	13.05	25.05	24.10	19.11
			Actinidia arguta				
R8P1	04.03	20.03	01.04	08.05	19.05	18.09	12.11
R10P20	04.03	20.03	01.04	08.05	19.05	18.09	12.11
Variety			**2019**				
			Actinidia chinensis				
R0P10	04.03	22.03	01.04	09.05	28.05	25.10	21.11
			Actinidia deliciosa				
Hayward	06.03	28.03	12.04	25.05	10.06	08.11	03.12
Bruno	04.03	25.03	09.04	20.05	05.06	08.11	30.11
			***A. chinensis* and *A. deliciosa* interspecific hybrid**				
R0P13	06.03	28.03	12.04	20.05	05.06	05.11	30.11
R1P8	06.03	28.03	12.04	23.05	10.06	05.11	03.12
R1P9	06.03	28.03	12.04	23.05	10.06	05.11	03.12
R1P12	06.03	28.03	12.04	23.05	10.06	05.11	03.12
			***A. chinensis* and *A. arguta* interspecific hybrid**				
R2P6	04.03	22.03	05.04	20.05	01.06	25.10	21.11
			Actinidia arguta				
R8P1	02.03	25.03	05.04	16.05	25.05	17.09	21.11
R10P20	02.03	25.03	05.04	16.05	25.05	17.09	21.11

Table 5. Kiwifruit growth stages and the main orchard management practices on a growing cycle

Season	Winter			Spring			Summer			Autum		
	DEC	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
	Dormant			Budbreak		Flowering	Fruit set		Fruit growth			Leaf fall
	Winter pruning			Budbreak sprays		Pollination	Male pruning		Canopy management, thinning and girdling		Harvest	

During flowering, in May, in commercial orchards natural (introduction of bee hives) and/or artificial (hand and machine pollination) systems of pollination can be apply (Salinero et al., 2009). The bee hives must be moved into the orchard when 10–20% of flowers are open (Clinch, 1990). The introduction of bee hives should be done at BBCH stage 61, and hand and machine pollination from BBCH stage 65 to stage 67 (Salinero et al., 2009).

As summer starts, kiwifruit vines undergo tremendous growth and growers frequently prune the vines to direct growth and manage the canopy (the canes can sometimes reach up to 5-6 meters in length during the growing process) (Baker et al., 2018). The fruit grow quickly, and crop volume can be estimated. Growers selectively thin kiwifruit to optimize fruit size and taste (generally the less there are, the larger and tastier they grow) (Baker et al., 2018).

Summer pruning is carried out during the growing season in the spring-summer period, and should be done at BBCH stages 18 and 19 in spring, to remove upright growing suckers, and during the summer, starting immediately after fruit set (stage 69) until stage 73, to cut growing ends of fruiting canes, what will result in larger fruit. The summer pruning sometimes is done until few days before harvest (stage 85), to cut growing ends, to prevent tangling, and twisted and tangled ends of all shoots (Salinero et al., 2009).

Girdling is performed only in some kiwifruit orchards. It must be done on 1-year-old wood (parent canes), supporting seasons floral shoot, and is usually carried out after fruit set until 2–4 weeks afterwards (therefore starting after stage 69 until 73) (Salinero et al., 2009).

In last weeks of summer and beginning of autumn, the kiwiberry, respectively kiwifruit, are tested for ripeness. When they pass a certain criterion for quality (BBCH stage 85), the fruits are carefully picked.

CONCLUSIONS

Kiwifruit has certain requirements as well as all fruit species, regarding temperature, humidity, wind, soil etc. Besides of these, commercial crops require significant management practices to be productive. Vine training, pruning, pollination, shelter from the wind, pest and disease control among other things all have a significant impact on the profitability and productivity of the crop. These horticultural practices impact the size and the dry matter of fruit and also the market acceptance.

The phenological enlargement of kiwifruit could improve the quality of fruits by providing information about evolution of the varieties and local hybrids under the environmental conditions of Southern Romanian. An accurate understanding of kiwifruit plant phenological stages it is essential for an appropriate orchard management.

In conclusion, this study can improve the cultivation of this new crop in Romania, can contribute in Romanian breeding program and also in zoning of the main *Actinidia* species on our country climatic conditions.

Further observation needs to be done, because the effect of climate and especially the temperature on seasonal variation requires longer observation periods than presented in the present study. To obtain more accurate results, continuing research is proposed for more years.

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