

**UNITED KINGDOM NATIONAL LIST/ PLANT BREEDERS RIGHTS TECHNICAL
PROTOCOL FOR THE OFFICIAL EXAMINATION OF DISTINCTNESS, UNIFORMITY AND
STABILITY (DUS)**

Radish

(Raphanus sativus L. var. sativus)

Black Radish

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

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SECTION A - GENERAL INFORMATION**1 PURPOSE**

- 1.1 This Protocol sets out the procedures for conducting tests and assessments in relation to official examinations of DUS and maintenance of reference stocks of varieties of Radish and Black Radish entered for National List (NL) Trials and Plant Breeders' Rights (PBR) tests.

2 SCOPE

- 2.1 These procedures apply to all varieties of Radish (*Raphanus sativus* L. var. *sativus*), Black Radish (*Raphanus sativus* L. var. *niger* (Mill.) S. Kerner) and hybrids between those species. Excludes agricultural fodder types (Oleiformis Group) which are tested according to UPOV TG/178/3.
- 2.2 Except where specified in this protocol or authorised by The Animal and Plant health Agency (APHA), Plant Varieties and Seeds, only National List candidates, Plant Breeders' Rights candidates, candidates for Foreign Authorities and the reference varieties may be incorporated in the DUS tests.

3 RESPONSIBILITIES

- 3.1 The growing tests and assessments in this protocol are carried out under the responsibility of the Secretary of State for Environment, Food and Rural Affairs, Scottish Ministers, Welsh Ministers and the Minister for Agriculture and Rural Development in Northern Ireland (the National Authorities).
- 3.2 They are supervised, on behalf of the National Authorities, by officials of the Testing Authorities, that is The Animal and Plant Health Agency (APHA), the Scottish Government Agriculture and Rural Development Division (SGARD), the Department of Agriculture and Rural Development for Northern Ireland (DARDNI) and the Welsh Government (WG).
- 3.3 This protocol is authorised by the Plant Variety and Seeds Committee (PVSC). It cannot be amended without their approval. Requests and suggestions for amendment of the protocol should be put in writing to APHA, Plant Varieties and Seeds, either directly or via the Test Centre.
- 3.4 The procedures are administered by:

Plant Varieties and Seeds
Animal and Plant Health Agency
Eastbrook
Shaftesbury Road
Cambridge
CB2 8DR

Tel No 02080 265993
Fax No 02084 152504

3.5 TEST CENTRE

The DUS growing tests and assessments in this protocol are co-ordinated and carried out by the:

Vegetable DUS Test Centre
Science and Advice for Scottish Agriculture (SASA)
Roddinglaw Road
Edinburgh
EH12 9FJ

Tel No 0131-244 8853
Fax No 0131-244 8940

- 3.6 The Test Centre is responsible for providing the appropriate facilities.

4 NON COMPLIANCE WITH THE PROTOCOL

- 4.1 Where the protocol uses the word “must” for any action then failure to carry out this action will result in non-compliance. Where non-compliance occurs or there are concerns regarding the validity of any data or tests this must be reported to APHA, Plant Varieties and Seeds. Where this protocol uses the word “should” for any action this is the method to be followed unless there are clear reasons not to do so which can be justified by the Test Centre as technically sound.

5 RESPONSIBILITY FOR GM RELEASES

- 5.1 GM Release Consent Holders are responsible for GM releases. All parties involved in DUS work operating under a GM Release Consent must adhere to the instructions of the Release Consent Holder where necessary, to comply with the relevant consent conditions. Where DUS protocol non-compliance occurs, this must be reported to the consent holder and the Test Centre who will notify APHA, Plant Varieties and Seeds.

6 PROCEDURES FOR GM VARIETIES

- 6.1 Applicants intending to enter GM candidates must consult APHA, Plant Varieties and Seeds, well in advance of their application, about specific requirements under GM regulations.
- 6.2 The Test Centre must ensure that no test or trial sites are planted with GM candidates and/or varieties until APHA, Plant Varieties and Seeds, has given the specific clearances.

7 ASSOCIATED DOCUMENTS

- 7.1 The following documents are associated with this protocol

Reference	Title
UPOV TG/1/3	General Introduction to the Examination of Distinctness, Uniformity and Stability and the Development of Harmonised Descriptions of New Varieties of Plants. 19.04.2002
CPVO TP/064/2 Rev.	Protocol for Tests on Distinctness, Uniformity and Stability. Radish (<i>Raphanus sativus</i> L. var. <i>sativus</i>) and Black Radish (<i>Raphanus sativus</i> L. var. <i>niger</i> (Mill.) S. Kerner) (11/03/2015)
UPOV TGP/8/1	Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability. 16.10.2014
UPOV TGP/9/1	Examining Distinctness 29.10.2015
UPOV TGP/10/1	Examining Uniformity 30.10.2008
UPOV TWC/26/14	An Adjustment to the COYD Method When Varieties are Grouped Within the DUS Trial 01.08.2008.
UPOV TG/63/7-TG/64/7	Guidelines for the Conduct of Tests for Distinctness, Uniformity and Stability, Radish (<i>Raphanus sativus</i> L. var. <i>sativus</i>), Black Radish (<i>Raphanus sativus</i> L. var. <i>niger</i> (Mill.) S. Kerner) 28.03.2012
Commission Directives	Commission Directive of 2003/91/EC, as amended, setting out implementing measures for the purposes of Article 7 of Council Directive 2002/55/EC (13 th June 2002) as regards the characteristics to be covered as a minimum by the examination and the minimum conditions for examining certain varieties of vegetable species. [Radish and Black Radish]
Council Regulation	Council Regulation (EC) No. 2100/94 of 27 July 1994 on Community Plant Variety Rights.

SECTION B - APPLICATION REQUIREMENTS**1 PURPOSE**

- 1.1 The purpose of this section is to identify the specific requirements for National List and Plant Breeders' Rights applications.

2 SCOPE

- 2.1 These procedures apply to all applications.

3 RESPONSIBILITIES

- 3.1 The applicants are responsible for ensuring that these procedures are complied with.

4 RECEIPT OF APPLICATIONS

- 4.1 The latest date for receipt of applications for acceptance of a variety onto the National List or for Plant Breeders' Rights is 28th February, which is set administratively by APHA, Plant Varieties and Seeds. Applications received after this date may be considered for inclusion in the current year's tests and trials on a case by case basis.

- 4.2 The procedures for the submission of National List and Plant Breeders' Rights applications, Technical Questionnaires (TQ) and for payment of administrative fees are set out on the GOV.UK website at [Plant varieties and seeds](#).

- 4.3 Applicants should notify APHA, Plant Varieties and Seeds of special DUS characteristics which may require additional examinations. These claims should, in addition, be noted in the TQ accompanying the application.

5 RECEIPT OF SEED

- 5.1 The latest date for receipt of seed is 31st March and is set administratively by APHA, Plant Varieties and Seeds. Seed submissions received after this date will normally be refused. Instructions for the delivery of seed will be made available to applicants by APHA, Plant Varieties and Seeds.

6 SEED QUALITY REQUIREMENTS

- 6.1 The seed must satisfy the quality requirements for Basic Seed as laid down in Schedule 4 Part II of the Vegetable Seeds Regulations (England) 2002 SI.3175/2002, as amended, and equivalent regulations made by Devolved Administrations.

- 6.2 The seed must not be chemically treated. Seed treatment, where appropriate, will be undertaken by the Test Centre. The chemicals applied and rates of application will be determined by the Test Centre.

7 SEED QUANTITY

- 7.1 Year 1

2,000 or 6,000 seeds

- 7.2 Year 2

4,000 seeds if 2,000 seeds were provided in 1st test cycle
No seed if 6,000 seeds were provided in the 1st test cycle

Where a second sample has been provided, it will be authenticated against the original submission. An additional charge will be applied.

8 LABELLING REQUIREMENTS, INCLUDING PROVISIONS FOR GM VARIETIES

8.1 Applicant must clearly label their seed with the following information:

- Applicant
- Breeder's Reference number or name
- Quantity of seed

8.2 All packages of GM material must be clearly labelled as "GMO" or "Genetically Modified Organism".

SECTION C – GROWING TEST PROCEDURES**1 PURPOSE**

- 1.1 The purpose of this section is to provide details of the procedures used in the growing tests for DUS analysis.

2 SCOPE

- 2.1 These procedures apply to all varieties of Radish (*Raphanus sativus* L. var *sativus*) and Black Radish (*Raphanus sativus* L. var. *niger* (Mill.) S. Kerner).

3 RESPONSIBILITIES

- 3.1 The Test Centre is responsible for conducting these procedures.
- 3.2 The Test Centre will be responsible for ensuring that no material supplied to them is used for any other purpose than the conduct of these procedures or the release of reference samples for authorised purposes. (See Section E7)

4 REFERENCE VARIETIES

- 4.1 The principles governing the selection of reference varieties are set out in Appendix 1.
- 4.2 Seed of reference varieties will be supplied by the Test Centre.

5 DESIGN OF TESTS

- 5.1 The Test Centre is responsible for selecting a suitable site which should be on ground that has normally not had a Cruciferous crop in the previous five years but may be less where the risk is negligible.
- 5.2 Field husbandry should follow best local practice for all operations and particularly as regards cultivation, drilling, fertiliser and spray application, use of irrigation, and control of pests and diseases.
- 5.3 From information given in the Technical Questionnaire the candidate variety may be grown in plots and compared with varieties which are in the same classification for the following characters:

CPVO characteristics that could be used for grouping

- Only N-type varieties: Ploidy (characteristic 1)
- Only N-type varieties: Leaf: length (characteristic 3)
- Only S-type varieties: Leaf: length (characteristic 4)
- Leaf blade: number of lobes (characteristic 8)
- Petiole: anthocyanin coloration (characteristic 10)
- Only N-type varieties: Radish: length (characteristic 13)
- Only S-type varieties: Radish: length (characteristic 14)
- Only N-type varieties: Radish: diameter (characteristic 15)
- Only S-type varieties: Radish: diameter (characteristic 16)
- Radish: shape (characteristic 17)
- Radish: number of colours of skin (excluding non-thickened root) (characteristic 21)
- Radish: colour of skin of stem end (characteristic 22)
- Only varieties with Radish: Number of colours of skin: two: Radish: extent of white colour from non-thickened root end (characteristic 25)
- Time to harvest maturity (characteristic 28)

- 5.4 Varieties known to be clearly different from the candidate on any other discontinuous or continuous characteristic may be excluded from the trial. If this exclusion is based on a characteristic which is not listed in section D 5.1 approval by the NLSC and CPVO must be sought. See section F for further information on additional characters.
- 5.5 The tests are carried out using a grouped design, with a plot of each candidate and close control variety present in each replicate as follows:

Radish

Number of replications	2
Number of rows per plot	2
Spacing between plot rows	0.4m
Plot length	5 m
Number of plants per replicate	at least 100
Hence, number of plants per variety	at least 200
Plant spacing	0.1m (approx)

Black Radish

Number of replications	2
Number of rows per plot	3
Spacing between plot rows	0.4m
Plot length	5 m
Number of plants per replicate	at least 80
Hence, number of plants per variety	at least 160
Plant spacing	0.2m (approx)

Groups are randomised and varieties are randomised within groups.

- 5.6 Seed is sown directly into the field in late July or early August according to a plan produced by the Test Centre. Varieties are coded by the Test Centre.
- 5.7 Any candidate with distinctness problems in the first test cycle may be grown side by side with their close controls in the second or third test cycles.
- 5.8 Recordings are taken on each trial at harvest maturity stage. Characters recorded are listed in Section D.

6 RECORDS AND RECORDING

- 6.1 All records and plot data should be in a form determined and validated by the Test Centre.
- 6.2 Characters, recording details and instructions are given in Section D. Any variant and abnormal plants or plants resulting from an adverse reaction to husbandry practice are noted but excluded from the sample.
- 6.3 In the first recording cycle, characters, as indicated in Section D5.1, are recorded on all candidates and their controls. The data for measured characters are analysed and used to determine the most similar reference varieties and assess uniformity of the candidate. (For details see Section G).
- 6.4 In the second recording cycle, characters, as indicated in Section D5.1, are recorded on all candidates and their controls. The data for measured characters are analysed and, together with those from the first recording cycle, used to determine the most similar reference varieties and assess uniformity of the candidate. (For details see Section G).
- 6.5 If a third test cycle is necessary, characters, as indicated in Section D5.1, are recorded on all candidates and their controls. The data for measured characters are analysed and, together with those from the first and second test cycles, are used to determine the most similar reference varieties and assess uniformity of the candidate. (For details see Section G).

6.6 If the Test Centre notices unusual or novel characters in a candidate, a note may be made of these at any time and a photographic record made.

7 COMMUNICATION WITH THE APPLICANT

7.1 The Test Centre will notify the applicant or his agent of any DUS problems at the earliest practical opportunity. All such notifications must be copied to APHA, Plant Varieties and Seeds. In the case of tests for foreign DUS authorities, notifications must be copied to the test authority and to APHA, Plant Varieties and Seeds. In the case of European applications, notifications must be copied to CPVO and APHA, Plant Varieties and Seeds.

7.2 If confidentiality considerations allow, the applicant should be informed which variety is similar to his own and be invited to submit any information which may help to distinguish them.

7.3 If DUS problems arise, applicants will be invited to visit the DUS tests by arrangement so that the material can be examined and discussions held with the Test Centre.

7.4 After each recording season the results are summarised and reported by the Test Centre to the applicant, APHA, Plant Varieties and Seeds, who will inform the applicant, foreign test authorities or the CPVO as appropriate.

SECTION D - SUMMARY OF DUS CHARACTERISTICS TO BE ASSESSED METHOD OF ASSESSMENT AND STANDARDS APPLIED

1 PURPOSE

1.1 The purpose of this section is to summarise the characteristics to be assessed.

2 SCOPE

2.1 This section summarises characteristics, states of expression, method of observation and standards required for DUS assessment.

3 RESPONSIBILITIES

3.1 The Test Centre is responsible for co-ordinating the procedures in this summary.

4 ORGANISATION

4.1 The minimum duration of tests to assess characteristics is normally two independent growing cycles. Shorter periods may be applied for assessment of additional characteristics. Additional growing periods may be approved by the UK National List and Seeds Committee (NLSC).

5 DUS CHARACTERISTICS TO BE ASSESSED

5.1 Routine Characteristics

The following table summarises the DUS characteristics to be routinely examined.

Legend:

Key to abbreviations used with character number

Types of expression of characteristics: (for an explanation see UPOV TG/1/3: A GENERAL INTRODUCTION TO THE EXAMINATION OF DISTINCTNESS, UNIFORMITY AND STABILITY - 4.4 Types of Expression of Characteristics)

QL Qualitative characteristic
 QN Quantitative characteristic
 PQ Pseudo-qualitative characteristic

Type of observation of characteristics:

MG Single measurement of a group of plants or parts of plants
 • Using all plants in the test but disregarding any off-types
 MS Measurement of a number of individual plants or parts of plants
 • Using 40 plants from at least 2 replications
 VG Visual assessment by a single observation of a group of plants or parts of plants
 • Using all plants in the test but disregarding any off-types
 VS Visual assessment by observation of individual plants or parts of plants
 • Using 40 plants from at least 2 replications

Note: The characteristics to be used in the DUS tests and the 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 prevented by the environmental conditions under which the test is conducted, or by specific legislation of plant health. In the latter case, the CPVO should be informed. In the case of disease resistance characteristics, only those resistances marked with an asterisk (*) in the CPVO column are compulsory.

RADISH

Character Number		Character (G denotes grouping character)	Material examined	Method of assessment and recording (see Section D5)	States of expression	D Method and Minimum distance required	U Method and Standard applied
CPVO TP/064/2 2015	UPOV TG/63/7 TG/64/7 2012						
1	*1	Only N-type varieties: Ploidy (G)	Single plants (seedlings)	QL MG	2=diploid 4=tetraploid	Clear visual difference or 1 state	Off-type standard
2	*2	Leaf: attitude	DUS plot	QN VG	1=erect 3=semi erect 5=horizontal	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
3	*3	Only N-type varieties: Leaf: length (G)	DUS plot	QN VG/MS	3=short 5=medium 7=long	Clear visual difference or 2 states or COYD @ 5% for both 2 and 3 year tests	Off-type standard and Uniformity score >5 or COYU at 0.1% for both 2 and 3 year tests
4	*4	Only S-type varieties: Leaf: length (G)	DUS plot	QN VG/MS	3=short 5=medium 7=long 9=very long	Clear visual difference or 2 states or COYD @ 5% for both 2 and 3 year tests	Off-type standard and Uniformity score >5 or COYU at 0.1% for both 2 and 3 year tests
5	5	Only N-type varieties: Leaf: width	DUS plot	QN VG/MS	1=narrow 2=medium 3=broad	Clear visual difference or 2 states or COYD @ 5% for both 2 and 3 year tests	Off-type standard and Uniformity score >5 or COYU at 0.1% for both 2 and 3 year tests
6	6	Leaf blade: shape of apex	DUS plot	PQ VG	1=acute 2=obtuse 3=rounded	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
7	7	Leaf blade: colour	DUS plot	PQ VG	1=yellow green 2=light green 3=medium green 4=dark green 5=light grey green 6=medium grey green 7=dark grey green	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
8	*8	Leaf: number of lobes (G)	DUS plot	QN VG	1=absent or very few 3=few 5=medium 7=many 9=very many	Clear visual difference or 2 states	Off-type standard and Uniformity score >5

SECTION D

CPVO TP/064/2 2013	UPOV TG/63/7 TG/64/7 2012	Character (G denotes grouping character)	Material examined	Method of assessment and recording	States of expression	D Method and Minimum distance required	U Method and Standard applied
9	9	Leaf blade: depth of incisions of margin	DUS plot	QN VG	1=absent or very shallow 3=shallow 5=medium 7=deep	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
10	10	Petiole: anthocyanin coloration (G)	DUS plot	QN VG	1=absent or very weak 3=weak 5=medium 7=strong 9=very strong	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
11	11	<u>Only S-type varieties:</u> Foliage: width of attachment	DUS plot	QN VG	3=narrow 5=medium 7=wide	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
12	12	<u>Only N-type varieties:</u> Foliage: number of fully developed leaves	DUS plot	QN VG	3=few 5=medium 7=many	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
13	*13	<u>Only N-type varieties:</u> Radish: length (G)	DUS plot	QN MS/VG	1=very short 3=short 5=medium 7=long 9=very long	Clear visual difference or 2 states or COYD @ 5% for both 2 and 3 year tests	Off-type standard and Uniformity score >5 or COYU at 0.1% for both 2 and 3 year tests
14	*14	<u>Only S-type varieties:</u> Radish: length (G)	DUS plot	QN MS/VG	1=very short 3=short 5=medium 7=long 9=very long	Clear visual difference or 2 states or COYD @ 5% for both 2 and 3 year tests	Off-type standard and Uniformity score >5 or COYU at 0.1% for both 2 and 3 year tests
15	15	<u>Only N-type varieties:</u> Radish: diameter (G)	DUS plot	QN MS/VG	1=very small 3=small 5=medium 7=large 9=very large	Clear visual difference or 2 states or COYD @ 5% for both 2 and 3 year tests	Off-type standard and Uniformity score >5 or COYU at 0.1% for both 2 and 3 year tests
16	16	<u>Only S-type varieties:</u> Radish diameter (G)	DUS plot	QN MS/VG	1=very small 3=small 5=medium 7=large 9=very large	Clear visual difference or 2 states or COYD @ 5% for both 2 and 3 year tests	Off-type standard and Uniformity score >5 or COYU at 0.1% for both 2 and 3 year tests

SECTION D

CPVO TP/064/2 2013	UPOV TG/63/7 TG/64/7 2012	Character (G denotes grouping character)	Material examined	Method of assessment and recording	States of expression	D Method and Minimum distance required	U Method and Standard applied
17	*17	Radish: shape (G)	DUS plot	PQ VG	1=narrow triangular 2=medium triangular 3=ovate 4=acicular 5=oblong 6=narrow elliptic 7=medium elliptic 8=circular 9=medium oblate 10=narrow oblate 11=obovate 12=bell shaped	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
18	18	<u>Only N-type varieties</u> : Radish: position in soil	DUS plot	QN VG	1=very shallow 3=shallow 5=medium 7=deep 9=very deep	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
19	19	Radish: shape of shoulder	DUS plot	QN VG	1=truncate 2=rounded 3=obtuse	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
20	20	Radish: shape of apex	DUS plot	PQ VG	1=narrow acute 2=acute 3=obtuse 4=rounded 5=truncate	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
21	*21	Radish: number of colours of skin (excluding non-thickened root) (G)	DUS plot	QL VG	1=one 2=two	Clear visual difference or 1 state	Off-type standard
22	*22	Radish: colour of skin of stem end (G)	DUS plot	PQ VG	1=white 2=yellowish white 3=yellow 4=brown 5=light green 6=medium green 7=dark green 8=pink 9=dark pink red 10=red 11=purple 12=violet 13=black	Clear visual difference or 2 states	Off-type standard and Uniformity score >5

SECTION D

CPVO TP/064/2 2013	UPOV TG/63/7 TG/64/7 2012	Character (G denotes grouping character)	Material examined	Method of assessment and recording	States of expression	D Method and Minimum distance required	U Method and Standard applied
23	*23	Non-thickened root: colour	DUS plot	PQ VG	1=white 2=yellowish white 3=yellow 4=brown 5=light green 6=medium green 7=dark green 8=pink 9=dark pink red 10=red 11=purple 12=violet 13=black	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
24	24	<u>Only N-type varieties</u> : Radish: red colour pattern of skin	DUS plot	QL VG	1=absent 9=present	Clear visual difference or 1 state	Off-type standard
25	*25	<u>Only varieties with Radish: Number of colour of skin: two</u> : Radish: extent of white colour from non-thickened root end (G)	DUS plot	QN VG	1=very small 3=small 5=medium 7=large 9=very large	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
26	26	<u>Only N-type varieties</u> : Radish: ridging of surface	DUS plot	QN VG	1=absent or weak 3=medium 5=strong	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
27	27	Radish: main colour of flesh	DUS plot	PQ VG	1=translucent white 2=opaque white 3=green 4=red	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
28	*28	Time of harvest maturity (G)	DUS plot	QN VG	1=S-type early 2=S-type medium 3=S-type late 4=N-type very early 5=N-type early 6=N-type medium 7=N-type late 8=N-type very late	Clear visual difference or 2 states	Off-type standard and Uniformity score >5
29	29	Radish: tendency to become pithy	DUS plot	QN VG	1=absent or very weak 3=weak 5=moderate 7=strong 9=very strong	Clear visual difference or 2 states	Off-type standard and Uniformity score >5

5.2 UK Additional DUS Characteristics

There are other additional characteristics which have been used by the UK in the past, but which are not accepted by the CPVO. It might be possible to use these characters in decisions for NL and UK PBR but without detailed discussion and eventual acceptance by the CPVO any DUS reports using these characters will not be accepted for EU Plant Breeders Rights. For further information please contact APHA Tel. No.03000 600497. A fee may be charged for examination of these characteristics as advised by APHA

Applicants can suggest new additional characters on the Technical Questionnaire for testing DUS or after notification by the DUS Test Centre of distinctness problems. For procedures see Section F.

SECTION E - REFERENCE SEED STOCK MAINTENANCE**1 PURPOSE**

- 1.1. This section sets out the procedures for the authentication of replacement reference seed.

2 SCOPE

- 2.1 These procedures apply to all reference collection varieties.

3 RESPONSIBILITIES

- 3.1 The Test Centre is responsible for conducting these procedures.

4 PROCEDURES FOR REFERENCE SEED STOCK MAINTENANCE

- 4.1 The seed sample submitted with the successful or pending application is considered to be the definitive stock of the variety. Subject to meeting the required quality standards a small portion of the seed is sown for observation and measurement. The remainder is stored under controlled and monitored refrigerated conditions as part of the official reference collection.
- 4.2 If during the normal tests there is any evidence that a seed stock is deteriorating in storage, or that stocks have low quantity, a request will be made to the maintainer asking for a replacement stock of the variety. This replacement stock must be authenticated, by comparing plots established from the replacement seed with that of the definitive seed, over a maximum of two recording cycles.
- 4.3 If the replacement seed sample cannot be visually distinguished from the definitive reference stock, it will be accepted as representing the variety. If there are visual differences, the new sample will be recorded, and will be accepted as representing the variety if there are no significant ($P=0.05$) differences in the first recording cycle, or no significant ($P=0.05$) differences over two recording cycles in a COYD analysis (see associated document UPOV TGP/8/1 for details). It may then be accepted as definitive and substituted for the existing definitive stock in the reference collection. These procedures may be modified, where, in the opinion of the technical officer, differences are the result of environmental or cultural factors.
- 4.4 A replacement sample or additional replacement sample will be considered sufficiently uniform after one recording cycle, if the level of off-types is the same or less than the number at 1% population standard and 95% acceptance probability, and the standard deviations of the measured characters are not significantly greater at the 0.1% ($P=0.001$) significance level than that of the mean standard deviations of the control varieties. Over 2 year recording cycles the additional replacement sample will be considered sufficiently uniform if the combined over years uniformity (COYU) is not significantly greater at the 0.1% ($P=0.001$) significance level than that of the reference varieties. These procedures may be modified, where, in the opinion of the technical officer, differences are the result of environmental or cultural factors.
- 4.5 In the event of the replacement sample not meeting the required acceptance standards, an additional replacement sample is requested. Plots will be established from any additional replacement seed sample and compared over a maximum of two recording cycles. If the additional replacement sample does not meet the acceptance criteria set out in 4.3, the variety will be deleted from the reference collection.

5 PROCEDURES FOR THE INCLUSION OF NEW COMMON KNOWLEDGE VARIETIES INTO THE REFERENCE COLLECTION

- 5.1 When a new variety enters into common knowledge it must be included in the reference collection if seed is available. A request will be sent by the Test Centre to the maintainer of the variety and an official description will be requested from the Test Authority which registered the variety. If an official description is provided, seed received will be assumed to be definitive if the seed conforms to the official description. Small differences in the expression of quantitative characters are likely to be the result of recording in a different environment, and will be considered as conforming to the description. If no official description is available, seed will be assumed to be definitive.
- 5.2 If the seed does not conform to the official description, a request for definitive seed will be sent to the Testing Authority that added the variety to its National List or granted Plant Breeders' Rights' This seed will be used to validate the sample of seed from the maintainer. The standards for the validation will be as for authentication of replacement seed (seed E4).

6 RELEASE OF REFERENCE SAMPLES FOR AUTHORISED PURPOSES

- 6.1 Seed of reference samples can be supplied by the Test Centre, on request, to UK, EU and UPOV DUS Testing Authorities and UK, EU and OECD Seed Certification Agencies, provided the recipient is notified in writing that this material, or any material derived from it, must not be supplied to a third party or used for any other purpose than as a reference for official DUS testing or seed certification.
- 6.2 Provision of reference samples, other than in 6.1, to any other parties must be authorised by NLSC.

SECTION F- PROCEDURES FOR ASSESSMENT OF NEW ADDITIONAL DUS CHARACTERS**1 PURPOSE**

- 1.1 This Section sets out the procedures for assessment of new additional DUS characters for varieties of Radish and Black Radish entered for National List trials and Plant Breeders Rights tests.

2 SCOPE

- 2.1 These procedures apply to applications where new additional DUS characteristics which have not been approved by the NLSC are requested for use in DUS testing.

3 RESPONSIBILITIES

- 3.1 The Test Centre is responsible for liaising with the applicant to produce a proposed procedure for the conduct of new tests. This procedure must ensure that Distinctness, Uniformity and Stability will be assessed.
- 3.2 All new additional characteristics must be authorised by the NLSC and the CPVO.

4 REFERENCE VARIETIES

- 4.1 The reference varieties will include only those varieties from which the candidate variety is not distinct, as well as other appropriate varieties for control purposes.
- 4.2 Seed of reference varieties will be supplied by the Test Centre.

5 PROCEDURES

- 5.1 Details of the proposed special test or assessments will be submitted by the DUS Centre to the NLSC to consider the feasibility of setting up a test acceptable to the UK Authorities. The applicant will be advised by APHA, Plant Varieties and Seeds of arrangements and costs.
- 5.2 The NLSC will consider the results of the commissioned test or trial when reaching its recommendation on the granting of Plant Breeders' Rights and/or National Listing.
- 5.3 Where the test for a character is approved by the NLSC it should be subsequently listed in Section D5.1 or 5.2 as appropriate.

SECTION G - PROCEDURES FOR DUS DECISIONS**1 PURPOSE**

- 1.1 This section sets out the procedures for assessing DUS decisions on varieties of Radish and Black Radish.

2 SCOPE

- 2.1 These procedures apply to all varieties of Radish (*Raphanus sativus* L. var. *sativus*) and Black Radish (*Raphanus sativus* L. var. *niger* (Mill.) S. Kerner) entered for UK National List and Plant Breeders' Rights tests and those being tested for the CPVO or for other Foreign Authorities.

3 RESPONSIBILITIES

- 3.1 The Test Centre is responsible for applying the criteria for DUS, set out in this procedure.
- 3.2 The Test Centre is responsible for producing the DUS reports in accordance with these procedures and for ensuring that they are in accordance with CPVO Protocols.

4 REFERENCE VARIETIES

- 4.1 Appendix I sets out which varieties are considered as reference varieties for these procedures.

5 DISTINCTNESS

- 5.1 Distinctness is normally assessed in two independent test cycles, but a candidate variety could be considered distinct after one test cycle if there are no other similar varieties. A third independent test cycle may be undertaken if distinctness is not established after two test cycles.
- 5.2 In accordance with associated document UPOV TG/1/3 varieties can be considered distinct where they have a different expression in a grouping character.
- 5.3 The distinctness standard applied for qualitative is a difference of one state, unless otherwise indicated in Section D. For pseudo-qualitative characters the distinctness standard is a difference of 1, 2 or 3 states depending on the characteristic.
- 5.4 If a candidate is clearly different in a visually observed quantitative character, it is considered to be distinct, without the need for a repeated observation.
- 5.5 Where varieties are grown in close proximity under the same conditions, and a direct comparison can be made, a candidate is considered to be distinct, without the need for a repeated observation.
- 5.6 Where varieties are not grown in close proximity, a candidate is considered to be distinct if a difference of at least two states (see table in section D 5.1) is recorded in a visually observed quantitative character.
- 5.7 The standard for measured or counted quantitative characters, is, at least, as 5% (P=0.05) significant difference in one character over two or three growing cycles in a Combined Over Years Distinctness (COYD) analysis. Please see associated documents UPOV TGP/8/1 for details.

- 5.8 Where COYD cannot be applied, alternative methods should be considered.
- 5.8.1 When the number of varieties grown does not provide sufficient degrees of freedom for use of the standard COYD analysis, alternative methods should be adopted. If there is sufficient historical data (at least 5 years and sufficient degrees of freedom) then the long term LSD is applied. This LSD is calculated using up to 10 years of the most recent data. If there is insufficient historical data, the 2 x 1% method should be used.
- 5.8.2 Where the candidate has a full complement of data for two test cycles, but there is only data for control varieties for one test cycle, the use of FITC (Fitted Constant program in DUST) may be applied. This situation may arise due to the loss of plant material within plots in any one year or where suitable control varieties were not grown in both test cycles. The standard applied for Distinctness in such cases is $P=0.01$.

6 UNIFORMITY

- 6.1 Uniformity is assessed for all characteristics used to establish Distinctness.

Uniformity based on the assessment of 'Off-types'

- 6.2 The assessment of Off-types is undertaken in the first test cycle.
- 6.3 Off-type plants in the glasshouse or field are identified and marked for exclusion from recording.
- 6.4 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. [CPVO-TP/064/2, 27/02/2013 – 4.2 Uniformity (a)]
- 6.5 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. [CPVO-TP/064/2, 27/02/2013 – 4.2 Uniformity (b)]
- 6.6 Providing that the number of off-types in the first test cycle does not exceed the maximum permitted number of off-types for two test cycles then the applicant may submit a new seed sample (Resubmission) in the second test cycle with the aim of meeting the off-type standard. Distinctness will be assessed on data from the original seed submitted in the first test cycle and on data from the resubmitted seed in the second test cycle. The resubmitted seed will be authenticated against the original seed in side by side plots.
- 6.7 After the variants have been excluded, the characteristics listed in Section D5 are used to assess the uniformity of the remaining plants, according to the methods described.

Uniformity based on the assessment of general variation where no measurements are recorded.

- 6.8 Uniformity of continuous variation (quantitative characters) is assessed visually according to the following scale:

Score	1-5	unacceptable (1 is worst)
Score	6-9	acceptable (9 is best)

A candidate with a visual uniformity score of 6 or more is satisfactory.

Uniformity based on the assessment of general variation where measurements are recorded:

- 6.9 Provided a variety meets the off-type standard, it can be considered sufficiently uniform after two or three, test cycles if, for all measured characters necessary for distinctness, the Combined Over Years Uniformity (COYU) analysis is not significantly greater than that of the reference varieties at the 0.1% ($P=0.001$) significance level (see document TGP/8/1). In all cases an examination of data from individual test cycles is carried out to investigate the uniformity problem indicated by the COYU result. Decisions on whether any outlier plants (off-types) identified by data analysis should be excluded from the calculation of variety means and standard deviations, should be taken by the Test Centre.

7 STABILITY

- 7.1 A variety is considered sufficiently stable when there is no evidence to indicate that it lacks uniformity or fails to conform to the essential characteristics of its description in different submissions or in different tests.

8 DUS REPORT AND VARIETY DESCRIPTION

- 8.1 Upon completion of the DUS examination the DUS Summary report will be submitted to APHA, Plant Varieties and Seeds by the specified date. This report will specify all non-routine characteristics for establishing distinctness.
- 8.2 The final DUS report, including the full variety description, will be submitted to APHA, Plant Varieties and Seeds by the specified date. The characteristics to be used in the description are identified in Section D.

APPENDIX 1.**REFERENCE COLLECTION VARIETIES****1 NATIONAL LISTING**

- 1.1 The DUS reference collection, for NL purposes, for any given category of plant variety comprises the following at the time when the application for the candidate is made.
- 1.2 All other candidate varieties already in DUS test in the UK, or entering testing at the same time as the candidate, including those being tested for other Member States.
- 1.3 All varieties on the UK National List and varieties on the EC Common Catalogue.
- 1.4 Varieties nominated by the authorities concerned where tests are done for other Member States.
- 1.5 Varieties nominated by the applicant as being comparable i.e. known to be similar.
- 1.6 Any other varieties considered to be comparable i.e. known to be similar by the appropriate Test Centre.

2 PLANT BREEDERS RIGHTS

- 2.1 The DUS reference collection, for PBR purposes, for any given category of plant variety comprises the following at the time when the application for the candidate is made.
- 2.2 All other candidate varieties already in DUS tests in the UK, or entering DUS testing at the same time as the candidate, including those being tested for other Member States or the Community Plant Variety office (CPVO).
- 2.3 Varieties protected in the UK, EC or in a UPOV Member State, which are known to be similar to the candidate variety.
- 2.4 Other available comparable varieties in common knowledge.