



## **PROTOCOL FOR TESTS ON DISTINCTNESS, UNIFORMITY AND STABILITY**

***Raphanus sativus* L. var. *sativus*  
*Raphanus sativus* L. var. *niger* (Mill.) S. Kerner**

**RADISH, BLACK RADISH**

UPOV Code: RAPHA\_SAT\_SAT  
RAPHA\_SAT\_NIG

**Adopted on 11/03/2015**

**Entry into force on 01/03/2015**

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## 1. SUBJECT OF THE PROTOCOL AND REPORTING

### 1.1 Scope of the technical protocol

This Technical Protocol applies to all varieties of *Raphanus sativus* L. var. *sativus*, *Raphanus sativus* L. var. *niger* (Mill.) S. Kerner and hybrids between those species.

The protocol describes the technical procedures to be followed in order to meet the requirements of Council Regulation 2100/94 on Community Plant Variety Rights. The technical procedures have been agreed by the Administrative Council and are based on documents agreed by the International Union for the Protection of New Varieties of Plants (UPOV), such as the General Introduction to DUS (UPOV Document TG/1/3 [http://www.upov.int/en/publications/intro\\_dus.htm](http://www.upov.int/en/publications/intro_dus.htm)), its associated TGP documents (<http://www.upov.int/en/publications/tgp/>) and the relevant UPOV Test Guideline TG/63/7-TG/64/7 dated 28/03/2012 ([http://www.upov.int/en/publications/tg-rom/tg064/tg\\_64\\_6.pdf](http://www.upov.int/en/publications/tg-rom/tg064/tg_64_6.pdf)) for the conduct of tests for Distinctness, Uniformity and Stability.

### 1.2 Entry into Force

The present protocol enters into force on **01.03.2015**. Any ongoing DUS examination of candidate varieties started before the aforesaid date will not be affected by the approval of the Technical Protocol. Technical examinations of candidate varieties are carried out according to the TP in force when the DUS test starts. The starting date of a DUS examination is considered to be the due date for submitting of plant material for the first test period.

In cases where the Office requests to take-over a DUS report for which the technical examination has either been finalized or which is in the process to be carried out at the moment of this request, such report can only be accepted if the technical examination has been carried out according to the CPVO TP which was in force at the moment when the technical examination started.

### 1.3 Reporting between Examination Office and CPVO and Liaison with Applicant

#### 1.3.1 Reporting between Examination Office and CPVO

The Examination Office shall deliver to the CPVO a preliminary report ("the preliminary report") no later than two weeks after the date of the request for technical examination by the CPVO.

The Examination Office shall also deliver to the CPVO a report relating to each growing period ("the interim report") and, when the Examination Office considers the results of the technical examination to be adequate to evaluate the variety or the CPVO so requests, a report relating to the examination ("the final report").

The final report shall state the opinion of the Examination Office on the distinctness, uniformity and stability of the variety. Where it considers those criteria to be satisfied, or where the CPVO so requests, a description of the variety shall be added to the report. If a report is negative the Examination Office shall set out the detailed reasons for its findings.

The interim and the final reports shall be delivered to the CPVO as soon as possible and no later than on the deadlines as laid down in the designation agreement.

#### 1.3.2 Informing on problems in the DUS test

If problems arise during the course of the test the CPVO should be informed immediately so that the information can be passed on to the applicant. Subject to prior permanent agreement, the applicant may be directly informed at the same time as the CPVO particularly if a visit to the trial is advisable.

#### 1.3.3 Sample keeping in case of problems

If the technical examination has resulted in a negative report, the CPVO shall inform the Examination Office as soon as possible in case that a representative sample of any relevant testing material shall be kept.

## 2. MATERIAL REQUIRED

### 2.1 Plant material requirements

Information with respect to the agreed closing dates and submission requirements of plant material for the technical examination of varieties can be found on <http://www.cpvo.europa.eu/main/en/home/documents-and-publications/s2-gazette> in the special issue S2 of the Official Gazette of the Office. General requirements on submission of samples are also to be found following the same link.

## **2.2 Informing the applicant of plant material requirements**

The CPVO informs the applicant that

- he is responsible for ensuring compliance with any customs and plant health requirements.
- the plant material supplied should be visibly healthy, not lacking in vigor, nor affected by any important pest or disease.
- 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.

## **2.3 Informing about problems on the submission of material**

The Examination Office shall report to the CPVO immediately in cases where the test material of the candidate variety has not arrived in time or in cases where the material submitted does not fulfil the conditions laid down in the request for material issued by the CPVO.

In cases where the examination office encounters difficulties to obtain plant material of reference varieties the CPVO should be informed.

## **3. METHOD OF EXAMINATION**

### **3.1 Number of growing cycles**

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

The two independent growing cycles should be in the form of two separate plantings.

### **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"

[http://www.upov.int/export/sites/upov/en/publications/tgp/documents/tgp\\_9\\_1.pdf](http://www.upov.int/export/sites/upov/en/publications/tgp/documents/tgp_9_1.pdf).

### **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 60 plants for N-type varieties and 200 plants for S-type varieties, which should be divided between at least two replicates."

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**

In accordance with Article 83(3) of Council Regulation No. 2100/94 an applicant may claim either in the Technical Questionnaire or during the test that a candidate has a characteristic which would be helpful in establishing distinctness. If such a claim is made and is supported by reliable technical data, an additional test may be undertaken providing that a technically acceptable test procedure can be devised.

Additional tests will be undertaken, with the agreement of the President of CPVO, where distinctness is unlikely to be shown using the characters listed in the protocol.

### **3.6 Constitution and maintenance of a variety collection**

The process for the constitution and the maintenance of a variety collection can be summarized as follows:

Step 1: Making an inventory of the varieties of common knowledge.

Step 2: Establishing a collection ("variety collection") of varieties of common knowledge which are relevant for the examination of distinctness of candidate varieties.

Step 3: Selecting the varieties from the variety collection which need to be included in the growing trial or other tests for the examination of distinctness of a particular candidate variety.

#### 3.6.1 Forms of variety collection

The variety collection shall comprise variety descriptions and living plant material, thus a living reference collection. The variety description shall be produced by the EO unless special cooperation exists between EOs and the CPVO. The descriptive and pictorial information produced by the EO shall be held and maintained in a form of a database

#### 3.6.2 Living Plant Material

The EO shall collect and maintain living plant material of varieties of the species concerned in the variety collection.

#### 3.6.3 Range of the variety collection

The living variety collection shall cover at least those varieties that are suitable to climatic conditions of a respective EO.

#### 3.6.4 Making an inventory of varieties of common knowledge for inclusion in the variety collection

The inventory shall take into account the list of protected varieties and the official, or other, registers of varieties, in particular:

The inventory shall include varieties protected under National PBR (UPOV contracting parties) and Community PBR, varieties registered in the Common Catalogue, the OECD list, the Conservation variety list and varieties in trade or in commercial registers for those species not covered by a National or the Common Catalogue.”

#### 3.6.5 Maintenance and renewal/update of a living variety collection

The EO shall maintain seeds in conditions which will ensure germination and viability, periodical checks, and renewal as required. For the renewal of existing living material the identity of replacement living plant material shall be verified by conducting side-by-side plot comparisons between the material in the collection and the new material.

### **4. ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY**

The prescribed procedure is to assess distinctness, uniformity and stability in a growing trial.

#### **4.1 Distinctness**

##### 4.1.1 General recommendations

It is of particular importance for users of this Technical Protocol to consult the UPOV-General Introduction to DUS (link in chapter 1 of this document) and TGP 9 'Examining Distinctness' ([http://www.upov.int/export/sites/upov/en/publications/tgp/documents/tgp\\_9\\_1.pdf](http://www.upov.int/export/sites/upov/en/publications/tgp/documents/tgp_9_1.pdf)) prior to making decisions regarding distinctness. However, the following points are provided for elaboration or emphasis in this Technical Protocol.

Further guidance is provided in documents TGP/9 "Examining Distinctness" and TGP/8 "Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability".

##### 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 Technical Protocols are familiar with the recommendations contained in the UPOV-General Introduction to DUS prior to making decisions regarding distinctness.

## **Decision standards**

### **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 40 plants or parts taken from each of 40 plants and any other observations made on all plants in the test, disregarding any off-type plants.

### **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 third 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**

It is of particular importance for users of this Technical Protocol to consult the UPOV-General Introduction to DUS (link in chapter 1 of this document) and TGP 10 'Examining Uniformity' ([http://www.upov.int/export/sites/upov/en/publications/tgp/documents/tgp\\_10\\_1.pdf](http://www.upov.int/export/sites/upov/en/publications/tgp/documents/tgp_10_1.pdf)) prior to making decisions regarding uniformity. However, the following points are provided for elaboration or emphasis in this Technical Protocol:

- (a) Cross-pollinated varieties: The assessment of uniformity for cross-pollinated varieties should be according to the recommendations for cross-pollinated varieties in the UPOV-General Introduction to DUS. However, for the characteristics "Radish: shape (characteristic 17) and "Radish: colour of skin (characteristic 21)", a population standard of 2% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 200 plants, 7 off-types are allowed. In the case of a sample size of 60 plants, 3 off-types are allowed.
- (b) Single cross hybrids and inbred lines: For the assessment of uniformity for single cross hybrids and inbred lines, a population standard of 2% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 200 plants, 7 off-types are allowed. In the case of a sample size of 60 plants, 3 off-types are allowed.

## **4.3 Stability**

### **4.3.1** It is of particular importance for users of this Technical Protocol to consult the UPOV-General Introduction to DUS (link in chapter 1 of this document) and TGP 11 'Examining Stability' ([http://www.upov.int/export/sites/upov/en/publications/tgp/documents/tgp\\_11\\_1.pdf](http://www.upov.int/export/sites/upov/en/publications/tgp/documents/tgp_11_1.pdf))

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) Only N-type varieties: Ploidy (characteristic 1)
  - b) Only N-type varieties: Leaf: length (characteristic 3)
  - c) Only S-type varieties: Leaf: length (characteristic 4)
  - d) Leaf blade: number of lobes (characteristic 8)
  - e) Petiole: anthocyanin coloration (characteristic 10)
  - f) Only N-type varieties: Radish: length (characteristic 13)
  - g) Only S-type varieties: Radish: length (characteristic 14)
  - h) Only N-type varieties: Radish: diameter (characteristic 15)
  - i) Only S-type varieties : Radish: diameter (characteristic 16)
  - j) Radish: shape (characteristic 17)
  - k) Radish: number of colours of skin (excluding non-thickened root) (characteristic 21)
  - l) Radish: colour of skin of stem end (characteristic 22)
  - m) Only varieties with Radish: Number of colours of skin: two: Radish: extent of white colour from non-thickened root end (characteristic 25)
  - n) Time to harvest maturity (characteristic 28)
- 5.4** If other characteristics than those from the TP are used for the selection of varieties to be included into the growing trial, the EO shall inform the CPVO and seek the prior consent of the CPVO before using these characteristics.

## 6. INTRODUCTION TO THE TABLE OF CHARACTERISTICS

### 6.1 Characteristics to be used

The characteristics to be used in DUS tests and preparation of descriptions shall be those referred to in the table of characteristics. All the characteristics shall be used, providing that observation of a characteristic is not rendered impossible by the expression of any other characteristic, or the expression of a characteristic is prevented by the environmental conditions under which the test is conducted or by specific legislation on plant health. In the latter case, the CPVO should be informed.

The Administrative Council empowers the President, in accordance with Article 23 of Commission Regulation N°874/2009, to insert additional characteristics and their expressions in respect of a variety.

#### **Technical Protocols with asterisked characteristics (only for certain vegetable species)**

In the case of disease resistance characteristics, only those resistances marked with an asterisk (\*) in the CPVO column are compulsory.

### States of expression and corresponding notes

In the case of qualitative and pseudo-qualitative characteristics, 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 Example Varieties

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

## 6.3 Legend

G	Grouping characteristic	– see Chapter 5
(*)	Asterisked characteristic	– see Chapter 6.1.2
MG, MS, VG, VS	– see Chapter 4.1.5	
QL	Qualitative characteristic	
QN	Quantitative characteristic	
PQ	Pseudo-qualitative characteristic	

Legend: Explanations covering several characteristics

- (a)-(c) See Explanations on the Table of Characteristics in Chapter 8.1
- (+) See Explanations on the Table of Characteristics in Chapter 8.



## 7. TABLE OF CHARACTERISTICS

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
<b>1.</b>	<b>1.</b> (* )	<b>MG</b>	<b><u>Only N-type varieties:</u> Ploidy</b>		
(+)		<b>C</b>	diploid	Halblanger weißer Sommer (N)	2
<b>QL</b>			tetraploid	Rex (N)	4
<b>2.</b>	<b>2.</b> (* )	<b>VG</b>	<b>Leaf: attitude</b>		
(+)			erect	Clipo (S), Karissima (S), Rex (N)	1
<b>QN</b>			semi erect	Balkar (S), Ostergruß rosa 2 (N)	3
			horizontal	Bel Image (S), Mikura Cross (N), Minowase Summer Cross No. 3 (N), Ronde Witte (S)	5
<b>3.</b>	<b>3.</b> (* )	<b>VG/MS</b>	<b><u>Only N-type varieties:</u> Leaf: length</b>		
<b>QN</b>		<b>(b)</b>	short	Sutong (N), Yeoreumdalang (N)	3
		<b>(c)</b>	medium	Chungilpum (N), Noir long maraîcher (N), Rex (N)	5
			long	Gilzo (N), Noir gros rond d'hiver (N)	7
<b>4.</b>	<b>4.</b> (* )	<b>VG/MS</b>	<b><u>Only S-type varieties:</u> Leaf: length</b>		
<b>QN</b>		<b>(b)</b>	short	Cerise (S), Saxa 2 (S)	3
		<b>(c)</b>	medium	Amored (S), Novo (S)	5
			long	National 2 (S)	7
			very long	Red Hazera (S)	9
<b>5.</b>	<b>5.</b>	<b>VG/MS</b>	<b><u>Only N-type varieties:</u> Leaf: width</b>		
<b>QN</b>		<b>(b)</b>	narrow		1
		<b>(c)</b>	medium	April Cross (N)	2
			broad	Mantanghong (N), Rex (N)	3

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note	
<b>6.</b>  <b>(+)</b>	<b>6.</b>	<b>VG</b>	<b>Leaf blade: shape of apex</b>			
			<b>(b)</b>	acute	Matsumoto kiriba (N), Paradiso (S)	1
			<b>(c)</b>	obtuse	Minowase Summer Cross No. 3 (N)	2
rounded	Everest (N), Neckarperle (S), Sora (S)	3				
<b>7.</b>  <b>PQ</b>	<b>7.</b>	<b>VG</b>	<b>Leaf blade: colour</b>			
			<b>(b)</b>	yellow green	Kiba Risou (N)	1
			<b>(c)</b>	light green	Cross (N), Everest (N), Miura (N)	2
				medium green	Miyashige Green neke (N)	3
				dark green	April Cross (N), Minowase Summer Cross No. 3 (N)	4
				light grey green	Okura (N)	5
				medium grey green	Red Poppins (S), Sakurajima oonaga (N)	6
dark grey green	Kuroba Risou (N)	7				
<b>8.</b>  <b>(+)</b>	<b>8.</b> <b>(*)</b>	<b>VG</b>	<b>Leaf: number of lobes</b>			
			<b>(b)</b>	absent or very few	Everest (N), Ostergruß rosa 2 (N), Ping Pong (S)	1
			<b>(c)</b>	few	Cherry Belle (S), Halblanger weißer Sommer (N), Nelson (S), Osaka 40 days (N)	3
				medium	De cinq semaines rose (N), Minowase Summer Cross No. 3 (N), Scarlet Champion (S)	5
				many	Noir long maraîcher (N), Suikomi ninengo (N)	7
<b>QN</b>	very many	Mikura Cross (N)	9			

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
<b>9.</b>	<b>9.</b>	<b>VG</b>	<b>Leaf blade: depth of incisions of margin</b>		
<b>QN</b>		<b>(b)</b>	absent or very shallow	Everest (N), Fury (S)	1
		<b>(c)</b>	shallow	Apolo (S), Blanche transparente (S), Neptun (N)	3
			medium	April Cross (N), Cracou (S)	5
			deep	Falco (N), Flamino (S), Hilds blauer Herbst und Winter (N), Matsumotokiriba (N)	7
<b>10.</b>	<b>10.</b>	<b>VG</b>	<b>Petiole: anthocyanin coloration</b>		
<b>QN</b>		<b>(b)</b>	absent or very weak	April Cross (N), Fakir (S), Noir gros rond d'hiver (N), Omny (N)	1
			weak	Blanche transparente (S), Flamino (S), Mirabeau (S)	3
			medium	Erfurter Riesenrot (S), Forro (S)	5
			strong	Pernot (S)	7
			very strong	Rex (N), Rose d'hiver de Chine (N), Violet de Gournay (N)	9
<b>11.</b>	<b>11.</b>	<b>VG</b>	<b><u>Only S-type varieties:</u> Foliage: width of attachment</b>		
<b>QN</b>		<b>(b)</b>	narrow	Flamino (S)	3
			medium	Apache (S), Flambo (S)	5
			wide	Rond écarlate (S)	7
<b>12.</b>	<b>12.</b>	<b>VG</b>	<b><u>Only N-type varieties:</u> Foliage: number of fully developed leaves</b>		
<b>QN</b>		<b>(b)</b>	few	Ostergruß rosa 2 (N), Rex (N)	3
			medium	Neptun (N)	5
			many	April Cross (N)	7

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note	
13.	13. (* )	MS/VG  (b)	<b><u>Only N-type varieties:</u> Radish: length</b>			
				very short	Noir gros rond d'hiver (N)	1
				short	Rex (N)	3
				medium	Minowase Summer Cross No. 3 (N)	5
				long	Suikomi ninengo (N)	7
				very long	Surato (N)	9
14.	14. (* )	MS/VG  (b)	<b><u>Only S-type varieties:</u> Radish: length</b>			
				very short	Gaudry 2 (S)	1
				short	Cerise (S), Saxa 2 (S)	3
				medium	Bamba (S)	5
				long	Flamboyant 2 (S)	7
				very long	Blanche transparente (S), Flambo (S)	9
15.	15.	MS/VG  (b)	<b><u>Only N-type varieties:</u> Radish: diameter</b>			
				very small	Ostergruß rosa 2 (N)	1
				small	Noir gros round d'hiver (N), Surato (N)	3
				medium	Minowase Summer Cross No. 3 (N)	5
				large	Koshin (N)	7
				very large	Sakurajima oomaru (N)	9
16.	16.	MS/VG  (b)	<b><u>Only S-type varieties:</u> Radish: diameter</b>			
				very small	Gaudry 2 (S)	1
				small	Cerise (S), Saxa 2 (S)	3
				medium	Rond rose à bout blanc 2 (S)	5
				large	Riesen von Aspen (S)	7
				very large		9

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
<b>17.</b>	<b>17. (*)</b>	<b>VG</b>	<b>Radish: shape</b>		
<b>(+)</b>		<b>(b)</b>	narrow triangular	Rex (N)	1
<b>PQ</b>			medium triangular	Ovale blanc de Munich (N), Suikomi ninengo (N)	2
			ovate	Fridolin weiss (N), Lavergne (S)	3
			acicular	Blanche transparente (S), De cinq semaines rose 3 (N), Minowase Summer Cross No. 3 (N)	4
			oblong	Clipo (S), Fluo (S), Neptun (N), Noir long maraîcher (N), Oshin (N), White Breakfast (N)	5
			narrow elliptic	Gensuke (N)	6
			medium elliptic	Murasakizukin (N), Pico (S), Sutong (N)	7
			circular	Cerise (S), Falco (N), Noir gros rond d'hiver (N), Oomaru Shogoin (N), Tinto (S)	8
			medium oblate	Fakir (S), Kuromaru (N), Rond rose à très grand bout blanc (S)	9
			narrow oblate	Sakurajima Oomaru (N)	10
			obovate	Miura (N)	11
			bell shaped	Kara Nezumi (N), Nezumi (N), Roche (S)	12
<b>18.</b>	<b>18.</b>	<b>VG</b>	<b><u>Only N-type varieties:</u> Radish: position in soil</b>		
<b>(+)</b>		<b>(b)</b>	very shallow	Kuromaru (N)	1
<b>QN</b>			shallow	Aonaga (N), Minowase Summer Cross No. 3 (N)	3
			medium	Miyashigenagabuto (N)	5
			deep	Miura (N)	7
			very deep	Suikomi ninengo (N)	9

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note		
<b>19.</b>	<b>19.</b>	<b>VG</b>	<b>Radish: shape of shoulder</b>				
			<b>(+)</b>	<b>(b)</b>	truncate	Bamba (S), Minowase Summer Cross No. 3 (N), Saxa 2 (S)	1
			<b>PQ</b>		rounded	Flamino (S), Rex (N)	2
	obtuse	Blanche transparente (S), Mantanghong (N), Pernot (S)		3			
<b>20.</b>	<b>20.</b>	<b>VG</b>	<b>Radish: shape of apex</b>				
			<b>(+)</b>	<b>(b)</b>	narrow acute	April Cross (N), Blanche transparente (S)	1
			<b>PQ</b>		acute	Flambo (S), Fridolin weiß (N), Oshin (N)	2
					obtuse	De dix-huit jours (S), Kuroba Risou (N), Ninja (N), Tama Winter (N)	3
					rounded	Bamba (S), Callisto (S), Noir gros rond d'hiver (N), Oomura Shogoin (N)	4
	truncate	À forcer rond écarlate (S), Akizumari (N), Jumbo Scarlet (N)		5			
<b>21.</b>	<b>21. (*)</b>	<b>VG</b>	<b>Radish: number of colours of skin (excluding non-thickened root)</b>				
			<b>QL</b>		one	Cerise (S), Minowase Summer Cross No. 3 (N), Saxa 2 (S)	1
		two		Akasuji (N), Bamba (S), Flamboyant 2 (S), Murasakizukin (N)	2		

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
<b>22.</b>	<b>22. (*)</b>	<b>VG</b>	<b>Radish: colour of skin of stem end</b>		
<b>(+)</b>		<b>(b)</b>	white	Minowase Summer Cross No. 3 (N), Rex (S)	1
<b>PQ</b>			yellowish white	Miura (N)	2
			yellow	Gold Star (S)	3
			brown		4
			light green	Miyashige Nagabuto (N), Oshin (N)	5
			medium green	Nezumi (N)	6
			dark green	Aonaga (N), Kazafu karami (N)	7
			pink	De cinq semaines rose 3 (S)	8
			dark pink red	Ostergruß rosa 2 (S)	9
			red	Benigeshou (N)	10
			purple	Karaineaka (N),	11
			violet	Hilds blauer Herbst und Winter (S), Violet de Gournay (S)	12
			black	Kuromaru (N), Noir gros rond d'hiver (N)	13

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
<b>23.</b>	<b>23.</b> (* )	<b>VG</b>	<b>Non-thickened root: colour</b>		
<b>PQ</b>		<b>(b)</b>	white	Minowase Summer Cross No. 3 (N)	1
			yellowish white	Miura (N)	2
			yellow	Gold Star (S)	3
			brown		4
			light green	Kazafukarami (N)	5
			medium green		6
			dark green		7
			pink	Koshin (N)	8
			dark pink red		9
			red	Benizonochunaga (N)	10
			purple	Karaineaka (N)	11
			violet		12
			black	Kuromaru (N)	13
<b>24.</b>	<b>24.</b>	<b>VG</b>	<b>Only N-type varieties: Radish: red colour pattern of skin</b>		
<b>(+)</b>		<b>(b)</b>	absent	Minowase Summer Cross No. 3 (N)	1
<b>QL</b>			present	Akasuji (N)	9
<b>25.</b>	<b>25.</b> (* )	<b>VG</b>	<b>Only varieties with Radish: Number of colour of skin: two: Radish: extent of white colour from non-thickened root end</b>		
<b>(+)</b>		<b>(b)</b>	very small	Benizonochunaga (N), Demi-long écarlate à très petit blanc 2 (S)	1
<b>QN</b>			small	Benikanmi (N), Pernot clair (S)	3
			medium	Aonaga (N), Fakir (S), Pépito (S)	5
			large	Delikat (S), Flamino (S), Oshin (N)	7
			very large	Murasakizukin (N), Rond rose à très grand bout blanc 2 (S)	9



CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
<b>26.</b>	<b>26.</b>	<b>VG</b>	<b><u>Only N-type varieties:</u> Radish: ridging of surface</b>		
<b>QN</b>		<b>(b)</b>	absent or weak	Minowase Summer Cross No. 3 (N), Suikominingo (N)	1
			medium	Halblanger weißer Sommer (N), Miyashige Nagabuto (N)	3
			strong	Aonaga (N)	5
<b>27.</b>	<b>27.</b>	<b>VG</b>	<b>Radish: main colour of flesh</b>		
<b>(+)</b>		<b>(b)</b>	translucent white	De dix-huit jours (S), Rex (N)	1
<b>PQ</b>			opaque white	Bamba (S), Noir gros long d'hiver de Paris (N), Saxa 2 (S)	2
			green	Green Meat (N), Kazafukarami (N)	3
			red	Mantanghong (N), Roche (S), Tenankoshin (N)	4
<b>28.</b>	<b>28. (*)</b>	<b>VG</b>	<b>Time of harvest maturity</b>		
<b>(+)</b>			S-type early	Donar (S)	1
<b>QN</b>			S-type medium	Flamboyant (S)	2
			S-type late	Blanche transparente (S), Scarlet Champion (S)	3
			N-type very early	Osaka 40 days (N), Ostergruß rosa 2 (N)	4
			N-type early	Minowase Summer Cross No. 3 (N)	5
			N-type medium	Miyashige nagabuto (N) Oshin (N), Sutong (N)	6
			N-type late	Miura (N)	7
			N-type very late	Sakurajima oomaru (N)	8

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
<b>29.</b>	<b>29.</b>	<b>VG</b>	<b>Radish: tendency to become pithy</b>		
<b>(+)</b>		<b>C</b>	absent or very weak	April Cross (N), Altox (S), Clipo (S), Savour (S), White Arrow (N)	1
<b>QN</b>			weak	Bamba (S), Early 40 days (N), Polka (S)	3
			moderate	Flamboyant 2 (S)	5
			strong	Cherry Belle (S), De Sezanne (S)	7
			very strong	Blanche transparente (S), De dix-huit jours (S)	9

## 8. EXPLANATIONS ON THE TABLE OF CHARACTERISTICS

### ***Grouping for *Raphanus sativus* L.***

Grouping for varieties to S-type and N-type varieties is based on the time of harvest maturity:

	Harvest maturity	Example variety
N-type varieties	> 60 days	Oshin (N), Sutong (N), Miyashige nagabuto (N)
S-type varieties	< 35 days	Flamboyant 2 (S)

Those varieties of which the harvest maturity falls between 35 and 60 days should be classified in a next step taking into account length and diameter of the radish as follows:

	Length of radish (for elongated varieties)	Diameter of radish (for rounded varieties)
N-type varieties	>15 cm	>3.5 cm
S-type varieties	<10 cm	<2.5 cm

Varieties which fall still between N-type varieties and S-type varieties should be tested in both groups.

### 8.1 Explanations covering several characteristics

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

- (a) All observations on the seedling and the cotyledon should be made when the first true leaf is expanded.
- (b) All observations on the leaf and the radish should be made at the time of harvest maturity depending on the type.
- (c) All observations on the leaf should be made on fully developed leaves.

### 8.2 Explanations for individual characteristics

#### Ad. 1: Only N-type varieties: ploidy

The ploidy status of the plant can be checked by different methods as determination of the number

- of chromosomes of the non-thickened root meristem
- and length of stomata on the lower side of the cotyledon (tetraploid varieties have more and longer stomata than diploid varieties)
- of chloroplasts of the guard cells on the lower side of the cotyledon (the guard cells of tetraploid varieties are bigger and contain more chloroplasts (> 20) than those of diploid varieties (> 10).

Another efficient method to determine the ploidy status is the flow cytometry.

#### Ad. 2: Leaf: attitude

N-type varieties should be observed 30 days after sowing, because the characteristic might be at a later stage influenced by the position of the radish in the soil.

S-type varieties should be observed at the time of harvest maturity.

Ad. 6: Leaf blade: shape of apex



1  
acute



2  
obtuse



3  
rounded

Ad. 8: Leaf blade: number of lobes

Parts of the leaf blade are considered as lobes if their length is at least equivalent to the width of the leaf petiole at their point of attachment and if both notches of the blade have at least half the length of the lobe itself.











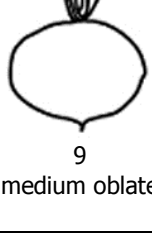



1  
absent or very few

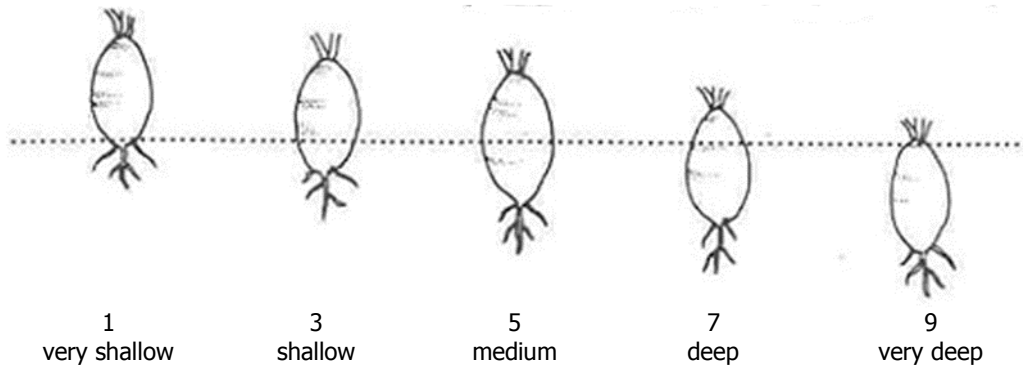


9  
very many

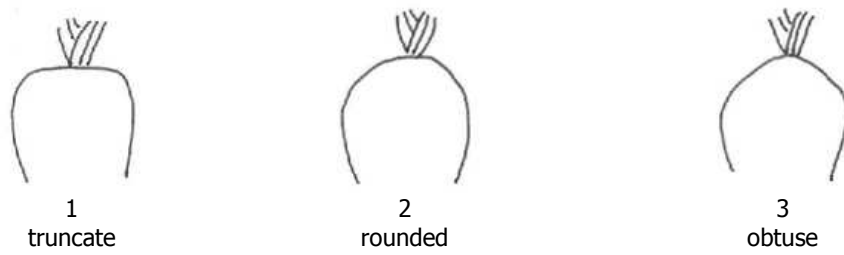
Ad. 17: Radish: shape

		← <i>broadest part</i> →				
		(below middle)	at middle	(above middle)		
narrow (elongated) → width (ratio length/width) ← broad (compressed)			 4 acicular			
			 5 oblong			
			 6 narrow elliptic	 1 narrow triangular		
		 12 bell shaped	 11 obovate	 7 medium elliptic	 3 ovate	 2 medium triangular
			 8 circular			
			 9 medium oblate			
			 10 narrow oblate			

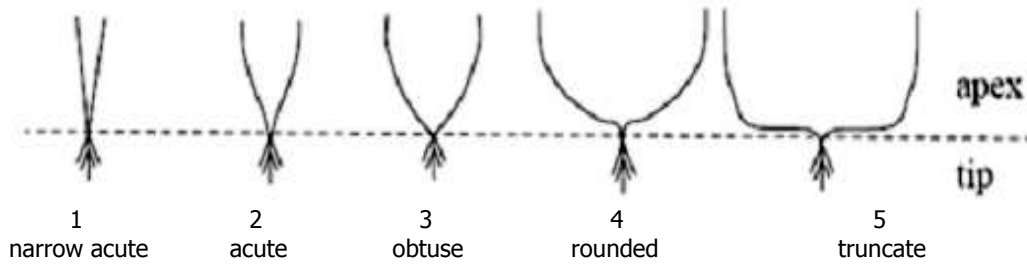
Ad. 18: Only N-type varieties: Radish: position in soil



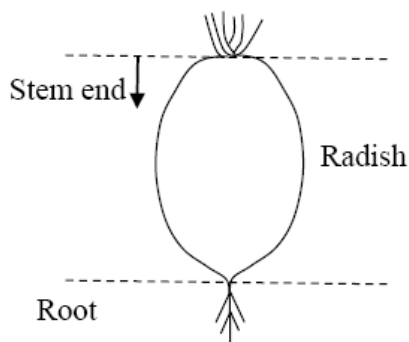
Ad. 19: Radish: shape of shoulder



Ad. 20: Radish: shape of apex



Ad. 22: Radish: colour of skin of stem end



Ad. 24: Only N-type varieties: Radish: red colour pattern of skin



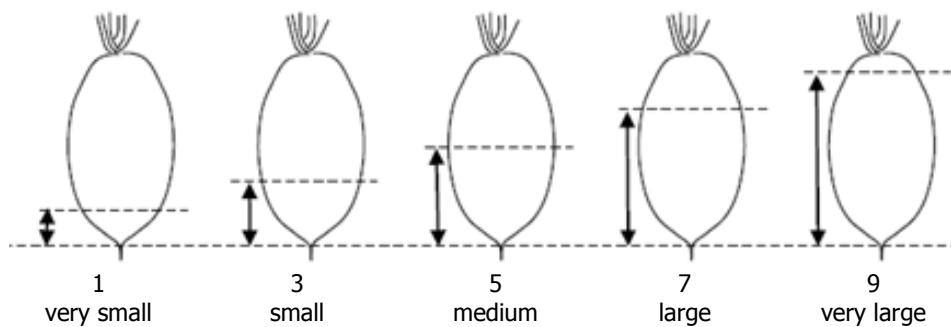
1  
absent



2  
present

Ad. 25: Only varieties with Radish: Number of colour of skin: two: Radish: extent of white colour from non-thickened root end

The extent of white tip should be observed in relation to the total length of the radish.



Ad. 27: Radish: main colour of flesh

The main colour is the colour with the largest surface area. To be observed in longitudinal section.

Ad. 28: Time of harvest maturity

Time of harvest maturity is reached should be observed at growth stage 48.

Ad. 29: Radish: tendency to become pithy

After having reached the harvest maturity radishes may be repeatedly harvested and cut in cross section to determine the tendency of becoming pithy. In this case, the number of days after sowing is to be recorded when 50% of the plants show this characteristic. Varieties which are very early pithy correspond to the expression very strong, varieties becoming pithy very late correspond to the expression absent or very weak.

**Decimal code for growth stages**

*Phenological growth stages and BBCH-Identification keys of non-thickened root and stem vegetables (radish = Raphanus sativus L.) Feller et al., 1995 (Meyer, 1997)*

<b>Code</b>	<b>Description</b>
<i>Principal growth stage 0: Germination</i>	
09	<b><i>Emergence: cotyledons break through soil surface</i></b>
<i>Principal growth stage 1: Leaf development (main shoot)</i>	
10	<b><i>Cotyledons completely unfolded; growing point or true leaf initial visible</i></b>
19	<b><i>9 or more true leaves unfolded</i></b>
<i>Principal growth stage 4: Development of harvestable vegetative plant parts</i>	
41	<b><i>Non-thickened roots beginning to expand (diameter &gt;0.5 cm)</i></b>
45	<b><i>50% of the expected non-thickened root diameter reached</i></b>
48	<b><i>80% of the expected non-thickened root diameter reached</i></b>
49	<b><i>Expansion complete; typical form and size of non-thickened roots reached</i></b>



## 9. LITERATURE

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## **10. TECHNICAL QUESTIONNAIRE**

The Technical Questionnaire is available on the CPVO website under the following reference: CPVO-TQ/064/2 Rev