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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

Geneva

DRAFT

QUINOA *

UPOV Code(s):

CHENO_QUI

Chenopodium quinoa Willd.

GUIDELINES

FOR THE CONDUCT OF TESTS

FOR DISTINCTNESS, UNIFORMITY AND STABILITY

prepared by experts from Denmark
to be considered by the
Technical Working Party for Agricultural Crops
at its forty-seventh session, to be held in Naivasha, Kenya,
from 2018-05-21 to 2018-05-25

Disclaimer: this document does not represent UPOV policies or guidance

Alternative names:*

Botanical name	*English*	*French*	*German*	*Spanish*
Chenopodium quinoa Willd.	Quinoa	Chénopode quinoa, Quinoa	Getreidekraut, Kleiner Reis von Peru, Reisspinat	Quinoa, Quinua

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.]

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1. Subject of these Test Guidelines

These Test Guidelines apply to all varieties of *Chenopodium quinoa* Willd..

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 seed.

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

200 g of seed.

The seed should meet the minimum requirements for germination, species and analytical purity, health and moisture content, specified by the competent authority. In cases where the seed is to be stored, the germination capacity should be as high as possible and should, be stated by the applicant.

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

The minimum duration of tests should normally be two independent 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

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 The optimum stage of development for the assessment of each characteristic is indicated by a number in the Table of Characteristics. The stages of development denoted by each number are described in Chapter 8.

3.4 Test Design

Each test should be designed to result in a total of at least 160 plants, which should be divided between at least 2 replicates.

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 or Parts of Plants to be Examined

Unless otherwise indicated, for the purposes of distinctness, all observations on single plants should be made on 40 plants or parts of plants taken from each of 40 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 1.

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 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 self-pollinated varieties, a population standard of 5% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 160 plants, 13 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 further examined by testing a new seed 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) Time of flowering (characteristic 6)
(b) Inflorescence: color (characteristic 11)
(c) Grain: foam height (characteristic 20)

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

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
1	**2**	**3**	**4**	**5**	**6**	**7**			
		Name of characteristics in English		**Nom du caractère en français**		**Name des Merkmals auf Deutsch**	**Nombre del carácter en español**		
		states of expression		types d'expression		Ausprägungsstufen	tipos de expresión		

1 Characteristic number

2 (*) Asterisked characteristic – see Chapter 6.1.2

3 Type of expression
QL Qualitative characteristic – see Chapter 6.3
QN Quantitative characteristic – see Chapter 6.3
PQ Pseudo-qualitative characteristic – see Chapter 6.3

4 Method of observation (and type of plot, if applicable)
MG, MS, VG, VS – see Chapter 4.1.5

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

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

7 Growth stage key See Explanations on the Table of Characteristics in Chapter 8

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

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
1.	**(*)**	**PQ VG**		**5**			
		Foliage: color	**Feuillage: couleur**	**Laub: Farbe**	**Follaje: color**		
		light green				Riobamba	1
		medium green				Titicaca	2
		dark green				Puno	3
		red					4
		purple				Red Carina	5
2.		**QN VG**	**(+)**	**5**			
		Foliage: glaucosity					
		absent or weak				Vikinga	1
		medium				Red Carina	3
		strong				Riobamba	5
3.		**QN VG**	**(a)**	**5-6**			
		Leaf: size					
		small				Vikinga	3
		medium				Titicaca	5
		large				Red Carina	7
4.		**QN VG**	**(+)** **(a)**	**5-6**			
		Leaf: dentation					
		absent or weak				Riobamba	1
		medium				Puno	3
		strong				Red Carina	5
5.		**PQ VG**	**(+)** **(a)**	**5-6**			
		Leaf: angle of base					
		acute					1
		obtuse				Riobamba	2
		truncate				Atlas	3

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
6.	**(*)**	**QN MG**	**(+)**	**8**			
		Time of flowering	**Époque de floraison**	**Zeitpunkt der Blüte**	**Época de floración**		
		early	précoce	früh	temprana	Vikinga	3
		medium	moyenne	mittel	media	Red Carina	5
		late	tardive	spät	tardía	Riobamba	7
7.		**PQ VG**	**(b)**	**11**			
		Stem: color					
		white				Regalona	1
		green				Riobamba, Titicaca	2
		yellow				Puno	3
		purple				Red Carina	4
8.		**QL VG**	**(b)**	**11**			
		Stem: stripes					
		absent				Riobamba	1
		present				Puno	9
9.		**PQ VG**	**(b)**	**11**			
		Stem: color of stripes					
		green				Regalona	1
		yellow				Titicaca	2
		pink				Puno	3
		red				Pasto	4
		purple					5
10.		**QN VG**	**(b)**	**11**			
		Stem: pigmentation at leaf axil					
		absent or very weak				Jessie	1
		weak					3
		medium				Pasto	5
		strong					7

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
11.	**(*)**	**PQ VG**		**11**			
		Inflorescence: color					
		white				Jessie	1
		green				Riobamba	2
		yellow				Atlas	3
		orange				Puno	4
		red				Carmen	5
		purple				Red Carina	6
12.		**QN MG**	**(+)**	**12**			
		Panicle: time of maturity					
		early				Jessie	3
		medium				Vikinga	5
		late				Red Carina	7
13.	**(*)**	**QN MG/VG**		**12**			
		Plant: height					
		short				Vikinga	3
		medium				Titicaca	5
		tall				Red Carina	7
14.	**(*)**	**PQ VG**		**12**			
		Panicle: color					
		light yellow brown				Jessie	1
		brown				Atlas	2
		black				Titicaca	3
15.		**QN VG**	**(c)**	**12**			
		Panicle: density					
		sparse				Titicaca	3
		medium				Riobamba	5
		dense				Pasto	7
16.		**QN MG/VG**	**(c)**	**12**			
		Panicle: width					
		narrow				Atlas	3
		medium				Riobamba	5
		broad				Red Carina	7

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
17.	**(*)**	**PQ** **VG**		**12**			
		Seed: color	**Graine : couleur**	**Samen: Farbe**	**Semilla: color**		
		whitish				Atlas, Puno	1
		yellow				Carmen	2
		red					3
		light brown				Serena, Titicaca	4
		grey					5
		black				Red Carina	6
18.		**PQ** **VG**	**(+)**	**12**			
		Seed: color without tegument					
		white				Atlas	1
		yellow				Titicaca	2
		red					3
		grey				Red Carina	4
19.		**QN** **MG**		**12**			
		1000 seed weight					
		very low					1
		low				Red Carina	3
		medium				Jessie	5
		high				Titicaca	7
		very high					9
20.	**(*)**	**QN** **MG**	**(+)**	**12**			
		Grain: foam height					
		absent or very low				Jessie	1
		low				Zeno	2
		high				Puno	3

8. Explanations on the Table of Characteristics

8.1 Explanations covering several characteristics

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

(a) To be observed on the middle part of the plant.

(b) To be observed on the lower third of the plant.

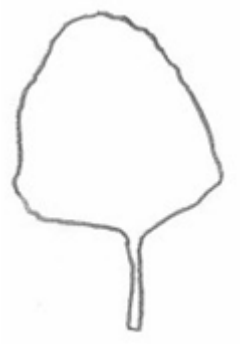
(c) To be observed on the upper third of the plant.

8.2 Explanations for individual characteristics

Ad. 2: Foliage: glaucosity

Glaucosity. The presence or absence of a fine whitish powdery coating on the surface of the leaves, stem and seeds in development, which can be removed by rubbing, and the degree thereof when present, are observed. In quinoa plant this whitish layer of minute grains is Calcium oxalate.

Ad. 4: Leaf: dentation



1
absent or weak

3
medium

5
strong

Ad. 5: Leaf: angle of base

1
acute

2
obtuse

3
truncate

Ad. 6: Time of flowering

To be observed when 50% of plants have open flowers on the upper third of the plant.

Ad. 12: Panicle: time of maturity

To be observed when 50% of the plants are dried on the upper third of the plant.

Ad. 18: Seed: color without tegument

To be observed after seeds have been softly rubbed with sanding paper.

Ad. 20: Grain: foam height

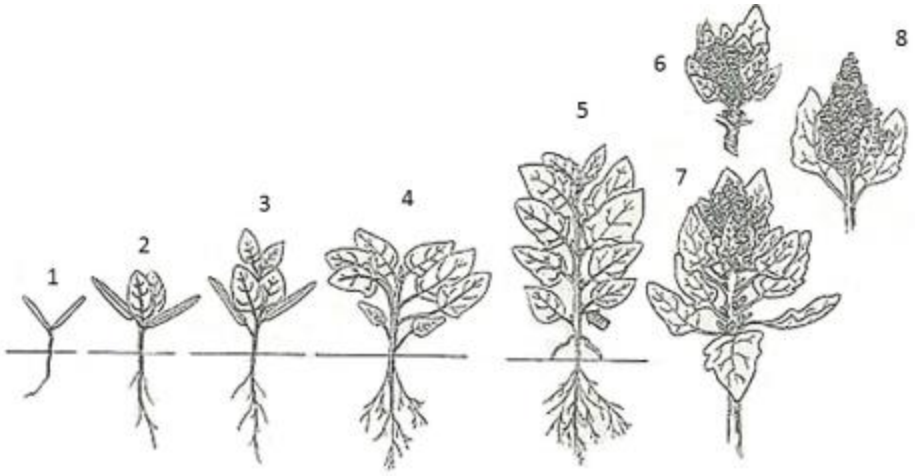
Grain: foam heigth.
Standard afrosimetric method.

1. Weigh 0,5 g. (+/- 0,2 g.) quinoa seeds into a test tube (160x16 mm.)
2. Addition 5 ml. of distilled water, and cap the test tube.
3. Shake the test tube vigorously (4 shakes s.) for 30 s. in up and down movements.
4. Let the test tube rest for 30 minutes.
5. Repeat number 3-4.
6. After the second rest period, shake the test tube again for 30 s. give a last shakedown as one would to a thermometer.
7. Rest for 5 minutes.
8. Measure the height of the foam with a ruler to the nearest 0,1 cm.

(c.f. Koziol, 1991).

Grain:saponin	Absent or very low	Low	High
Foam height	< 1.0 cm	1.0 cm - 5.0 cm	> 5.0 cm

*8.3 Phenology of Quinoa (*Chenopodium quinoa *Willd.)*



1. Emergence (cotyledons)
2. Vegetative stage - two leaves
3. Vegetative stage - four leaves
4. Vegetative stage - six leaves
5. Ramification
6. Beginning of inflorescence emergence (panicle)
7. Inflorescence
8. Beginning of flowering
9. Flowering
10. Milky grain
11. Doughy grain
12. Physiological maturity

9. Literature

Jacobsen, S.-E., Stølen, O., 1993: Quinoa - Morphology, phenology and prospects for its production as a new crop in Europe. European Journal of Agronomy 2, pp 19 to 29.

Koziol, M.J. 1991: Afrosimetric estimation of threshold saponin concentration for bitterness in quinoa (*Chenopodium quinoa* Willd). Journal of the Science of Food and Agriculture, 54**,** pp. 211 to 219.

Mujica, A., Canahua, A., 1989: Fenología del cultivo de la quinua. En Curso Taller de Fitopatología de Cultivos Andinos y Uso de la Información Agrometeorológica. PICA. INIIA. Puno, PE.

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	*Chenopodium quinoa* Willd.
1.2 Common name	Quinoa

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

4.1.3 Mutation [ ]
(please state parent variety)

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) Other (please provide details) [ ]

4.2.2 Other [ ]
(Please provide details)

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 (6)	**Time of flowering**		
	very early		1 [ ]
	very early to early		2 [ ]
	early	Vikinga	3 [ ]
	early to medium		4 [ ]
	medium	Red Carina	5 [ ]
	medium to late		6 [ ]
	late	Riobamba	7 [ ]
	late to very late		8 [ ]
	very late		9 [ ]
5.2 (11)	**Inflorescence: color**		
	white	Jessie	1 [ ]
	green	Riobamba	2 [ ]
	yellow	Atlas	3 [ ]
	orange	Puno	4 [ ]
	red	Carmen	5 [ ]
	purple	Red Carina	6 [ ]
5.3 (20)	**Grain: foam height**		
	absent or very low	Jessie	1 [ ]
	low	Zeno	2 [ ]
	high	Puno	3 [ ]

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	*Panicle: color*	*red*	*orange*

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

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.]

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:

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.

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]