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**INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS**  
GENEVA

**TECHNICAL WORKING PARTY FOR AGRICULTURAL CROPS**

**Thirty-Eighth Session**  
**Seoul, August 31 to September 4, 2009**

TGP DOCUMENTS

*Document prepared by the Office of the Union*

1. The purpose of this document is: to report on developments since the thirty-seventh session of the Technical Working Party for Agricultural Crops (TWA), concerning the consideration of TGP documents; to provide background information to assist the TWA in its consideration of the drafts of individual TGP documents; and to present the program for the development of TGP documents agreed by the Technical Committee at its forty-fifth session, held in Geneva from March 30 to April 1, 2009.

2. The following abbreviations are used in this document:

CAJ:	Administrative and Legal Committee
TC:	Technical Committee
TC-EDC:	Enlarged Editorial Committee
TWA:	Technical Working Party for Agricultural Crops
TWC:	Technical Working Party on Automation and Computer Programs
TWF:	Technical Working Party for Fruit Crops
TWO:	Technical Working Party for Ornamental Plants and Forest Trees
TWV:	Technical Working Party for Vegetables
TWPs:	Technical Working Parties

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## I. BACKGROUND

3. The purpose of document TG/1/3 “General Introduction to the Examination of Distinctness, Uniformity and Stability and the Development of Harmonized Descriptions of New Varieties of Plants” (General Introduction), and the associated series of documents specifying Test Guidelines’ Procedures (TGP documents), is to set out the principles which are used in the examination of DUS. The only binding obligations for members of the Union are those contained in the UPOV Convention itself. However, on the basis of practical experience, the General Introduction and the TGP documents seek to provide general guidance for the examination of all species in accordance with the UPOV Convention. In addition, UPOV has developed “Guidelines for the Conduct of Tests for Distinctness, Uniformity and Stability” (Test Guidelines), for many individual species or other variety groupings. The purpose of those Test Guidelines is to elaborate certain of the principles contained in the General Introduction and the associated TGP documents, into detailed practical guidance for the harmonized examination of DUS and, in particular, to identify appropriate characteristics for the examination of DUS and production of harmonized variety descriptions.

4. As noted by the Chair at the fifty-fourth session of the Administrative and Legal Committee (CAJ), held in Geneva on October 16 and 17, 2006, the development of TGP documents in relation to the DUS examination may be seen as another element in the preparation of information materials concerning the UPOV Convention<sup>1</sup> and, in addition to being published in their own right, the TGP documents can be used in support of various UPOV activities. In particular, the General Introduction and the TGP documents will form the basis of an advanced module on “Examination of Applications for Plant Breeders’ Rights” for inclusion in the Distance Learning program, which the Consultative Committee has entrusted the Office of the Union to develop.

5. The situation with regard to the development of TGP documents can be summarized as follows:

Document reference	Title	Stage of development
TGP/0	List of TGP Documents and Latest Issue Dates	Approved (2005) / <i>Revision proposed for adoption by Council in October 2009</i>
<i>TGP/1</i>	<i>General Introduction with Explanations</i>	-
TGP/2	List of Test Guidelines Adopted by UPOV	Approved (2005)
<i>TGP/3<sup>2</sup></i>	<i>Varieties of Common Knowledge</i>	-

<sup>1</sup> The CAJ, at its fifty-second session, held in Geneva on October 24, 2005, agreed an approach for the preparation of information materials concerning the UPOV Convention, as explained in paragraphs 8 to 10 of document CAJ/52/4. It also agreed the establishment of an advisory group to the CAJ (“CAJ-AG”) to assist in the preparation of documents concerning such materials, as proposed in paragraphs 11 to 14 of document CAJ/52/4 (see paragraph 67 of document CAJ/52/5, Report).

<sup>2</sup> At its fifty-fifth session, held in Geneva on March 29, 2007, “[t]he CAJ endorsed the conclusion of the CAJ-AG that the General Introduction already provided guidance with respect to the term ‘common knowledge’ and that it would not be appropriate, for the time being, to pursue the development of document TGP/3 ‘Varieties of Common Knowledge’.” (see document CAJ/55/7, paragraph 46).

Document reference	Title	Stage of development
TGP/4	Constitution and Maintenance of Variety Collections	Adopted by Council (2008)
TGP/5	Experience and Cooperation in DUS Testing	Approved (2005) / Partial Revision Adopted by Council (2008)
TGP/6	Arrangements for DUS Testing	Approved (2005)
TGP/7	Development of Test Guidelines	Approved (2004) / <i>under revision</i>
<i>TGP/8</i>	<i>Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability</i>	<i>under development</i>
TGP/9	Examining Distinctness	Adopted by Council (2008)
TGP/10	Examining Uniformity	Adopted by Council (2008)
<i>TGP/11</i>	<i>Examining Stability</i>	<i>under development</i>
<i>TGP/12</i>	<i>[Special Characteristics] / [Guidance on Certain Physiological Characteristics]</i>	<i>Proposed for adoption by Council in October 2009</i>
<i>TGP/13</i>	<i>Guidance for New Types and Species</i>	<i>Proposed for adoption by Council in October 2009</i>
<i>TGP/14</i>	<i>Glossary of [Technical, Botanical and Statistical] Terms Used in UPOV Documents</i>	<i>under development</i>
<i>TGP/15</i>	<i>New Types of Characteristics</i>	-

The General Introduction, approved TGP documents and adopted Test Guidelines are published on the UPOV website at [http://www.upov.int/en/publications/list\\_publications.htm](http://www.upov.int/en/publications/list_publications.htm).

## II. DOCUMENTS TO BE CONSIDERED BY THE TECHNICAL WORKING PARTIES

### (a) *New TGP documents*

#### TGP/8 “Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability”

6. At its meeting on January 8, 2009, the Enlarged Editorial Committee (TC-EDC) noted that there were a number of sections within document TGP/8/1 Draft 1 for which development had not yet started, or for which substantial further development would be required. At the same time, the TC-EDC noted that there were a number of important sections within TGP/8 that were well-established and could already provide useful guidance. Therefore, the TC-EDC proposed that the TC should be invited to consider the adoption of a first version of document TGP/8 (document TGP/8/1) without the sections of that document that would require further substantial development. The TC-EDC also noted that the identification of well-established text within document TGP/8 would justify translation of those sections. With regard to the sections of document TGP/8 that would not be included in

the first version of document TGP/8 (document TGP/8/1), the TC-EDC proposed that those sections should continue to be developed without delay and should be incorporated into document TGP/8 by means of a revision of document TGP/8 (document TGP/8/2) at the earliest opportunity.

7. With regard to new proposals concerning the content of document TGP/8, the TWA, at its thirty-seventh session, proposed to remove Section III: "Examination of characteristics using image analysis" from TGP/12 and to include that section in document TGP/8, on the basis that it did not concern characteristics, but methods of examining characteristics. The TWC, at its twenty-sixth session, agreed with that proposal. The TC-EDC, at its meeting on January 8, 2009, noted that the section on the examination of characteristics using image analysis would require further substantial development and would not be finalized in time for the initial adoption of document TGP/8 (document TGP/8/1).

8. The TC-EDC agreed that the following sections of document TGP/8/1 Draft 11, considered by the TC-EDC at its meeting on January 8, 2009 (see [http://www.upov.int/restrict/en/tc\\_edc/index\\_tc\\_edc\\_jan09.htm](http://www.upov.int/restrict/en/tc_edc/index_tc_edc_jan09.htm)), would require further substantial development:

*Part I: DUS Trial Design and Data Analysis:*

2. *Data to be recorded*
3. *Control of variation due to different observers*
6. *Data processing for the assessment of distinctness and for producing variety descriptions*

*Part II: Techniques Used in DUS Examination*

- 3.5 *Statistical methods for very small sample sizes*
5. *Examining DUS in bulk samples*
6. *Examination of characteristics using image analysis*
7. *Methods for data processing for the assessment of distinctness and for producing variety descriptions*

9. In accordance with the recommendation of the TC-EDC, the above sections were omitted from document TGP/8/1 Draft 12, which was considered by the Technical Committee at its forty-fifth session, held in Geneva from March 30 to April 1, 2009, but were reproduced in document TC/45/14.

10. The TC agreed that document TGP/8/1 should be scheduled for adoption in 2010 on the basis of the content included in document TGP/8/1 Draft 12. The TC further agreed that, at the same time, separately from consideration of the draft of document TGP/8/1, the sections omitted from document TGP/8/1 Draft 12, as reproduced in document TC/45/14, Annex I, should continue to be developed without delay and should be incorporated into document TGP/8 by means of a revision of document TGP/8/1 (i.e. document TGP/8/2) at the earliest opportunity.

11. The TC agreed that it would not be appropriate to change the structure of document TGP/8/1. However, to assist users to identify relevant sections in the document more easily, it agreed that an orientation guide, possibly in the form of a grid or flow diagram, should be developed. It agreed that that guide should be considered alongside discussions on the draft of document TGP/8/1 with a view to its inclusion as an introduction in the document

before its adoption, if considered appropriate. The TC invited proposals on such a guide, to be received by the Office of the Union by no later than April 17, 2009. However, no proposals were received by the Office of the Union.

12. Document TGP/8/1 Draft 13 is based on document TGP/8/1 Draft 12, as amended by the Technical Committee at its forty-fifth session. That document will be considered by the Technical Working Parties at their sessions in 2009 and by the CAJ at its sixtieth session, to be held in Geneva on October 19 and 20, 2009.

13. The sections omitted from document TGP/8/1 Draft 12, incorporating comments made by the TC at its forty-fifth session, are reproduced in the Annex to document TWA/38/10 “Document TGP/8: Sections for separate development”.

#### TGP/11 “Examination of Stability”

14. At its forty-fourth session, held in Geneva from April 7 to 9, 2008, the TC noted the TWV proposal for the possible development of a document to provide guidance on matters concerning distinctness, uniformity, stability and novelty which are brought to the attention of an authority after the grant of a breeder’s right and the status and use of the “official” variety description. The TC also noted the comments of the TC-EDC that there would be practical advantages in dealing with all aspects of stability in a single document and the proposal of the TC-EDC that the TC, in conjunction with the CAJ, might consider an amendment to the title of TGP/11, with the document being clearly separated into two parts:

Part I: Examining Stability (Article 12 “Examination of the Application”, of the 1991 Act of the UPOV Convention)

Part II: Stability after the grant of a breeder’s right (Article 22(1) “Cancellation of the Breeder’s Right”, of the 1991 Act of the UPOV Convention)

15. The TC agreed that the view of the CAJ should be sought with regard to whether it would be appropriate to pursue those proposals (see document TC/44/13 “Report”, paragraph 118).

16. At its fifty-eighth session, held in Geneva on October 27 and 28, 2008, the CAJ considered document TGP/11/1 Draft 5 “Examining Stability”, in conjunction with document CAJ/58/2. The CAJ agreed that document TGP/11 should consider only the examination of stability in the context of the DUS examination and that a separate document should be developed to provide guidance on matters concerning distinctness, uniformity, stability and novelty which are brought to the attention of an authority after the grant of a breeder’s right (see document CAJ/58/6 “Report on the Conclusions”, paragraph 11).

17. At its forty-fifth session, the TC agreed to propose to the CAJ that, within its approach for the preparation of information materials concerning the UPOV Convention, a document be developed to provide guidance on matters concerning distinctness, uniformity, stability and novelty that are brought to the attention of an authority after the grant of a breeder’s right.

18. The TC considered document TGP/11/1 Draft 5 at its forty-fifth session and agreed that the following aspects should be addressed in the next draft:

- (a) as agreed by the CAJ, to consider only the examination of stability in the context of the DUS examination;
- (b) to explain the nature of stability and why it is connected to uniformity in such a way that the General Introduction states that “for many types of variety, when a variety has been shown to be uniform, it can also be considered to be stable” (General Introduction, Chapter 7.3.1.1);
- (c) to avoid text stating that “stability is not examined” (see Sections 2.1.2, 2.1.3, 2.1.5(a));
- (d) to avoid explanations of uniformity (e.g. Section 2.1.4 (a) and (b)) – if necessary to explain aspects of uniformity, to make a reference to TGP/10/1 “Examining Uniformity” or to quote text of TGP/10/1;
- (e) to focus the document on providing practical guidance on situations concerning specifically stability (not uniformity), e.g. Section 2.1.4 (c);
- (f) in addition to guidance on the examination of stability through the examination of uniformity, to provide guidance on the direct examination of stability, with the assistance of experts from Australia; and
- (g) in relation to Section 2.2.3, to note that the TC-EDC has proposed that the standard wording for stability in Test Guidelines be amended as follows (see document TGP/7/2 Draft 2: ASW 9 (TG Template: Chapter 4.3.2) – Stability assessment: general):

“Where appropriate, or in cases of doubt, stability may be further examined ~~tested, either by growing a further generation, or~~ by testing a new [seed or plant] stock to ensure that it exhibits the same characteristics as those shown by the previous initial material supplied.”

19. The TC noted that the forty-third session of the TWV, to be held in Beijing from April 20 to 24, 2009, was less than three weeks after the forty-fifth session of the TC. On that basis, it noted that it would not be feasible to prepare a new draft of document TGP/11/1 for consideration by the TWPs in 2009. Therefore, it agreed that, at their sessions in 2009, the TWPs should be invited to consider the comments made on document TGP/11/1 Draft 5 by the CAJ and the TC. On the basis of those comments and any further comments by the TWPs, a new draft of document TGP/11/1 (document TGP/11/1 Draft 6) would be prepared for consideration by the TC-EDC at its meeting in January 2010.

#### TGP/14 “Glossary of [Technical, Botanical and Statistical] Terms Used in UPOV Documents”

20. At its meeting on January 8, 2009, the TC-EDC noted the conclusions of the workshop on document TGP/14 Section 2, Subsection 3 “Color” (“TGP/14 Workshop”), held on May 30 and 31, 2008, and the related discussions by the TWPs at their sessions in 2008 (see document TWA/38/11 “Document TGP/14: Sections for separate development”, Annex II). It concluded that TGP/14 Section 2, Subsection 3 “Color” (Color Subsection) would require substantial further development before it could be considered for adoption. At the same time, the TC-EDC noted that the other sections within TGP/14 were well-established

and could already provide useful guidance. Therefore, the TC-EDC proposed that the TC should be invited to consider adoption of a first version of document TGP/14 (document TGP/14/1) without the Color Subsection. The TC-EDC also noted that such a procedure would make it realistic to translate document TGP/14/1 Draft 8. With regard to the Color Subsection, which would not be included in the first version of document TGP/14 (document TGP/14/1), the TC-EDC proposed that it should continue to be developed without delay and should be incorporated into document TGP/14 by means of a revision of document TGP/14 (document TGP/14/2) at the earliest opportunity.

21. The TC agreed that document TGP/14/1 should be scheduled for adoption in 2010 on the basis of the content included in document TGP/14/1 Draft 8. At the same time, the TC agreed that, separately from consideration of the draft of document TGP/14/1, the Color Subsection should continue to be developed without delay and should be incorporated into document TGP/14 by means of a revision of document TGP/14/1 (i.e. document TGP/14/2) at the earliest opportunity.

22. Document TGP/14/1 Draft 9 is based on document TGP/14/1 Draft 8, as amended by the Technical Committee at its forty-fifth session. In addition, the TC agreed to combine synonymous terms within a single entry (e.g. Breeder's Right, Plant Breeder's Right and PBR), but to list the terms individually in the index. That change has not yet been made for two reasons: firstly, the complication in indexing (for example, the index for "PBR" would require a page number and a reference to the relevant term ("Plant Breeder's Right") in that page in order to be able to find the term "PBR")) would mean that it would be impractical to undertake that exercise before all terms in the document are finalized; and secondly, in order to allow further consideration of any consequences in terms of ease of use of the document.

23. Document TGP/14/1 Draft 9 will be considered by the Technical Working Parties at their sessions in 2009 and by the CAJ at its sixtieth session, to be held in Geneva on October 19 and 20, 2009. Document TGP/14 Draft 9 is available in all UPOV languages; however, the French, German and Spanish versions follow the English alphabetic order. Therefore, to facilitate the reading of the document in those languages, a supplement (document TGP/14/1 Draft 9 Supplement) has been prepared in each language with the indexed terms presented in alphabetic order of the languages concerned.

24. The Color Subsection, omitted from document TGP/14/1 Draft 9, and the conclusions of the workshop on document TGP/14 Section 2, Subsection 3 "Color" ("TGP/14 Workshop"), held on May 30 and 31, 2008, and the related discussions by the TWPs at their sessions in 2008, is reproduced in Annexes I and II to document TWA/38/11 "Document TGP/14: Sections for separate development", respectively.

*(b) Revision of TGP Documents*

TGP/0 "List of TGP Documents and Latest Issue Dates"

25. Document TGP/0/1 "List of TGP Documents and Latest Issue Dates" was approved on April 6, 2005 and does not reflect the adoption and revision of certain TGP documents since that date. Therefore, the TC agreed to propose that document TGP/0 be revised (to become document TGP/0/2) in conjunction with the scheduled adoption of documents TGP/12 and TGP/13 by the Council at its forty-third ordinary session, to be held in Geneva on October 22, 2009.



TGP/7 “Development of Test Guidelines”

26. Reference to document TGP/7 is made in certain adopted TGP documents (e.g. document TGP/9/1, Section 2.3.1.2.2, refers to “document TGP/7/1, Annex 3: GN 13.4”). For that reason, document TGP/7/2 Draft 3 seeks to conserve the numbering from document TGP/7/1 as far as possible. In that respect, additional items are added after the last number for Additional Standard Wording (ASW) and Guidance Notes (GN), or are accommodated by sub-numbering, e.g. GN 11.1 and 11.2.

27. The revisions proposed to document TGP/7/1, on the basis of the comments made by the TWPs and the CAJ at their sessions in 2008 by the TC-EDC at its meeting on January 8, 2009 and certain other proposals, are incorporated in document TGP/7/2 Draft 3, as approved by the TC at its forty-fifth session. The background to the proposed revisions is presented in the form of endnotes.

28. The TWO, at its forty-first session, proposed to include guidance on modifying the states of expression of characteristics in the Table of Characteristics, including asterisked characteristics. It was proposed that such changes might be notified to UPOV by means of document TGP/5 “Experience and Cooperation in DUS Testing”: Section 10 Notification of Additional Characteristics (see document TGP/7/2 Draft 2, Introduction, Section 1.2.1.9 “(e) Modification of Test Guidelines characteristics”). The TWO noted that such an approach would require a corresponding revision of document TGP/5: Section 10/1. In that regard, the TC agreed to review whether Section 1.2.1.9 in document TGP/7/2 Draft 3 was necessary, given the possibility for partial revisions of Test Guidelines.

29. On the basis of the comments made by the TWPs and the CAJ, and agreed by the TC-EDC, the TC agreed that the following matters, which the TC had previously agreed should be considered in the revision of document TGP/7/1, should not be pursued:

<i>Annex 3: Guidance Notes (GN) for the TG Template</i>	
GN 20	<i>(to consider whether the revision of Test Guidelines might not fully follow the guidance on the presentation of characteristics in document TGP/7 if that would involve substantial revision of databases of variety descriptions, which would not otherwise be necessary.)</i>
GN 29	<i>(to consider the possibility of introducing a table of trade names associated with the denominations of the example varieties)</i>

<i>Annex 4: Collection of Approved Characteristics</i>	
Collection	<i>(to consider incorporating characteristics which are used in most Test Guidelines (e.g. Leaf: length) into the electronic template. To consider developing electronic templates for variety types (e.g. seed-propagated vegetables) which would incorporate more standard characteristics for the varieties concerned)</i>

30. The TC agreed that the following aspects concerning the “Collection of Approved Characteristics” should be addressed in parallel with the revision of document TGP/7. Where appropriate, an amendment will be made to document TGP/7/1, Annex 4, paragraphs 1 and 2.

<i>Annex 4: Collection of Approved Characteristics</i>	
<i>Introduction</i>	<p><i>(to be clarified that characteristics contained in adopted UPOV Test Guidelines may be omitted from the “Collection of approved characteristics” (document TGP/7, Annex 4) where considered appropriate by the TC, on the basis of recommendations by the Enlarged Editorial Committee (TC-EDC))</i></p> <p><i>(to explain that the indication of the characteristic number, the method of observation, type of characteristic and the indications of (+) and (*) had been retained from the Table of Characteristics from which the characteristic had originated, but to clarify that the information might not be appropriate for other Test Guidelines)</i></p> <p><i>(to explain to drafters of Test Guidelines that, for characteristics where any element of the characteristic is changed after copying from the collection, the translations into French, German and Spanish should be deleted )</i></p>
<i>Collection</i>	<p><i>(examples of color characteristics developed in conjunction with TGP/14 Section 2.3: “Glossary of Technical, Botanical and Statistical Terms Used in UPOV Documents: Botanical Terms: Color” to be incorporated into TGP/7: Annex 4 “Collection of Approved Characteristics”. (It was noted that that might require the organization of the TGP/7 to be modified to some extent.))</i></p> <p><i>(to consider including a collection of approved illustrations and to consider making that collection available to breeders to assist in their applications for PBR. (see also TGP/14 Section 2.1: Plant shapes))</i></p> <p><i>(to consider the development of tools such as CD-ROMs containing photographs to enhance the understanding of the characteristics used in the Test Guidelines and thereby reduce observer error)</i></p>

31. The TC noted that the Office of the Union planned to develop an improved TG Template and to integrate the Collection of Approved Characteristics into that template in a user-friendly package for drafters of Test Guidelines.

### III. COMMENTS MADE BY THE TECHNICAL WORKING PARTY FOR VEGETABLES AND THE TECHNICAL WORKING PARTY ON AUTOMATION AND COMPUTER PROGRAMS

32. Annex I to this document presents the comments made by the Technical Working Party for Vegetables (TWV), at its forty-third session held in Beijing, from April 20 to 24, 2009, and the Technical Working Party on Automation and Computer Programs (TWC), at its twenty-seventh session, held in Alexandria, Virginia, United States of America, from June 16 to 19, 2009, on the TGP documents to be considered by the TWA.

### IV. PROGRAM FOR THE DEVELOPMENT OF TGP DOCUMENTS

33. Annex II to this document presents the program for the development of TGP documents as agreed by the TC at its forty-fifth session.

[Annex I follows]

## ANNEX I:

COMMENTS ON TGP DOCUMENTS MADE BY THE TECHNICAL WORKING PARTY  
FOR VEGETABLES AND THE TECHNICAL WORKING PARTY ON AUTOMATION  
AND COMPUTER PROGRAMS

The following comments on draft TGP documents were made by the Technical Working Party for Vegetables (TWV), at its forty-third session, held in Beijing, China, from April 20 to 24, 2009, and by the Technical Working Party on Automation and Computer Programs (TWC), at its twenty-seventh session, held in Alexandria, Virginia, United States of America, from June 16 to 19, 2009.

(a) *New TGP documents*

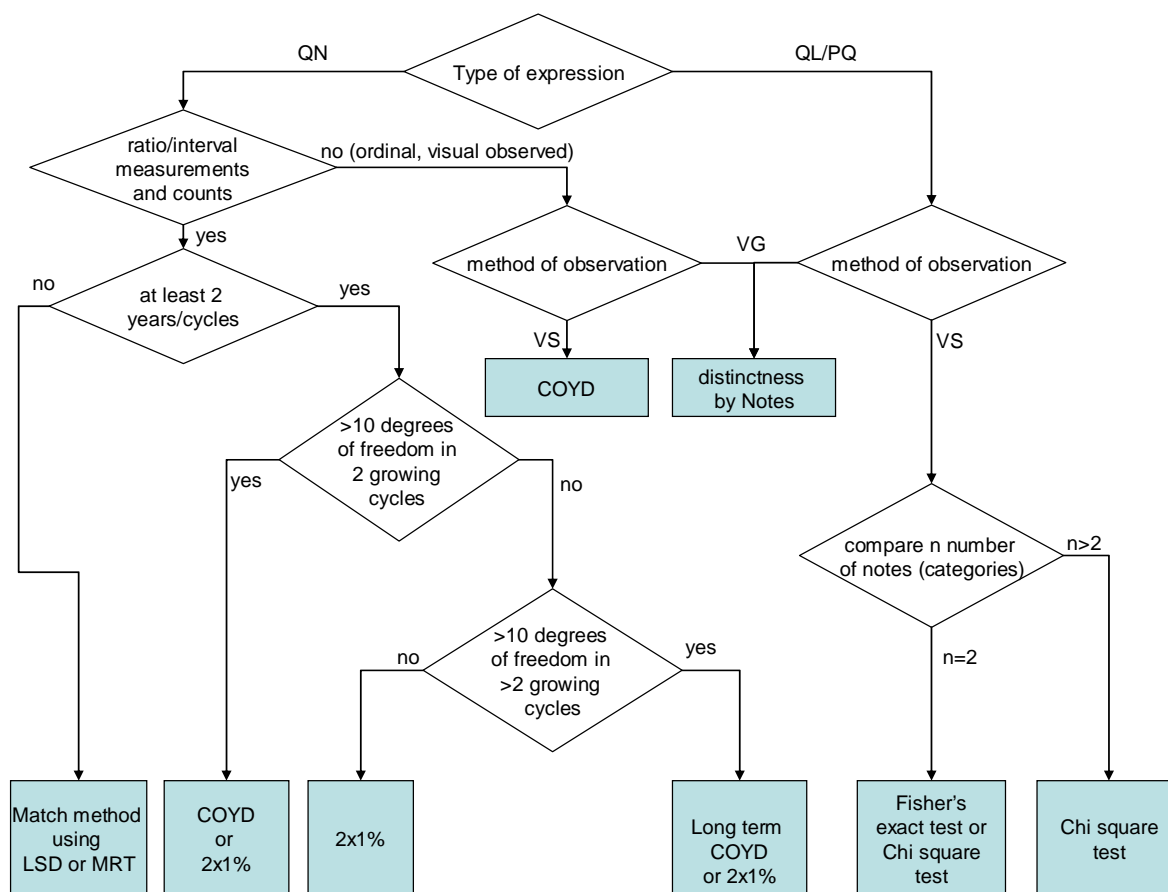
TGP/8 “Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability”

Comments on document TGP/8/1 Draft 13:

Introduction	to read “PART II: TECHNIQUES USED IN DUS EXAMINATION: includes, in particular, details on certain techniques referred to in documents TGP/9 “Examining Distinctness”, and TGP/10 “Examining Uniformity”.	TWC
General	to provide an explanation of the term “reference variety” throughout the document (e.g. COY)	TWC
	<u>PART I</u>	
1.1	text in square brackets to be deleted	TWC
1.3.1.2	to delete “s 1.2.2.5 and”	TWC
1.3.2.2	to read “If multiple growing trials are used as explained in sections 1.3.1.(a) and (c), DUS could be examined at all growing trial locations. However, in general, DUS is not examined at all growing trials locations.”	TWC
1.5.3.1.7 (table)	title of third row to read “Variety mean / Statistical analysis of records for a group of plants / [Replicate plots for group data records] / (MG/MS)	TWC
1.5.3.1.7 (table)	to explain the terms MG, MS, VG, VS	TWC
1.5.3.3.2	to be deleted	TWC
1.5.3.3.4.6	second sentence to read “The blocks should be formed so that the variation between plots within each block is minimized.	TWC
1.5.3.3.7.2.6 (table)	to delete “ ”	TWC
1.5.3.3.7.4	to be deleted	TWC

2.3	first paragraph to be deleted	TWC
2.3.1 (title)	to delete “[/variety means]”	TWC
2.3.1	to delete text in square brackets	TWC
2.3.1.1.3	to add blank line before 2.3.1.2	TWC
3.1	to delete note in box	TWC
3.2.1.3 (b)	to read “The 2x1% method to assess distinctness, which has also been developed by UPOV to analyze data from two or more years of growing trials where there are at least a certain minimum number of varieties in trial. Differences are assessed in each year using a statistical test based on a two-tailed LSD to compare the within-year variety means. Whether differences are sufficiently consistent is determined by the requirement that two varieties are significantly different in the same direction at the 1% level in both years, or, where trials are conducted in three years, in at least two out of three years. Details of the 2x1% method are given in document TGP/8 Part II section 4.”	TWC
3.2.1.3 (c)	<p>to read “The Match method to assess distinctness was developed for use where the trials are conducted by the breeder in the first year and examined by the testing authority in the second year (see document TGP/6 section 2/1). They typically involve relatively small scale trials. Whether differences are sufficiently consistent is tested using a statistical test (eg LSD, MRT, Chi-Square or Fisher’s Exact) to gauge whether the differences in the second year are significant and agree with the “direction of the differences” declared by the breeder in the first year. The choice of statistical test depends on the type of expression of the characteristic concerned. Details of the Match method are given in document TGP/8 Part II, Section 5.”</p> <p><i>Subsequent to the TWC session, the following text was proposed by an expert from Australia in conjunction with the re-drafting of text of Part II, Sections 5.3 and 6 (see comments in table)</i></p> <p>to read “The Match method to assess distinctness was developed to analyze data from more than one year of testing . Trials are conducted by the breeder in the first year and examined by the testing authority in the second year (see document TGP/6 “Arrangements for DUS Testing”, Section 2 “Examples of Arrangements for DUS Testing”). Whether differences are sufficiently consistent is assessed using a statistical test (e.g. LSD, Multiple Range Test (MRT), Chi-Square or Fisher’s Exact) to gauge whether the differences in the second year are significant and agree with the “direction of the differences” declared by the breeders in the first year. The choice of statistical test depends on the type of expression of the characteristic concerned. Details of the Match method are given in document TGP/8 Part II, Section 5”</p> <p><del>The above methods use different statistical tests to assess whether differences between variety means are significant. The choice of the statistical test that is used has implications for the risks to the breeder and the tester of making statistical errors and is discussed below.</del></p>	TWC

3.2.1.3	to delete the words “and is discussed below”	TWC
3.2.1.4, 3.2.1.5	to be deleted and to be replaced by an explanation that different statistical methods will produce different results and to consider that in the context of harmonization	TWV
3.2.1.4, 3.2.1.5	to be deleted and to be replaced by an explanation that “In the context of consistency and harmonization, it should be noted that different statistical methods will produce different results.”	TWC
3.2.1.5	second sentence to be deleted	TWC
3.3 (title)	to read “Summary of selected statistical methods for examining distinctness”	TWV, TWC
3.3	- title of flow diagram to be amended and to avoid an indication that there is a preference of COYD over 2x1% method if there are more than 20 degrees of freedom - to clarify that other statistical methods would not be excluded	TWV
3.3.1 (table)	- to update the minimum degrees of freedom according to changes agreed for the relevant methods (see below) - to delete “Distribution” column - to replace Chi square and Fisher’s exact test with row for Match method - to add a column to indicate method of observation as “MS/VS” for COYD and Long Term COYD, with a note that those methods might also be applicable for MG and VG in certain circumstances; and to indicate “MS” for 2x1% method and “VS” for Match method	TWC
3.3.1	flow diagram to read as follows:	TWC



<u>PART II</u>		
Title	to read “Selected techniques used in DUS examination”	TWV, TWC
General	to check that the term “clearly distinct” is replaced by “clearly distinguishable”, “distinct” or another suitable term (e.g. 6.1.9)	TWV, TWC
3.1	to read “– there should be at least 10, and preferably at least 20, degrees of freedom for the varieties-by-years mean square in the COYD analysis of variance, or if there are not, then Long-Term COYD can be used (see 3.6.2 below);”	TWC
3.7	to read “The COYD method can be applied using TVRP module of the DUST package for the statistical analysis of DUS data, which is available from Dr. Sally Watson (Email: info@afbini.gov.uk) or from <a href="http://www.afbini.gov.uk/dustnt.htm">http://www.afbini.gov.uk/dustnt.htm</a> . Sample outputs are given in Part II section 3.10 [cross ref].”	TWC
3.9.2.1, 3.9.2.2	to replace “SE” with “standard error” (3 occurrences)	TWC
3.9.2.5	formula to be centrally aligned	TWC
4. (title)	to read “2X1% METHOD”	TWC
4.1.1	to add indent to read “– there are at least 10, and preferably at least 20, degrees of freedom”	TWC

4.2 (title)	to read “The 2X1% method”	TWC
4.2.1	second sentence to read “The tests in each year are based on Student’s two-tailed t-test of the differences between variety means with standard errors estimated using the residual mean square from the analysis of the variety x replicate plot means.”	TWC
4.2.2	to delete final sentence of second indent	TWC
5.1.4	to delete “or establish that the type of data collected does not fit the parametric assumptions”	TWV
5.1	to be deleted	TWC
5.2	to be deleted	TWC
5.3 general	<p>section to be edited according to the comments below, the proposals agreed by the TWC at its twenty-sixth session (see document TWC/26/29 “Report”, paragraph 29: items 21, 23, 21) and any written comments provided to Mr. Nik Hulse by July 3, 2009.</p> <p>Mr. Hulse to prepare a new draft of the section for circulation by the Office by July 17, 2009 to the TWC, with a request for comments to be provided July 31, 2009. On the basis of comments received, Mr. Hulse to prepare a text by August 3, 2009, to be presented to the Technical Working Party for Agricultural Crops (TWA) and subsequent Technical Working Party sessions in 2009.</p> <p><i>The proposed new draft of Section 5, on the basis above, is presented in the Appendix to Annex I to this document</i></p>	TWC
New Section (Match method)	<p>to read</p> <p>“5. MATCH METHOD</p> <p><u>5.1 Requirements for application of method</u></p> <p>5.1.1 The Match method is appropriate for assessing distinctness of varieties where:</p> <ul style="list-style-type: none"> <li>- observations made on a plant (or plot) in the second year are compared to observations made by the breeder in the first year.</li> <li>- there are claimed differences between plants (or plots) of a variety based on information from the first year trial</li> <li>- the requirements of the method depend on the particular statistical test that is used (e.g. LSD, Multiple Range Tests (MRT), Chi-Square or Fisher’s Exact).</li> </ul> <p><u>5.2 Match Method</u></p> <p>5.2.1 The Match method to assess distinctness was developed for use where the trials are conducted by the breeder in the first year and examined by the testing authority in the second year (see document TGP/6 section 2/1). Whether differences are sufficiently consistent is tested using a statistical test (eg LSD, MRT, Chi-Square or Fisher’s Exact) to gauge whether the differences in the second year are significant and agree with the “direction of the differences” declared by the breeders in the first year. The choice of statistical test depends on the type of expression of the characteristic concerned. For two varieties to be distinct using the Match method, the</p>	TWC

	<p>varieties need to be significantly different in the same direction claimed by the breeder in the first year.</p> <p>5.2.2 The requirements of the method depend on the particular statistical test that is used (e.g. LSD, MRT, Chi-Square or Fisher's Exact). For quantitative characteristics, the statistical test may be based on a one-tailed LSD, if there is one candidate, or on a one-tailed MRT, if there is more than one candidate included in the growing trial. A Chi-square test or Fisher's exact test may be used for pseudo-qualitative or qualitative characteristics where the requirements for those tests are met.</p> <p>5.2.3. The Match method typically involves relatively small scale trials. The number of candidate and reference varieties in the trial is limited to the most similar varieties of common knowledge. Although these tests are most useful in trials of cross-pollinated varieties, they can be similarly applied to trials of self-pollinated and vegetatively propagated varieties provided the relevant criteria are met.</p>	
5.3 title	to read "Chi-square test applied to contingency tables"	TWC
5.3	<p>(a) to provide list of requirements and circumstances for the use of Chi-square test applied to contingency tables, which would include:</p> <ul style="list-style-type: none"> <li>- the only source of variation should be caused by random sampling, e.g. there should be no variation due to soil conditions, etc.</li> <li>- useful where observations on a characteristic are allocated to two or more categories (classes)</li> <li>- the minimum expected value in each category should be five</li> </ul> <p>(b) to explain contingency tables</p>	TWC
5.3.2	to read "In some cases, distinctness may be established by classifying individual varieties into broad groups and demonstrating statistically different grouping patterns for different varieties. Such examples include counts based on the flower color groups - red, pink or white etc. and the disease/pest/nematode infection classes. Data based on counts of individuals in a sample/population belonging to each of several classes require a different kind of statistical analysis. A method commonly used for analyzing such enumeration data is called the <i>Chi-square</i> ( $\chi^2$ )."	TWC
5.3.6	to indicate "contingency table" in the title	TWC
5.3.16 to 5.3.19	to be deleted	TWC
6.	<p>section to be edited according to the comments below and any written comments provided to Mr. Nik Hulse by July 3, 2009.</p> <p>Mr. Hulse to prepare a new draft of the section for circulation by the Office by July 17, 2009, with a request for comments to be provided by July 31, 2009. On the basis of comments received, Mr. Hulse to prepare a text by August 3, 2009, to be presented to the Technical Working Party for Agricultural Crops (TWA) and subsequent Technical Working Party sessions in 2009. (as for Section 5).</p> <p><i>The following amendments were proposed on the above basis:</i></p>	TWC



## 6. FISHER'S EXACT TEST

Fisher's Exact Test is a statistical test used in the analysis of categorical (qualitative) data where the number of samples (i.e. sample size) is small and is named after its inventor, R.A. Fisher. Fisher's Exact test applied to 2 x 2 contingency tables is useful where;

- observations on a characteristic are allocated to two or more categories (classes)
- the only source of variation should be caused by random sampling, e.g. there should be no variation due to soil conditions, etc.
- the expected values in each category are less than 10

### 6.1 Assessment of Distinctness

6.1.1 Fisher's Exact Test is used to determine if there are non-random associations between two categorical variables in a 2 x 2 contingency table and can be used when the sample number for one or more categories for each variety is less than 10 (see bold framed cells in Table 1) or when the table is very unbalanced. Where there is a larger number of samples (i.e. 10 or more), a chi-square test is often preferred. ~~as it is usually quicker to calculate.~~

[...]

6.1.9 Interpreting the p value calculated by Fisher's Exact Test is straight forward. In the example above,  $p = 0.04$  meaning that there is a 4% chance that, given the sample size and distribution in Table 1, observed differences are due to sampling alone. Given the small sample size, and the need for varieties to be clearly ~~distinct~~ distinguishable from each other, it is open to examination authorities to choose  $p = 0.01$  as the upper cut off significance acceptability level of our null hypothesis.

6.	to provide list of requirements and circumstances for the use of the method	TWC
6.2	to be deleted and to be covered by new section in future revision of TGP/8 (see below)	TWV
6.2	to be deleted	TWC
7.1	note in square brackets to be deleted	TWC
7.1.5.4	note in square brackets to be deleted	TWC
8.1	to delete "COYU is an appropriate method for use in assessing the uniformity of varieties"	TWC
8.9	to read "The COYU criterion can be applied using COYU module of the DUST software package for the statistical analysis of DUS data. This is available from Dr. Sally Watson (Email: info@afbini.gov.uk) or from <a href="http://www.afbini.gov.uk/dustnt.htm">http://www.afbini.gov.uk/dustnt.htm</a> ."	TWC
8.11	to delete paragraph after Table 1	TWC
9.1 Title	to read "Uniformity assessment on the basis of relative variance method"	TWC

9.1 Introduction	<p>to add an introduction based on Section 9.4.4 and to add a requirement that there should be a normal distribution for the method to be used.</p> <p><i>The following amendments were proposed on the above basis:</i></p> <p>9.1 <del>Use of the relative variance method</del> <u>Uniformity assessment on the basis of the relative variance method</u></p> <p><del>In Australia, the relative variance method is applied to any measured characteristic that is a continuous variable, irrespective of the method of propagation of the variety.</del></p> <p><u>The relative variance for a particular characteristic refers to the variance of the candidate divided by the average of the variance of the reference varieties (i.e. Relative variance = variance of the candidate/average variance of the reference varieties). The data should be normally distributed. The relative variance method may be applied to any measured characteristic that is a continuous variable, irrespective of the method of propagation of the variety.</u></p>	TWC
9.1	to read “The relative variance method may be applied to any measured characteristic that is a continuous variable, irrespective of the method of propagation of the variety.”	TWC, TWC
9.1.1	to add space before “∞”	TWC
9.6	to be deleted	TWC

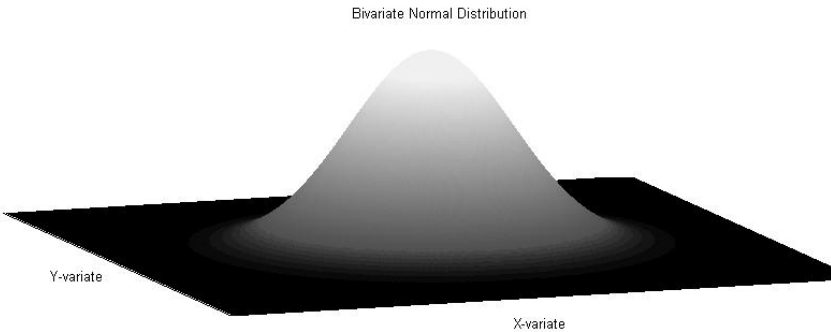
TGP/11 “Examination of Stability”

Comments on document TGP/11/1 Draft 5:

General	The expert from Australia explained that, in Australia, stability was examined for seed-propagated varieties by growing two generations and verifying that there was no difference in the characteristics observed.	TWC
	<p>An expert from the United States of America reported that, in the United States of America, distinct plants within a variety were identified according to the following definitions of “off-type” and “variant”:</p> <p>“<u>Variant</u>: The term “variant” means any seed or plant which: (a) is distinct within the variety but occurs naturally in the variety; (b) is stable and predictable with a degree of reliability comparable to other varieties of the same kind, within recognized tolerances, when the variety is reproduced or reconstituted; and (c) was originally a part of the variety as released. A variant is not an off-type.”</p> <p>“<u>Off-type</u>: The term “off-type” means any seed or plant not part of the variety in that it deviates in one or more characteristics from the variety as described and may include: a seed or plant of another variety; a seed or plant not necessarily any variety; a seed or plant resulting from cross-pollination by another kind or variety; a seed or plant resulting from uncontrolled self-pollination during production of hybrid seed; or segregates from any of the above.”</p>	TWC

TGP/14 “Glossary of Technical, Botanical and Statistical Terms Used in UPOV Documents”

Comments on document TGP/14/1 Draft 9:

	SECTION 2. BOTANICAL TERMS SUBSECTION 2. SHAPES AND STRUCTURES I. SHAPE	
1.3	to introduce the possibility to provide a different definition for the terms “base” and “apex” where that would be appropriate for the Test Guidelines concerned, in particular to avoid confusion in the use of commonly used terms by breeders. On that basis, it was agreed that the definitions of the terms should always be provided in the Test Guidelines. Furthermore, in order to ensure that applicants used the correct terms in completing the Technical Questionnaire, it was agreed that the relevant illustration of shapes in the Test Guidelines should be added to the Technical Questionnaire.	TWV
1.5	to retain the states “small” and “large” for ratio, but to add a clarification in brackets, e.g. for ratio length/width, to have “small (moderately compressed)”, “large (moderately elongated)” etc.	TWV
1.5 (second)	(after Chart for Other Plane Shapes) to remove reference to a decision-tree	TWV
2.10	to update cross-references	TWV
	SECTION 3 “STATISTICAL TERMS”	
General	To add the following introductory text: “The definitions included in the glossary are in relation to the use of these terms in DUS examination”	TWC
Bivariate Normality	To add to following illustration:  <div style="text-align: center;">  </div>	TWC

Contingency Table	<p>to read “A contingency table is a table showing the responses of subjects to one factor as a function of another factor. For instance, the following contingency table shows a characteristic as a function of different varieties (the data are hypothetical). The entries show the number of plants for each variety with particular notes for a characteristic.</p> <table border="1"> <thead> <tr> <th><i>Characteristic Variety</i></th> <th>State 1</th> <th>State 2</th> <th>State 3</th> </tr> </thead> <tbody> <tr> <td>Variety A</td> <td>18</td> <td>20</td> <td>2</td> </tr> <tr> <td>Variety B</td> <td>3</td> <td>10</td> <td>27</td> </tr> <tr> <td>Variety C</td> <td>6</td> <td>24</td> <td>10</td> </tr> </tbody> </table>	<i>Characteristic Variety</i>	State 1	State 2	State 3	Variety A	18	20	2	Variety B	3	10	27	Variety C	6	24	10	TWC
<i>Characteristic Variety</i>	State 1	State 2	State 3															
Variety A	18	20	2															
Variety B	3	10	27															
Variety C	6	24	10															
Random effect	To be deleted	TWC																
Random Term/ Random Factor	to read “Random Term / Random Factor: A factor is random when the levels under study can be considered a random sample drawn from some large homogeneous population. A goal of the study may be to make a statement regarding the larger population. See also factor.”	TWC																

(b) *Revision of TGP Documents:*

TGP/7: Development of Test Guidelines

Comments on document TGP/7/2 Draft 3

General	to replace “range of variation” with “level of variation”, or where the General Introduction is quoted, to explain that the term “level of variation” is considered to be more appropriate than the term “range of variation”, which has been used in the General Introduction (see, for example, Chapter 6.4).	TWC
	<i>Section 1</i>	
1.2	to explain the importance for harmonization of variety descriptions of using the Test Guidelines as individual authorities’ test guidelines. In cases where that would not be possible, to encourage the inclusion of references to the characteristic number in the Test Guidelines in the individual authorities’ test guidelines.	TWV
1.2.1.5	to clarify that the harmonization of variety descriptions could be lost if different example varieties are used in individual authorities’ test guidelines	TWV
1.2.1.7	to amend to cover information provided by breeders in a breeder testing system	TWV

2.2.4.4	to read “In advance of the TWP session, the leading expert should prepare a preliminary draft of the Test Guidelines (“Subgroup draft”) for comments by the subgroup. On the basis of the comments received from the subgroup, the leading expert should establish a first draft for the TWP. This draft is sent to the Office which will produce a document for distribution to the members of the TWP(s) concerned for discussion at their session(s). Prior to the TWP session, the Office will make a preliminary check that the draft has been prepared according to document TGP/7 and, in particular, that it conforms with the TG/Template (Annex 1 [cross ref.]). A result of that check will be provided to the Leading Expert at least one week before the session. [...]	TWV
	<i>Annex 1: TG Template</i>	
2.3	Netherlands to develop draft guidance on the quantity of plant material to be provided for Test Guidelines, for consideration at the forty-fourth session of the TWV with a view to its inclusion in a future revision of TGP/7 (document TGP/7/3)	TWV
4.1	to develop ASW for the assessment of distinctness of hybrids using the parental formula, on the basis of the wording in the Test Guidelines for Maize.	TWV
	<i>Annex 2: Additional Standard Wording (ASW) for the TG Template</i>	
ASW 13	to include an indication that the parental formula would be used	TWV
	<i>Annex 3: Guidance Notes (GN) for the TG Template</i>	
GN 28	the TWV noted that it would not be able to review any proposed amendments to GN 28 before the Technical Committee considered the approval of document TGP/7/2 in 2010. The TWV noted the importance of example varieties in Test Guidelines for vegetable crops and generally supported the text in GN 28. Therefore, to avoid a delay in the adoption of document TGP/7/2, it proposed that document TGP/7/2 should be adopted in 2010 without amendments to GN 28 and that any proposed amendments should be considered in a future revision of document TGP/7, if appropriate.	TWV
GN 31	to add the possibility to indicate that the variety is a parent line, with a reference to document TGP/5 “Experience and Cooperation in DUS Testing”, Section 11/1 “Examples of Policies and Contracts for Material Submitted by the Breeder”, which explains in paragraph 1.1 that “[...] in the particular case of parent lines submitted as a part of the examination of a candidate hybrid variety, living plant material should only be made available to other variety collectors in such a way that the legitimate interests of the breeder would be safeguarded.”	TWV
GN 32	Three-Way Hybrid: to add a line to enter the name of the female hybrid parent	TWV

[Appendix to Annex I follows]

APPENDIX TO ANNEX I:

PROPOSED NEW TEXT FOR TGP/8/1 DRAFT 13, PART II, SECTION 5

## **5. MATCH METHOD<sup>3</sup>**

### **5.1 Requirements for application of method**

5.1.1 The match method is appropriate for assessing distinctness of varieties where:

- data from more than one year are analyzed,
- observations made on a plant (or plot) in the second year are compared to observations made by the breeder in the first year,
- there are claimed differences between plants (or plots) of a variety based on information from the first year trial,
- the requirements of the method depend on the particular statistical test that is used (e.g. LSD, Multiple Range Tests (MRT), Chi-square or Fisher's Exact).

### **5.2 Match Method**

5.2.1 The Match method to assess distinctness was developed for use where the trials are conducted by the breeder in the first year and examined by the testing authority in the second year (see document TGP/6 section 2/1). Whether differences are sufficiently consistent is assessed using a statistical test (e.g. LSD, MRT, Chi-Square or Fisher's Exact) to gauge whether the differences in the second year are significant and agree with the "direction of the differences" declared by the breeders in the first year. The choice of statistical test depends on the type of expression of the characteristic concerned. For two varieties to be distinct using the Match method, the varieties need to be significantly different in the same direction claimed by the breeder in the first year.

5.2.2 The requirements of the method depend on the particular statistical test that is used (e.g. LSD, MRT, Chi-Square or Fisher's Exact). For quantitative characteristics the statistical test may for example be based on a one-tailed LSD, if there is one candidate, or on a one-tailed MRT, if there is more than one candidate included in the growing trial. A Chi-square test or Fisher's exact test may be used for pseudo-qualitative or qualitative characteristics where the requirements for these tests are met. Although these tests are most useful in trials of cross-pollinated varieties, they can be similarly applied to trials of self pollinated and vegetatively propagated varieties provided the relevant requirements are met

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<sup>3</sup> Comment by expert from Australia: Discussion of ordinal and nominal scales have been moved out of TGP/8 for further development (see TWC27/11). It is agreed that paragraphs 5.1 and 5.2 do not sit well here as they are applicable to nominal data generally. If they are to be removed they should be placed elsewhere in TGP/8 as they place use of this type of data in context.

5.2.3 The Match method typically involves relatively small scale trials where the number of candidate and reference varieties in the trials is limited to the most similar varieties of common knowledge.

### 5.3 Pearson's chi-square test applied to contingency tables

5.3.1 A contingency table is a table showing the responses of subjects to one factor as a function of another factor. In DUS testing it is generally used for categorical data where individuals of a variety can be allocated to discrete states of expression for a characteristic. Various statistical tests can be used to analyze the data in contingency tables depending on the particular circumstances. For example, Pearson's Chi-square test, as applied to contingency tables, is useful where:

- observations on a characteristic are allocated to two or more categories (classes) and are recorded in a contingency table
- there are some differences between plants (or plots) of a variety;
- the only source of variation should be caused by random sampling, e.g. there should be no variation due to soil conditions, etc<sup>4</sup>
- the minimum expected value in each category should be five

5.3.2 In some cases, distinctness may be established by classifying individual varieties into broad groups and demonstrating statistically different grouping patterns for different varieties. Examples include counts based on broad flower color groups - such as dark blue violet versus not dark blue violet and the disease/pest/nematode infection classes. Data based on counts of individuals in a sample/population belonging to each of several classes require statistical analysis capable of dealing with categorical data.

5.3.3 To use the Chi-square analysis for plant breeder rights' (PBR) purposes, we should consider how we are going to arrive at certain conclusions about distinctness by formulating certain hypotheses using the classification data.

The standard formula for the chi-square statistic used in such analysis is:

$$\chi^2 = \sum \frac{(\text{Observed value of a class} - \text{Expected value of a class})^2}{\text{Expected value}}$$

5.3.4 Hence, the Chi-square distribution is a continuous distribution based upon an underlying normal distribution.

5.3.5 The following precautions are to be considered before using the chi-square test.

- (1) Selection of the hypothesis to be tested should be based on previously known facts or principles

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<sup>4</sup> Comment by expert from Australia: – is this covered in Part 1? Sources of variation are discussed in section 1.5.3.3. Particularly 1.5.3.3.4. Also in 1.5.3.3.7.3.1. TGP/8 does not specifically refer to random sampling although the term is defined in TGP/14. Propose that this element is removed as 'limiting other sources of variation' should be covered generally elsewhere as the requirement applies equally to the other methods.

(2) Given the hypothesis, you should be able to assign expected values for each class correctly. Avoid using the chi-square test if the smallest expected class is less than five. By increasing the sample size the size of the smallest expected class can be made larger. Alternatively, if some classes have a size less than five, either pool those adjacent classes to bring the size of the pooled class to five or more than five, or use an exact test.

(3) Degrees of freedom is defined as the number of classes that are independent to be assigned an arbitrary value. For example, if we have two classes the degrees of freedom is  $2-1 = 1$ . Hence, in using this method to test a hypothesis, the degrees of freedom for the chi-square test is one less than the number of classes.

(4) Avoid using two class situations which follow more like the binomial distribution, with  $np$  or  $nq$  less than 5. If you encounter such situations, calculate expected values using formulae based on the binomial distribution. In a two class situation,  $np$  is the size of one of the classes determined by the number of events ( $n$ ) times the probability of falling into that class ( $p$ ). Similarly the size of the other class ( $nq$ ) is determined by  $n$  times the probability ( $q$ ) of falling into that class. So in a situation where the probability of falling into either class is equal ( $p=q=0.5$ ) and the sample size is 10 ( $n$ ) the number expected in each class is 5. Always use Yates Correction for determining the chi-square test with only one degree of freedom.

5.3.6 Let us examine the following data on the disease scoring of a Lucerne candidate variety and its four reference varieties. The disease scored was *Colletotrichum trifolii* (Characteristic 19, TG/6/5, Lucerne). The scoring was on a 5 class scale, with class 1 (note 9) being resistant and class 5 (note 1) being susceptible.

*Contingency table of number of plants counted in different classes in each variety after 7-10 days of inoculation*

Note(Class)	Candidate	Reference 1	Reference 2	Reference 3	Reference 4
9(1)	34	12	6	1	7
7(2)	4	7	6	5	10
5(3)	1	9	5	5	5
3(4)	1	7	9	8	7
1(5)	6	9	19	9	15
Total	46	44	45	28	44

5.3.7 It can be seen from the table that the candidate variety has more plants in the resistant category than the reference varieties. However, to statistically test the significance of the difference, we need to formulate a hypothesis:

(1) Whether the reference varieties differ significantly or not from the candidate in the distribution of scores i.e. by testing the null hypothesis. The null hypothesis in this case is all the varieties show similar reaction to the *Colletotrichum* crown rot. This can be done by testing the “distinctness  $X^2$ ”.

5.3.8 Pooling of classes to form a new intermediary pooled class is necessary to meet the minimum expected value requirement for the use of the chi square test.



Now the observed data is reduced to:

Class/Score	Candidate	Reference variety 1	Reference variety 2	Reference variety 3	Reference variety 4
1	34	12	6	1	7
2	6	23	20	18	22
3	6	9	19	9	15
<b>Total</b>	<b>46</b>	<b>44</b>	<b>45</b>	<b>28</b>	<b>44</b>

5.3.9 For each comparison of the candidate with each reference variety, a two-way table of observed values is formed. The expected values are calculated as the product of the row and column totals divided by the grand total, and the chi square statistic is calculated. The distributions of expected values for different varieties are as follows:

Observed for Reference Variety 1

Class/Score	Candidate	Reference variety 1	Total
1	34	12	46
2	6	23	29
3	6	9	15
<b>Total</b>	<b>46</b>	<b>44</b>	<b>90</b>

Expected for Reference Variety 1

Class/Score	Candidate	Reference variety 1	Total
1	$23.5=46 \times 46 / 90$	$22.5=46 \times 44 / 90$	46
2	$14.8=29 \times 46 / 90$	$14.2=29 \times 44 / 90$	29
3	$7.7=15 \times 46 / 90$	$7.3=15 \times 44 / 90$	15
Total	46	44	90

Similarly, using the table of observed data in 5.3.8, the expected values for reference varieties 2,3 and 4 are;

Class/Score	Candidate	Reference variety 2	Total
1	20.2	19.8	40
2	13.1	12.9	26
3	12.6	12.4	25
Total	46	45	91

Class/Score	Candidate	Reference variety3	Total
1	21.8	13.2	35
2	14.9	9.1	24
3	9.3	5.7	15
Total	46	28	74

Class/Score	Candidate	Reference variety4	Total
1	21.0	20.0	41
2	14.3	13.7	28
3	10.7	10.3	21
Total	46	44	90

### 5.3.10<sup>5</sup>

5.3.11 For calculating the “distinctness  $X^2$ ” for Reference variety 1

$$X^2 = (34-23.5)^2/23.5 + (12-22.5)^2/22.5 + (6-14.8)^2/14.8 + (23-14.2)^2/14.2 + (6-7.7)^2/7.7 + (9-7.3)^2/7.3$$

$$= 21.1$$

on  $(\text{No rows} - 1)(\text{No cols} - 1) = 2 \text{ df}$

5.3.12 The number of degrees of freedom for looking up the  $\chi^2$  table is one less than the number of rows multiplied by one less than the number of columns i.e.,  $3 - 1 \times 2 - 1 = 2$ .

5.3.13 At  $P = 0.01$ , for 2 df, the tabular value is 9.21. The calculated distinctness  $X^2$  is more than the tabulated  $\chi^2$  value. Therefore, we reject the null hypothesis that Reference variety 1 has a similar reaction to the disease as the candidate variety.

5.3.14 Similarly the calculated “distinctness  $X^2$ ” for Reference variety-2, Reference variety-3 and Reference variety-4 are 33.9, 35.4 and 30.8, respectively, which are all greater than the tabulated  $\chi^2$  value of 9.21 at 2 df.

5.3.15 Hence, all the Reference varieties are significantly different from the candidate variety in reaction to Colletotrichum crown rot.

[Annex II follows]

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<sup>5</sup> Comment by expert from Australia: Deletion of 5.3.10 is a necessary consequence of the deletion in 5.3.9 as it relates directly to the information deleted. Also 5.3.12 should now be retained as it is the only place that shows how to look up the value from the Chi table.

## ANNEX II: SCHEDULE OF TGP DOCUMENTS

Ref.	Title of document	Current approved* documents	Drafter (TWP)	Drafter (Name)	2009					2010										
					TC-EDC	TC/45	CAJ/59	TWPs	CAJ/60	C/43	TC-EDC	TC/46	CAJ/61	TWPs	CAJ/62	C/44				
TGP/0	List of TGP Documents and Latest Issue Dates	TGP/0/1 ADOPTED																		
TGP/1	General Introduction with Explanations	-	Office																	
TGP/2	List of Test Guidelines Adopted by UPOV	TGP/2/1 ADOPTED																		
TGP/3	Varieties of Common Knowledge	C(Ext.)/19/2 Rev.	CAJ																	
TGP/4	Constitution and Maintenance of Variety Collections	TGP/4/1 ADOPTED																		
TGP/5	Experience and Cooperation in DUS Testing	ADOPTED																		
TGP/6	Arrangements for DUS Testing	TGP/6/1 ADOPTED																		
TGP/7	Development of Test Guidelines	TGP/7/1 ADOPTED																		
TGP/8	Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability ( <i>Coordinator: Office / TWC Chairperson</i> )																			
TGP/9	Examining Distinctness	TGP/9/1 ADOPTED																		
TGP/10	Examining Uniformity	TGP/10/1 ADOPTED																		
TGP/11	Examining Stability ( <i>Coordinator: Office</i> )		TWV	Mr. Semon (OZ)																
TGP/12	[Special Characteristics] / [Guidance on Certain Physiological Characteristics]																			
TGP/13	Guidance for New Types and Species		TWO	Mr. Kwakkenbos (OZ)																
TGP/14	Glossary of [Technical, Botanical and Statistical] Terms Used in UPOV Documents ( <i>Coordinator: Office</i> )																			
TGP/15	New Types of Characteristics ( <i>Coordinator: Office</i> )																			