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TWV/45/3
ORIGINAL: English
DATE: June 14, 2011

UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

TECHNICAL WORKING PARTY FOR VEGETABLES

Forty-Fifth Session
Monterey, United States of America
July 25 to 29, 2011

TGP DOCUMENTS

Document prepared by the Office of the Union

1. The purpose of this document is: to report on developments concerning TGP documents since the Technical Working Party (TWP) sessions held in 2010; to provide background information to assist the TWPs in their consideration of the drafts of individual TGP documents; and to present the program for the development of TGP documents agreed by the Technical Committee (TC) at its forty-seventh session, held in Geneva from April 4 to 6, 2011.

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

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[1] 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	**Issue**	**Title**	**Issue date**
TGP/0	/3	List of TGP Documents and Latest Issue Dates	October 21, 2010
TGP/1		General Introduction With Explanations	not yet issued
TGP/2	/1	List of Test Guidelines Adopted by UPOV	April 6, 2005
TGP/3		Varieties of Common Knowledge	not yet issued[2]
TGP/4	/1	Constitution and Maintenance of Variety Collections	April 11, 2008
TGP/5		Experience and Cooperation in DUS Testing	

[1] 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).

[2] 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 47).

Document reference	Issue	Title	Issue date
Introduction		Introduction	October 30, 2008
Section 1	/2	Model Administrative Agreement for International Cooperation in the Testing of Varieties	October 30, 2008
Section 2	/3	UPOV Model Form for the Application for Plant Breeders' Rights	October 21, 2010
Section 3	/1	Technical Questionnaire to be Completed in Connection with an Application for Plant Breeders' Rights	April 6, 2005
Section 4	/2	UPOV Model Form for the Designation of the Sample of the Variety	October 30, 2008
Section 5	/2	UPOV Request for Examination Results and UPOV Answer to the Request for Examination Results	October 30, 2008
Section 6	/2	UPOV Report on Technical Examination and UPOV Variety Description	October 30, 2008
Section 7	/2	UPOV Interim Report on Technical Examination	October 30, 2008
Section 8	/1	Cooperation in Examination	April 6, 2005
Section 9	/1	List of Species in Which Practical Knowledge has Been Acquired or for Which National Test Guidelines Have Been Established	April 6, 2005
Section 10	/1	Notification of Additional Characteristics	April 6, 2005
Section 11	/1	Examples of Policies and Contracts for Material Submitted by the Breeder	October 30, 2008
TGP/6	/1	Arrangements for DUS Testing	
Section 1	/1	Introduction	April 6, 2005
Section 2	/1	Examples of Arrangements for DUS Testing	April 6, 2005
Section 3	/1	Declaration on the Conditions for the Examination of a Variety Based on Trials Carried Out by or on behalf of the Breeder	April 6, 2005
TGP/7	/2	Development of Test Guidelines	October 21, 2010
TGP/8	/1	Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability	October 21, 2010
TGP/9	/1	Examining Distinctness	April 11, 2008
TGP/10	/1	Examining Uniformity	October 30, 2008
TGP/11		Examining Stability	Proposed for adoption by Council in October 2011
TGP/12	/1	Guidance on Certain Physiological Characteristics	October 22, 2009
TGP/13	/1	Guidance for New Types and Species	October 22, 2009
TGP/14	/1	Glossary of Terms Used in UPOV Documents	October 21, 2010
TGP/15		New Types of Characteristics	not yet issued

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*.

II. DEVELOPMENT OF TGP DOCUMENTS

TGP documents to be considered for adoption in October 2011

TGP/11 "Examining Stability"

6. The Technical Committee (TC), at its forty-seventh session, held in Geneva from April 4 to 7, 2011, and the CAJ, at its sixty-third session, held in Geneva on April 7, 2011, agreed to propose document TGP/11/1 for adoption by the Council at its forty-fifth ordinary session, to be held in Geneva on October 20, 2011, on the basis of document TGP/11/1 Draft 10, with the amendments proposed by the TC at its forty-seventh session (see document TC/47/26 "Report on the conclusions", paragraph 48).

Revision of TGP Documents

(a) TGP/5, Section 10 "Notification of Additional Characteristics"

7. The TC, at its forty-seventh session, and the CAJ, at its sixty–third session, agreed to propose document TGP/5: Section 10/2 for adoption by the Council at its forty-fifth ordinary session, to be held in Geneva on October 20, 2011, on the basis of document TGP/5: Section 10/2 Draft 2 (see document TC/47/26 "Report on the Conclusions", paragraph 51).

(b) TGP/7 "Development of Test Guidelines"

8. Document TWV/29/11 provides an overview of proposals for the revision of document TGP/7 "Development of Test Guidelines" (to become document TGP/7/3).

9. In order to facilitate consideration by the TWPs, certain specific aspects of the revision of document TGP/7 are considered further in the following documents:

"*Providing photographs with the Technical Questionnaire"*

- see document TWV/45/12 "Revision of document TGP/7: Providing photographs with the Technical Questionnaire"

"*Example Varieties"*

- see document TWV/45/18 "Revision of document TGP/7: Example Varieties"

"*Quantity of plant material required"*

- see document TWV/45/17 "Revision of document TGP/7: Quantity of plant material required"

"*Number of plants to be examined (for distinctness)"*

- see document TWV/45/11 "Revision of document TGP/7: Number of plants to be examined (for distinctness)"

(c) TGP/8 "Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability"

- see document TWV/45/14 "TGP/8: Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability"

(d) TGP/12 "Guidance on Certain Physiological Characteristics"

- see document TWV/45/15 "TGP/12: Guidance on Certain Physiological Characteristics"

(e) TGP/14 "Glossary of Terms Used in UPOV Documents"

(i) Revision of existing sections of document TGP/14

Developing Shape-Related Characteristics:

10. The TC agreed that the states of expressions for ratios and avoidance of duplication of characteristics should be considered further by the Technical Working Parties (see document TC/47/26 "Report on the Conclusions", paragraph 81). Background information in those matters is provided in Annex I to this document. Annex II contains information prepared by experts from Denmark, Germany and the United Kingdom, concerning data on characteristics for length, width and length/width.

Comments of the Technical Working Parties at their sessions in 2011

11. At its fortieth session, held in Brasilia, Brazil, from May 16 to 20, 2011, the Technical Working Party for Agricultural Crops (TWA) considered document TWA/40/3 "TGP Documents", Annexes I and II.

12. The TWA received a presentation on a study concerning the "Examination of the use component and composite characters for determining distinctness", prepared by experts from Denmark, Germany and the United Kingdom as contained in Annex II to document TWA/40/3. The TWA stressed the importance of the results of the study. It illustrated the importance to get knowledge on the relationship between composite characteristics and their components in order to be able to decide which characteristics should be included in the Test Guidelines. The TWA proposed to prepare, for the forty-first session of the TWA, specific guidance in that respect based on the presented study. Furthermore, the TWA invited the other TWPs to consider the results of the aforementioned study in their sessions in 2011 (see document TWA/40/23 "Report", paragraphs 38 and 39).

13. The TWC, at its twenty-ninth session, held in Geneva, Switzerland, from June 7 to 10, 2011, considered documents TWC/29/3 Annexes I and II and TWC/29/16. The TWC took note of the comments as presented in paragraph 2.10 to 2.17 of Annex I of this document.

Perspective from which to observe plant shapes

14. The TC agreed to recommend that, where appropriate, an explanation for shape characteristics should provide guidance on the perspective from which to observe the shape.

Definition for Botanical Terms

15. With regard to a future revision of TGP/14 "Glossary of Terms Used in UPOV Documents", Section 2: Botanical Terms: Subsection 2: Shapes and Structures: I. Shape: II. Structure: Section 2.4, the TC agreed that additional definitions for botanical terms, such as for peduncle and petiole, should be added to document TGP/14 where the provision of such definitions would help to avoid confusion. However, it confirmed that this should not result in a change to the explanation in document TGP/14/1 that "In general, the meaning of botanical terms which are used in the Test Guidelines to indicate the relevant part of the plant to be examined, but which are not themselves used as states of expression (e.g. bract, petal, berry, etc.), do not require a UPOV specific definition and are not included in this document."

16. The TC agreed the following definition of "spike" for inclusion in a future revision of document TGP/14/1: Section 2: Botanical Terms: Subsection 2: Shapes and Structures: III. Definitions for Shape and Structure Terms (See document TC/47/26 "Report on the Conclusions", paragraphs 81 to 83):

Spike	an indeterminate inflorescence with sessile flowers on an unbranched axis.

(ii) New Section for Color Characteristics

- see document TWV/45/16 "Revision of Document TGP/14: New Section for Color Characteristics"

III. PROGRAM FOR THE DEVELOPMENT OF TGP DOCUMENTS

17. The TC agreed the program for the development of TGP documents, as set out in the Annex III to this document, subject to the revision of document TGP/7 (see document TC/47/26 "Report on the Conclusions").

18. The TC noted that the Council, at its forty-fifth ordinary session to be held on October 20, 2011, would need to adopt the revised text for document TGP/7 before the Test Guidelines could be adopted. Therefore, it agreed to adopt the Test Guidelines subject to the Council adopting the necessary revision to document TGP/7 (see document TC/47/26 "Report on the Conclusions", paragraph 99).

[Annexes follow]

ANNEX I

BACKGROUND TO DEVELOPING SHAPE-RELATED CHARACTERISTICS

SECTION 2: BOTANICAL TERMS: SUBSECTION 2: SHAPES AND STRUCTURES: I. SHAPE:

1. Components of Shape: states of expression for ratios

Proposal

1.1 Document TGP/14/1 states that:

> "1.5 To ensure that the ratio length/width is clearly understood, it is recommended to use meaningful states such as 'very elongated', rather than states such as 'very high'. To avoid confusion concerning the absolute dimensions, it is recommended to avoid the use of terms such as 'narrow' and 'broad' for ratio length/width, particularly where characteristics for the absolute dimensions are also included for the same plant part. The terms associated with certain length/width ratios used in the Chart for Simple Symmetric Plane Shapes are only intended to illustrate the use of ratio length/width. In the Test Guidelines, the use of terms such as '[very/moderately/slightly] elongated' and '[very/moderately/slightly] compressed' will need to be determined according to the range of expression for the characteristic concerned."

1.2 The Chart for Simple Symmetric Plane Shapes in Section 1.5 indicates that a typical set of states of expression could be as follows:

Characteristic: ratio length/width

State	Note
very compressed	1
moderately to very compressed	2
moderately compressed	3
slightly to moderately compressed	4
medium (slightly compressed to slightly elongated)	5
slightly to moderately elongated	6
moderately elongated	7
moderately to very elongated	8
very elongated	9

1.3 In the case of characteristics for which there are, for example, 9 states of expression that all correspond to elongated (or compressed), the following options for wording the characteristic might be considered:

(a) Characteristic: ratio length/width

State	Note
very weakly elongated	1
very weakly to weakly elongated	2
weakly elongated	3
weakly to moderately elongated	4
moderately elongated	5
moderately to strongly elongated	6

strongly elongated	7
strongly to very strongly elongated	8
very strongly elongated	9

(b) Characteristic: degree of elongation (or compression)

State	Note
very weak	1
very weak to weak	2
weak	3
weak to moderate	4
moderate	5
moderate to strong	6
strong	7
strong to very strong	8
very strong	9

Comments of the Technical Working Parties

1.4 The TWO, at its forty-third session, held in Cuernavaca, Morelos State, Mexico, from September 20 to 24, 2010, considered document TWO/43/22. With regard to characteristics for ratio length/width, the TWO confirmed its support for the use of meaningful states, such as compressed and elongated, but agreed that such characteristics should be reworded to correspond to those states (see document TWO/43/29 Rev. "Report", paragraphs 50 and 52).

1.5 The TWF, at its forty-first session, held in Cuernavaca, Morelos State, Mexico, from September 27 to October 1, 2010, considered document TWF/41/22. With regard to characteristics for ratio length/width, the TWF agreed that TGP/14 should be amended to indicate that the order of states of expression for ratio length/width should be from very compressed (low ratio) (e.g. note 1) to very elongated (high ratio) (e.g. note 9).

2. Developing Shape-Related Characteristics: avoidance of duplication of characteristics

2.1 Document TGP/14/1, Section 2: Botanical Terms: Subsection 2: Shapes and Structures: I. SHAPE: 2. "Developing Shape-Related Characteristics", paragraph 2.1.1, states that:

> "Duplication of the same difference in two separate characteristics should be avoided: for example, the use of characteristics for both ratio length/width and for shape should be avoided where states of expression of the characteristic for shape relate to different length/width ratios."

2.2 A further example of a duplication is when separate characteristics are included for ratio length/width, length and width, because two of those characteristics would determine the third.

Proposal by an expert from Germany

2.3 The ratio length/width (width/length) is a tool to describe the shape. The absolute measures are indications for the size. It is necessary to decide which are the most appropriate characteristics to describe those two sources of variation (shape and size), i.e. best

discrimination between varieties and greatest environmental stability. The aim is to distinguish varieties with the same shape by size and with the same size by shape.

2.4 Experience has often shown that "width in relation to length" or "length in relation to width" is more stable than the absolute measurements of width and length, because the absolute measures are more influenced by the environment. In such cases, the ratio is better for the description of the shape.

2.5 If all varieties have the same shape, only one characteristic is necessary to observe the size. In such cases, consideration needs to be given to whether the length or width would be more reliable.

2.6 If varieties have different shapes and different sizes within the same shape, one absolute dimension (length or width) and the ratio should be used for DUS. Thus, two characteristics should be included in the Test Guidelines:

"length" and "ratio width/length" (or "width in relation to length")
or
"width" and "ratio length/width (or "length in relation to width").

2.7 The inclusion of a third characteristic that is fully determined by the two other characteristics would not provide any additional information for the assessment of DUS and should be avoided.

2.8 If the duplication of characteristics is avoided, width in relation to length can be described with the states "narrow" to "broad" and length in relation to width with the states "short" to "long".

2.9 Document TGP/8/1 "Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability", Part II, 1. The GAIA Methodology, states the following with regard to correlation between characteristics:

"1.3.1 Weighting of characteristics

"1.3.1.1 It is important to take account of the correlation between characteristics when weighting. If two characteristics are linked (e.g. plant height including panicle; plant height excluding panicle), it is advisable to use only one of them in GAIA, to avoid double weight."

Comments of the Technical Working Parties

Technical Working Party for Agricultural Crops

2.10 At its thirty-ninth session, held in Osijek, Croatia, from May 24 to 28, 2010, the Technical Working Party for Agricultural Crops (TWA) considered document TWA/39/22 (paragraphs 7 to 15 of document TWA/39/22) (see document TWA/39/27 "Report", paragraphs 68 to 70).

2.11 The TWA agreed that experts from Denmark, Germany and the United Kingdom should send data on characteristics for length, width and length/width ratio to Mr. Trevor Gilliland

for collation. The TWA, at its fortieth session, would consider that data with a view to forming conclusions on any benefits in using all three characteristics in Test Guidelines.

2.12 The TWA noted that the text of TGP/8/1 Draft 15 "Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability", Part II, 1. The GAIA Methodology, Section 1.3.1.1, should be amended to clarify that there is an assumption that the length of panicle is used as a characteristic.

Technical Working Party on Automation and Computer Programs

2.13 The Technical Working Party on Automation and Computer Programs (TWC), at its twenty-eighth session, held in Angers, France, from June 29 to July 2, 2010, considered document TWC/28/22 (paragraphs 7 to 15 of document TWC/28/22) (see document TWC/28/36 "Report", paragraphs 46 and 47).

2.14 The TWC agreed that the first sentence of paragraph 8 should read "The ratio length/width (width/length) is a tool to describe a component of shape.". It also noted that any characteristics that were considered for distinctness would also need to be examined for uniformity. The TWC agreed that it should consider the results of the analysis of the data on characteristics for length, width and length/width ratio to be considered by the TWA (see paragraph 16, above), at its twentyninth session.

Technical Working Party for Vegetables

2.15 The Technical Working Party for Vegetables (TWV), at its forty-fourth session, held in Veliko Tarnovo, Bulgaria, from July 5 to 9, 2010, expressed concerns with regard to the proposal in document TWV/44/22 (paragraphs 7 to 15 of document TWV/44/22) that, if varieties have different shapes and different sizes within the same shape, only one absolute dimension (length or width) and the ratio should be used for DUS. In the first instance, it was noted that both length and width would need to be recorded in order to derive the ratio length/width. It also considered that it was often useful to have a separate description for length, width and ratio length/width. With regard to concerns about duplication of characteristics, it was noted that there was a suitable warning in relation to GAIA in document TGP/8/1 Draft 15, Part II, 1. The GAIA Methodology, Section 1.3.1 Weighting of characteristics. It did not anticipate problems for DUS examiners making decisions on DUS where the characteristics length, width and ratio length/width were considered separately and noted that there were correlations between other types of characteristics (see document TWV/44/34 "Report", paragraphs 59 and 60).

Technical Working Party for Ornamental Plants and Forest Trees

2.16 The TWO, at its forty-third session, held in Cuernavaca, Morelos State, Mexico, from September 20 to 24, 2010, considered document TWO/43/22. With regard to the proposal in document TWO/43/22 that, if varieties have different shapes and different sizes within the same shape, only one absolute dimension (length or width) and the ratio should be used for DUS, the TWO shared the concerns of the TWV. In the first instance, it was noted that both length and width would need to be recorded in order to derive the ratio length/width. It also considered that it was often useful to have a separate description for length, width and ratio length/width. With regard to concerns about duplication of characteristics, it was noted that there was a suitable warning in relation to GAIA in document TGP/8/1 Draft 15, Part II, 1. The GAIA Methodology, Section 1.3.1 Weighting of characteristics. It did not anticipate problems for DUS examiners making decisions on DUS where the characteristics length,

width and ratio length/width were considered separately and noted that there were correlations between other types of characteristics (see document TWO/43/29 Rev. “Report”, paragraphs 50 and 51).

Technical Working Party for Fruit Crops

2.17 The TWF, at its forty-first session, held in Cuernavaca, Morelos State, Mexico, from September 27 to October 1, 2010, considered document TWF/41/22. With regard to the proposal in document TWF/41/22 that, if varieties have different shapes and different sizes within the same shape, only one absolute dimension (length or width) and the ratio should be used for DUS, the TWF shared the concerns of the TWV. In the first instance, it was noted that both length and width would need to be recorded in order to derive the ratio length/width. It also considered that it was often useful to have a separate description for length, width and ratio length/width. With regard to concerns about duplication of characteristics, it was noted that there was a suitable warning in relation to GAIA in document TGP/8/1 Draft 15, Part II, 1. The GAIA Methodology, Section 1.3.1 Weighting of characteristics. It did not anticipate problems for DUS examiners making decisions on DUS where the characteristics length, width and ratio length/width were considered separately and noted that there were correlations between other types of characteristics (see document TWF/41/30 Rev. “Report”, paragraphs 54 and 55).

[Annex II follows]

ANNEX II

Examination of the use component and composite characters for determining distinctness

Background

It is possible to derive additional characteristics for comparing between varieties by calculating new ‘composite’ characters that are combinations of existing independently assessed plant characters. At the thirty-ninth TWA meeting in 2010 the document TWA/39/22 "Revision of existing sections of document TGP/14/1", was reviewed. During this process questions arose regarding whether it was appropriate to include both individually assessed ‘component’ characters along with calculated ‘composite’ characters within the same Test Guideline. It was agreed that experts from Denmark, Germany and the United Kingdom should interrogate their test data and provide the following evidence based report for consideration at the fortieth TWA session in Brasilia, Brazil, May 2011.

The key issue in this consideration is defined by document TGP/14/1 draft 11 (see footnote for full reference *). It states that:

“*Duplication of the same difference in two separate characteristics should be avoided*..”

It further specifically states that:

“..for example, the use of characteristics for both ratio length/width and for shape should be avoided where states of expression of the characteristic for shape relate to different length/width ratios.”

While the latter statement relates specifically to the duplicate assessment of one characteristic by two separate methods (as a shape assessment and as a ratio calculation), the principle of avoiding duplication of the same difference is clearly established in the former statement.

This issue has also been considered in the Technical Committee paper TC-EDC/Jan11/13. Based on the above principles it was questioned whether it was appropriate, for example, to include a length, a width and their ratio in a Test Guideline. The concern was that since the ratio was comprised entirely by the length and width assessments, using all three parameters could be introducing a duplication of the same difference. If so, then in a Test Guideline that included the ratio, only one of the two primary assessments (length or width) should also be included (i.e. ratio + length or ratio + width).

From the above synopsis it is clear that the key issue is to understand the relationship between a composite characteristic and its component characteristics. In practice, it needs to be ascertained whether the same difference is being duplicated. Evidence for this would include how each component distinguishes between large numbers of variety-pairs and specifically whether a high similarity existed in the differences recorded by a composite character and its components. The following report presents evidence and observations on the implications of using individually assessed characters and their calculated composite, for determining distinctness in several agricultural species.

* Section 2 (Botanical Terms), Subsection 2 (Shapes and structures: I), Shape: 2. “Developing Shape-related Characteristics”, para 2.1.1

Possible character combinations

There are several types of character-combinations that can be envisaged. A possible categorisation could be as follows:

1. Random character combinations
   It is possible to calculate a mathematical value for any combination of two characters, for example flowering date divided by leaf length. The issue in this case is not whether the same difference is being duplicated, but that the composite does not describe any biologically occurring or meaningful plant characteristic. It is suggested that it is important to declare in any guideline, that only those calculations that described an actual biological characteristic should be considered for approval as a new distinctness character.

2. Relationship characteristics
   These calculated characters describe a biologically meaningful relationship between two different plant characteristics. An example would be the ratio between ear length and awn length, whereby candidates are assessed for distinctness on whether the length of awn was significantly longer or shorter for the length of ear to which it was attached (or visa-versa). In theory, this category could also involve non-morphological characteristics such as those based on time or colour. A possible example could be a difference in the length of time between flower bud emergence and anthesis, derived by subtracting one date/time from the other. Similarly, a colour ratio between two plant parts may differ between varieties and could be assessed.

3. Multidimensional characteristics
   These calculated characters describe a nonlinear plant feature based on two linear component characters. These could include two-dimensional shape or area characteristics derived from the length and width parameters of leaves, cotyledons, petioles etc. These could also include multidimensional characteristics such as volume, described by the linear characters of height and width, most usefully where the structure is not a perfect sphere.

The demarcation between categories 2 and 3 is to some extent academic, though category 2 includes characteristics that are difficult or impossible to assess without examining the component parts, while category 3 characters are definable structures that could be directly assesses independently of its component parts. In practice, however, the relationships between assessed component and calculated composite characters would not be expected to fundamentally differ and the same question arise regarding inclusion of composite and component characters in the same guideline. The examples provided in this report, therefore, have applicability across both categories.

Dynamics of composite and component characters in example species

Several examples of the discrimination power and relationships between composite characters and their component characters are provided in the Appendix to Annex II. These were produced from DUS trials in Denmark, Germany and the United Kingdom.

In each case the tables examine the capacity of the composite character to distinguish between current varieties by providing a measure of overall discriminating power and the frequency of unique variety-pair separations. The equivalent data for the component characters is also provided, plus the relationship between composite and components measured as correlation/regression analyses. As far as practical the data have been standardised to facilitate across species comparisons.

A summary of the specific observations for each species is provided at the end of each section. The following bullet points summarise the overall observations and related considerations.

- In direct compliance with the current TGP/14 guidelines, duplication of the same difference in two separate characteristics should be avoided.

- Only ratios describing biologically meaningful plant characteristics should be calculated.

- As composite characteristics are calculated from components that are routinely assessed in trials, workloads and costs are unlikely to be a significant consideration in determining their practical value.

- There were large differences between the species in the discriminating power of the composite character relative to its component characters. In some cases, the composite character was much less discriminating than its individually examined components, in others it was intermediary and in others it was the most discriminating character of all.

- The composite character provided some level of unique variety-pair distinctions in all species, though in some cases this was at a very low frequency.

- Where one of the component characters was only weakly discriminating, the composite character was usually highly correlated to the other component character and had a lower discriminating power.

- The individual component characters were in the majority of cases independent of each other. The exceptions being the cotyledon characteristics in WOSR and to a lesser degree the fruit characteristics in apple.

- Composite characters were often very highly correlated with their component characters and in most cases with a significantly higher similarity than that existing between the two component characters.

- The degree of correlation between a component character and its composite character was not a good predictor of their independent discriminating potential. This was also the case between component characters where the level of similarity did not accurately indicate their relative discriminating power.

For overall consideration

There was considerable similarity in the underlying implications of combining individual characters into composites based on the relative discriminating power of each component, and to a lesser degree on the level of similarity and independence between them. There was not, however, sufficiently consistent relationships between composite and component characters in the different species to identify a simple unifying guideline. In some cases the inclusion of composite characters could provide useful additional information, in other cases they appeared to be largely repeating the information available in one or both of their components. Nonetheless, in all species, the composite character did achieve some level of unique variety-pair distinctions.

Determining the appropriate guidance for the future will largely depend on the TWA proposing an expert interpretation of the above observations but it also appears necessary to have specific knowledge of the component/composite dynamics in each species under consideration.

[Appendix to Annex II follows]

APPENDIX TO ANNEX II

Relationships between component and composite characteristics in example species

The experts provided several distinctness data sets for crop species examined at their research facilities, as follows:

1) Awn/Ear Length Ratio in Barley
   Component Characters: Ear Length and Awn Length
   Composite Character: Awn/Ear Length Ratio

Example A: Discrimination capacity of characteristics for test years 2008 & 2009

UPOV no.	Characteristic	Max.	Min.	LSD	Sig-Each	Sig-Next	Sig-Only
Winter Barley					15576 comparisons		
	Awn: length	143.97	87.47	12.00	48.0%	48.0%	18.4%
16	Ear: length	118.80	65.65	11.80	37.0%	18.8%	10.3%
17	Ratio	2.15	0.81	0.30	33.6%	0.7%	0.7%
Spring Barley					46360 comparisons		
	Awn length	146.27	76.92	11.47	42.7%	42.7%	14.1%
16	Ear length	97.32	61.95	8.70	29.2%	16.8%	7.5%
17	Ratio	2.14	1.05	0.24	34.7%	2.0%	2.0%

Key: Sig-Each = frequency of variety pairs separated by EACH character independently
Sig-Next = frequency of variety pairs separated by NEXT character when not separated by previous characters
Sig-Only = frequency of variety pairs separated ONLY by that character

Correlations between characters

Winter Barley	212 varieties in 2008		213 varieties in 2009	
	Ear Length	Ratio	Ear Length	Ratio
Ratio	-0.76		-0.83	
Awn Length	-0.24	0.80	-0.28	0.75

Spring Barley	329 varieties in 2008		342 varieties in 2009	
	Ear Length	Ratio	Ear Length	Ratio
Ratio	-0.68		-0.70	
Awn Length	-0.04	0.80	-0.07	0.80

Summary: The composite Ratio had similar discriminating power to Ear Length in Winter Barley and both characters were less powerful than Awn Length (Sig-Each). In Spring Barley the Ratio was more discriminating than Ear Length but again less discriminating that Awn Length. In both species the Ratio separated variety-pairs that were indistinguishable by either component characteristic (Sig-Only). In all data sets, the Ratio was highly positively correlated with Awn Length and highly negatively correlated with Ear Length, while the two component characters were only weakly related.

Example B: Discrimination capacity of characteristics for test years 2006/08, 07/09, 08/10 at two locations each with three growing cycles.

UPOV no.	Characteristic	Sig-Each	Sig-Only	Sig-Multi
Winter Barley		32,678 comparisons		
	Awn: length	54.3%	8.9%	45.4%
16	Ear: length	65.0%	10.3%	54.7%
17	Ratio	51.6%	0.6%	51.1%

Key: as for Example A, plus Sig-Multi = frequency of variety pairs separated by two or all three characters

Correlations between characters (regression coefficient R^2)

Winter Barley

	Ear: length	Ratio
Ratio	0.59	
Awn: length	0.02	0.43

Summary: In agreement with Example A, the calculated Ratio had similar powers of discrimination to one of the component characters, but was weaker than the other (Sig-Each). There were again variety-pairs that were only separated by the Ratio, although in this data set it was in a very small proportion of the comparisons (Sig-Only). The Ratio, therefore, provided little additional discriminating power over its two components. The Ratio was again highly correlated with the component characters which were mutually independent.

2) Length/Width Ratios of leaf and fruit in Apple

Component Characters: Leaf Length and Leaf Width;
Fruit Height and Fruit Diameter

Composite Character: Length/Width Ratio
Height/Diameter Ratio

Discrimination capacity of characteristics for test years 2006/07, 07/08, 08/09, 09/10 each with two growing cycles

UPOV no.	Characteristic	Sig-Each	Sig-Only	Sig-Multi
Apple (Leaf Characters)		13,644 comparisons		
14	Leaf length	52.8%	9.5%	43.4%
15	Leaf Width	43.9%	3.6%	40.2%
16	Ratio	47.1%	6.9%	40.2%
Apple (Fruit Characters)		13,644 comparisons		
14	Height	52.1%	4.5%	47.6%
15	Diameter	45.5%	6.9%	38.6%
16	Ratio	46.1%	7.5%	38.6%

Key: Sig-Each = frequency of variety pairs separated by EACH character independently
Sig-Only = frequency of variety pairs separated ONLY by that character
Sig-Multi = frequency of variety pairs separated by two or all three characters

Correlations between characters (regression coefficient R^2)

Apple (Leaf Characters)

	Length	Ratio
Ratio	0.19	
Width	0.30	0.26

Apple (Fruit Characters)

	Height	Ratio
Ratio	0.25	
Diameter	0.52	0.06

Summary: For leaf characters, the Ratio was slightly more discriminating than Width and slightly less than Length (Sig-Each). Similarly, for fruit characters Diameter and Ratio were similarly discriminating and marginally weaker than Height. In both leaf and fruit examinations the Ratio provided a comparable proportion of unique variety-pair separations to either of its component characters, with the Ratio highest in fruit and second highest in leaf comparisons (Sig-Only). This was probably a consequence of the observed relationships between the characters. In both the leaf and fruit characteristics, the component characters were more closely correlated to each other than to the Ratio, particularly in the fruit.

3) Length/Width Ratios of Petals and Cotyledons in Winter Oilseed Rape (WOSR)

Component Characters: Petal Length and Width
Cotyledon Length and Width
Composite Characters: Petal Length/Width Ratio
Cotyledon Length/Width Ratio

WOSR Petal Characteristics

Lines 2009			Hybrids 2009		
UPOV No.	Sig-Each	Sig-Next	UPOV No.	Sig-Each	Sig-Next
Length 11	27.4%	68.24%	Ratio 54	23.7%	63.01%
Ratio 54	24.2%	19.88%	Length 11	21.2%	20.90%
16	19.2%	5.93%	16	18.9%	7.96%
18	15.8%	2.71%	21	16.1%	3.62%
21	13.2%	1.33%	18	15.3%	1.73%
15	13.3%	0.81%	15	16.4%	1.16%
17	11.2%	0.40%	8	9.6%	0.56%
4	4.0%	0.23%	4	6.0%	0.27%
19	10.9%	0.17%	91	16.5%	0.25%
8	4.3%	0.10%	19	7.5%	0.14%
7	1.9%	0.07%	Width 12	22.8%	0.12%
Width 12	26.2%	0.06%	7	2.3%	0.10%
91	18.6%	0.03%	17	10.5%	0.10%
9	3.3%	0.03%	14	9.6%	0.07%
14	6.6%	0.01%	9	3.5%	0.02%
Totals	220286	99499		28887	10886

WOSR Cotyledon Characteristics

Lines 2009			Hybrids 2009		
UPOV No	Sig-Each	Sig-Next	UPOV No.	Sig-Each	Sig-Next
Ratio 13	21.4%	60.30%	74	19.4%	51.15%
72	17.5%	20.47%	**Width 3**	16.2%	23.07%
70	13.3%	8.42%	75	17.7%	11.29%
73	13.1%	4.32%	**Ratio 13**	18.9%	5.91%
Width 3	10.6%	3.23%	70	7.6%	2.86%
75	17.6%	1.02%	78	11.6%	1.47%
74	19.2%	0.69%	73	10.8%	1.42%
78	12.0%	0.43%	72	10.8%	0.88%
76	14.6%	0.31%	**Length 2**	13.6%	0.65%
Length 2	9.8%	0.27%	71	17.6%	0.47%
71	18.8%	0.25%	76	10.3%	0.30%
67	11.5%	0.14%	67	14.8%	0.26%
77	2.7%	0.10%	66	14.6%	0.12%
66	8.3%	0.03%	69	13.6%	0.07%
68	9.5%	0.02%	77	2.4%	0.05%
69	8.7%	0.01%	68	13.0%	0.02%
Totals	254906	90437		24715	9368

Key: Sig-Each = frequency of variety pairs separated by EACH character independently as above plus
Sig-Next = frequency of variety pairs separated by NEXT character when not separated by previous characters

Correlations between characters

WOSR	Lines 2009		Hybrids 2009	
Petal Characteristics	Length	Ratio	Length	Ratio
Ratio	0.52		-0.80	
Width	-0.20	0.74	-0.08	0.53
Cotyledon Characteristics	Length	Ratio	Length	Ratio
Ratio	-0.38		-0.32	
Width	0.72	0.37	0.82	0.30

Summary: For both variety types the Length, Width and Ratio petal characters were the three most discriminating of all the characters examined (Sig-Each). The Ratio was the most discriminating character for hybrids and the third most discriminating character for the conventional lines. For cotyledon characters Length, Width and Ratio were not the three most discriminating characters, though Ratio was the most discriminating for conventional lines, and more discriminating than either of its components for both variety types. Overall, therefore, Ratio separated variety-pairs that were not distinct by either of its component characters. Similar to other species, however, Ratio was strongly correlated with both of its components (in one case negatively), while the Length and Width characters were highly independent of each other. In an overall analysis of results from 2010 there was almost perfect correlation between all three characters (data not shown), yet the discriminating power of these three characters was still similar to the 2099 data. This indicated that discrimination power can differ between characters even when they are highly correlated.

4) Length/Width Ratios of Flag Leaves in perennial ryegrass

Component Characters: Flag Leaf Length and Flag Leaf Width
Composite Characters: Flag Leaf Length/Width Ratio

Example A: Discrimination capacity of characteristics for test years 2003/05, 05/07, 08/10 each with three growing cycles.

UPOV no.	Characteristic	Sig-Each	Sig-Only	Sig-Multi
Ryegrass (fodder diploid)		10,598 comparisons		
14	Leaf length	26.2%	8.6%	17.6%
15	Leaf Width	4.7%	1.5%	3.2%
16	Ratio	18.6%	2.0%	16.7%
Ryegrass (fodder tetraploid)		8,107 comparisons		
14	Leaf length	15.1%	5.7%	9.4%
15	Leaf Width	10.5%	4.8%	5.7%
16	Ratio	11.1%	1.5%	9.6%
Ryegrass (turf)		10,291 comparisons		
14	Leaf length	23.1%	13.9%	9.3%
15	Leaf Width	10.1%	4.2%	5.9%
16	Ratio	13.6%	4.9%	8.7%

Key: Sig-Each = frequency of variety pairs separated by EACH character independently
Sig-Only = frequency of variety pairs separated ONLY by that character
Sig-Multi = frequency of variety pairs separated by two or all three characters

Correlations between characters (regression coefficient R^2)

Ryegrass (fodder diploid)

	Length	Ratio

Ratio	0.50	
Width	0.01	0.23

Ryegrass (fodder tetraploid)

	Length	Ratio
Ratio	0.35	
Width	0.16	0.24

Ryegrass (turf)

	Length	Ratio
Ratio	0.26	
Width	0.08	0.61

Summary: Across all three variety types (ploidy and usage) the Ratio was intermediate in overall discriminating power between its component characters (Sig-Each), with Length greatest and Width least powerful. Length uniquely separated the highest proportion of variety-pairs (Sig-Only) with Ratio uniquely separating a similar or lower proportion to Width. Ratio only made a substantial contribution (~5%) of the unique separations in the turf group, which was similar to that achieved by Width. The highest correlation across the fodder diploids was between the Ratio and Length characters. This was most probably due to the low level of variation in Width and this also gave a low correlation between Ratio and Width. In contrast, the closest relationship in the turf types was between Ratio and Width. Overall, however, Length and Width were still highly independent in all three variety types, with the closest relationships involving the Ratio character.

Example B: Final reports on perennial ryegrass candidates 2010

Late Forage Tetraploids - data from 4 years 2006-2010

Candidate: Sures (AFP 13/2185)
Similar Control: Ventoux (AFP 13/1050)

T Values positive if Sures values Larger than Ventoux

		MJAR Analysis					
	Character	Stringency	T	Probability	Significance	F3	
14	Length	0.86	-2.81	0.536	**	1.5	NS
15	Width	0.84	-1.44	15.105	NS	0.5	NS
16	Ratio	0.84	-2.18	3.065	NS (5%)	1.34	NS

Late forage diploids - data from 4 years 2006-2010

Candidate: Romark (AFP 13/1480)
Similar Control: Kabota (AFP 13/1398)

If T Values positive Romark values Larger than Kabota

		MJAR Analysis					
	Character	Stringency	T	Probability		F3	
14	Length	0.95	1.61	10.809	NS	3.2	*
15	Width	0.89	2.62	0.947	**	0.8	NS
16	Ratio	0.95	2.34	2.019	NS (5%)	2.1	NS

Intermediate forage diploids - data from 4 years 2006-2010

Candidate: Perceval (AFP 13/1837)
Similar Control: Merganda (AFP 13/882)

T Values positive if Perceval values Larger than Merganda

	Character	Stringency	MJAR Analysis T	Probability		F3	
14	Length	0.82	2.50	1.282	NS (5%)	1.3	NS
15	Width	0.86	2.57	1.073	NS (5%)	0.5	NS
16	Ratio	0.83	2.67	0.812	**	1.1	NS

Summary: *Example B* was constructed from a different data set and a different location to *Example A*. Despite this the dynamics between the characters was broadly similar, except the overall discriminating power of Width was higher in *Example B* (data not shown) The three variety distinctness reports provide examples of positive distinctness decisions in 2010 that depended on either Flag Leaf Length, Width or Shape (Ratio). Candidate Sures was passed on a clear difference in Length and as Width had a low non-significant discrimination probability, the calculated difference in Ratio was only at the 5% level. An equivalent result was recorded for Romark, except in this case Width was the essential discriminating character. The third candidate, Percival, was indistinct from Merganda in both component characters (probability levels of only 5%), but their combination in the composite Ratio provided the essential 1% discrimination.

Information provided by the following experts

Beate Ruecker, Germany
Carol Norris,United Kingdom
Erik Lawaetz, Denmark
Trevor Gilliland, United Kingdom (coordinator)

6th May 2011

Ends

[Annex III follows]

			2010						2011						2012					
Ref.	**Title of document**	**Current approved* documents**	**TC-EDC**	**TC/46**	**CAJ/61**	**TWPs**	**CAJ/62**	**C/44**	**TC-EDC**	**TC/47**	**CAJ/63**	**TWPs**	**CAJ/64**	**C/45**	**TC-EDC**	**TC/48**	**CAJ/65**	**TWPs**	**CAJ/66**	**C/46**
TGP/0	**List of TGP Documents and Latest Issue Dates**	**TGP/0/3 ADOPTED**						**TGP/0/3 Adopt**												
TGP/1	**General Introduction with Explanations**	-	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TGP/2	**List of Test Guidelines Adopted by UPOV**	**TGP/2/1 ADOPTED**																		
TGP/3	**Varieties of Common Knowledge**	C(Extr.)/19/2 Rev.																		
TGP/4	**Constitution and Maintenance of Variety Collections**	**TGP/4/1 ADOPTED**																		
TGP/5	**Experience and Cooperation in DUS Testing**	**ADOPTED**																		
	Section 10: Notification of Additional Characteristics	Section 10/1 Adopted		TC/46/5	CAJ/61/2	(revisions)			**Section 10/2 Draft 1**	**Section 10/2 Draft 2**	**Section 10/2 Draft 2**			**Section 10/2 Draft 3 Adopt**						
TGP/6	**Arrangements for DUS Testing**	**TGP/6/1 ADOPTED**																		
TGP/7	**Development of Test Guidelines**	**TGP/7/2 ADOPTED**	**TGP/7/2 Draft 4**	**TGP/7/2 Draft 5 / approve**	**TGP/7/2 Draft 5 / approve**	(revisions)	---	**TGP/7/2 Draft 6 / Adopt**	TC-EDC/Jan11/2, 6, 7, 10	TC/47/16-19	---	(revisions)	---	**TGP/7/3 Adopt**	**(revision)**	**(revision)**	**(revision)**	---	---	**TGP/7/4 Adopt**
TGP/8	**Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability**	**TGP/8/1 ADOPTED**	**TGP/8/1 Draft 14**	**TGP/8/1 Draft 15 / approve**	**TGP/8/1 Draft 15 / approve**	(new sections & revisions)	---	**TGP/8/1 Draft 16 / Adopt**	TC-EDC/Jan11/8	TC/47/20	---	(new sections & revisions)	---	---	(new sections & revisions)	(new sections & revisions)	---	(new sections & revisions)	---	---
TGP/9	**Examining Distinctness**	**TGP/9/1 ADOPTED**																		
TGP/10	**Examining Uniformity**	**TGP/10/1 ADOPTED**																		
TGP/11	**Examining Stability**		**TGP/11/1 Draft 6 & Draft 7**	TC/46/5	---	**TGP/11 /1 Draft 8**	**TGP/11 /1 Draft 8**	---	**TGP/11 /1 Draft 9**	**TGP/11 /1 Draft 10**	**TGP/11 /1 Draft 10**	---	---	**TGP/11 /1 Draft 11 Adopt**						
TGP/12	**Guidance on Certain Physiological Characteristics**	**TGP/12/1 ADOPTED**							TC-EDC/Jan11/12	TC/47/23		(new sections & revisions)			**TGP/12/2 Draft 1**	**TGP/12/2 Draft 2**	**TGP/12/2 Draft 2**			**TGP/12/2 Draft 3 / Adopt**
TGP/13	**Guidance for New Types and Species**	**TGP/13/1 ADOPTED**																		
TGP/14	**Glossary of Terms Used in UPOV Documents**	**TGP/14/1 ADOPTED**	**TGP/14/1 Draft 10**	**TGP/14/1 Draft 11 / approve**	**TGP/14/1 Draft 11 / approve**	(Color Subsection & revisions)	---	**TGP/14/1 Draft 12 / Adopt**	TC-EDC/Jan11/13	TC/47/21, 22	---	(Color Subsection & revisions)	---	---	(Color Subsection & revisions)	(Color Subsection & revisions)	---	(Color Subsection & revisions)	---	---
TGP/15	**New Types of Characteristics**																			

[End of Annex III and of document]