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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

GENERAL INTRODUCTION

TO THE EXAMINATION OF

DISTINCTNESS, UNIFORMITY AND STABILITY

AND THE DEVELOPMENT OF HARMONIZED DESCRIPTIONS

OF NEW VARIETIES OF PLANTS

* This version replaces document TG/1/2, "Revised General Introduction to the Guidelines for the Conduct of Tests for Distinctness, Homogeneity and Stability of New Varieties of Plants."

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CHAPTER 1 – INTRODUCTION

1.1 According to Article 7 of the 1961/1972 and 1978 Acts and Article 12 of the 1991 Act of the UPOV Convention, protection can only be granted in respect of a new plant variety after examination of the variety has shown that it complies with the requirements for protection laid down in those Acts and, in particular, that the variety is distinct (D) from any other variety whose existence is a matter of common knowledge at the time of the filing of the application (hereinafter referred to as a "variety of common knowledge") and that it is sufficiently uniform (U) and stable (S), or "DUS" in short. The examination, or "DUS Test," is based mainly on growing tests, carried out by the authority competent for granting plant breeders' rights or by separate institutions, such as public research institutes, acting on behalf of that authority or, in some cases, on the basis of growing tests carried out by the breeder[1]. The examination generates a description of the variety, using its relevant characteristics (e.g. plant height, leaf shape, time of flowering), by which it can be defined as a variety in terms of Article 1(vi) of the 1991 Act of the Convention.

1.2 The purpose of this document (hereinafter referred to as "the General Introduction"), and the associated series of documents specifying Test Guidelines' Procedures (hereinafter referred to as "the TGP documents"), is to set out the principles which are used in the examination of DUS. The identification of those principles ensures that examination of new plant varieties is conducted in a harmonized way throughout the members of the Union[2]. This harmonization is important because it facilitates cooperation in DUS testing and also helps to provide effective protection through the development of harmonized, internationally recognized descriptions of protected varieties.

1.3 The only binding obligations on members of the Union are those contained in the text of the UPOV Convention itself, and this document must not be interpreted in a way that is inconsistent with the relevant Act for the member of the Union concerned. However, on the basis of practical experience, this General Introduction seeks to provide general guidance for the examination of all species in accordance with the UPOV Convention, and accordingly the document is adopted by the Council of UPOV. In addition, UPOV has developed "Guidelines for the Conduct of Tests for Distinctness, Uniformity and Stability," or "Test Guidelines", for many individual species or other variety groupings. The purpose of these Test Guidelines is to elaborate certain of the principles contained in this document, 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. Test Guidelines developed prior to the adoption of this version of the General Introduction will have been developed in accordance with the version in existence at that time, and will be updated on their next revision.

1.4 The individual Test Guidelines are prepared by the appropriate Technical Working Party, which is composed of government appointed experts from each member of the Union with invited experts from other interested States and observer organizations. The main international non-governmental organizations in the field of plant breeding and the seed and plant industries are given the opportunity to comment on the drafts of Test Guidelines before their adoption, thus ensuring that the knowledge and experience of breeders and the seed and plant industries is taken into account. Once developed, the Test Guidelines are submitted for approval by the Technical Committee. The list of individual Test Guidelines adopted by UPOV and information on how to obtain copies of adopted

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[1] Reference in this document to the term "breeder" should be understood as defined in Article 1(iv) of the 1991 Act of the UPOV Convention, i.e.

" – the person who bred, or discovered and developed, a variety,
– the person who is the employer of the aforementioned person or who has commissioned the latter's work, where the laws of the relevant Contracting Party so provide, or
– the successor in title of the first or second aforementioned person, as the case may be"

[2] The term "member of the Union" means a State party to the Act of 1961/1972 or the Act of 1978, or a Contracting Party to the 1991 Act.

Test Guidelines in electronic form can be found in document TGP/2, "List of Test Guidelines Adopted by UPOV."

1.5 This document seeks to address all aspects of DUS testing, in addition to providing guidance on the development of Test Guidelines, and is the replacement for document TG/1/2, "Revised General Introduction to the Guidelines for the Conduct of Tests for Distinctness, Homogeneity and Stability of New Varieties of Plants," which, as the title suggests, has served as the introduction to Test Guidelines.

1.6 Although the Test Guidelines provide detailed practical guidance on certain aspects of the examination of DUS and identify appropriate characteristics for variety description, there are certain general aspects that apply across all Test Guidelines which it would not be appropriate to reproduce in all the individual Test Guidelines.

1.7 Another situation in which a DUS examiner would use the basic principles contained in the General Introduction, rather than following the detailed recommendations of the Test Guidelines, is where the circumstances of the DUS examination determine that the recommended approach may not be the most appropriate for a particular set of conditions. In these or other circumstances where the Test Guidelines are not followed, the DUS examiner should consider how to proceed in a way that maintains, as far as possible, harmonization in DUS examination and variety description for that species.

1.8 In addition, the absence of Test Guidelines for the species or variety grouping concerned will obviously lead the DUS examiner to resort to this General Introduction, and there is a specific chapter (Chapter 9, "Conduct of DUS Testing in the Absence of Test Guidelines") in this document for such an eventuality.

1.9 In conclusion, it is important for any DUS examiner to be familiar with the principles of DUS examination set out in this document, and to consider them in conjunction with the appropriate individual Test Guidelines.

1.10 This document and the associated TGP documents are kept under review by the Technical Committee. Members of the Union will receive updated documents direct from UPOV, but details of the current versions of all documents are available in document TGP/0, which readers are advised to consult if they are in doubt as to the validity of the documents in their possession.

1.11 A glossary of technical terms, including many used in this document, are catalogued in document TGP/14, "Glossary of Technical, Botanical and Statistical Terms Used in UPOV Documents."

CHAPTER 2 – THE EXAMINATION OF DISTINCTNESS, UNIFORMITY AND STABILITY ("DUS TESTING")

2.1 Requirement for Examination

The UPOV Convention (Article 7(1) of the 1961/1972 and 1978 Acts and Article 12 of the 1991 Act) requires that a variety be examined for compliance with the distinctness, uniformity and stability criteria. The 1991 Act of the UPOV Convention clarifies that, "In the course of the examination, the authority may grow the variety or carry out other necessary tests, cause the growing of the variety or the carrying out of other necessary tests, or take into account the results of growing tests or other trials which have already been carried out."

2.2 Test Guidelines as a Basis for DUS Testing

2.2.1 Where UPOV has established specific Test Guidelines for a particular species, or other group(s) of varieties, these represent an agreed and harmonized approach for the examination of new varieties and, in conjunction with the basic principles contained in the General Introduction, should form the basis of the DUS test.

2.2.2 Where UPOV has not established individual Test Guidelines relevant to the variety to be examined, the examination should be carried out in accordance with the principles in this document and, in particular, the recommendations contained in Chapter 9, "Conduct of DUS Testing in the Absence of Test Guidelines." In particular, the recommendations in Chapter 9 are based on the approach whereby, in the absence of Test Guidelines, the DUS examiner proceeds in the same general way as if developing new Test Guidelines.

2.3 Design of the DUS Tests

The design of the growing trial or other tests, with regard to aspects such as the number of growing cycles, layout of the trial, number of plants to be examined and method of observation, is largely determined by the nature of the variety to be examined. Guidance on design is a key function of the Test Guidelines. Guidance on the development of Test Guidelines, including the design of the trials and tests, is provided in document TGP/7, "Development of Test Guidelines."

2.4 Characteristics as the Basis for Examination of DUS

2.4.1 For any variety to be capable of protection it must first be clearly defined. Only after a variety has been defined can it be finally examined for fulfillment of the DUS criteria required for protection. All Acts of the UPOV Convention have established that a variety is defined by its characteristics and that those characteristics are therefore the basis on which a variety can be examined for DUS.

2.4.2 The 1991 Act of the UPOV Convention makes this clear by stating in Article 1(vi) that a variety is a plant grouping that can be "defined by the expression of the characteristics resulting from a given genotype or combination of genotypes" and can be "distinguished from any other plant grouping by the expression of at least one of the said characteristics."

2.4.3 In addition to their use in defining a variety, characteristics are the basis for examining distinctness, uniformity and stability.

2.4.4 In the 1961/1972 and 1978 Acts of the UPOV Convention, Article 6(1)(a) specifies that distinctness is established by a variety being "clearly distinguishable by one or more important characteristics," while Article 6(1)(d) requires it to be stable in its "essential characteristics." Although the term characteristic is not specified in the criteria for uniformity, it is clearly implied that the uniformity requirement relates to the characteristics of the variety, given that they are the basis for distinctness and stability.

2.4.5 In the 1991 Act of the UPOV Convention, Article 8 states that uniformity is assessed on the basis of a variety being "sufficiently uniform in its relevant characteristics," and Article 9 states that a variety is "deemed to be stable if its relevant characteristics remain unchanged after repeated propagation or, in the case of a particular cycle of propagation, at the end of each such cycle." The requirement in Article 1(vi) that a variety "can be distinguished from any other plant grouping by the expression of at least one of the said characteristics" means that a variety must be distinguishable by characteristics.

2.4.6 Chapter 4, "Characteristics Used in DUS Testing," considers the various aspects of characteristics for their use in DUS testing.

2.5 Requirements of Material for DUS testing

2.5.1 Representative Plant Material

The material to be submitted for the examination of DUS should be representative of the candidate variety. In the case of varieties with a particular cycle of propagation, such as hybrid and synthetic varieties, this means that the material tested should include the final stage in the cycle of propagation.

2.5.2 General Health of Submitted Material

The plant material submitted for examination should be visibly healthy, not lacking in vigor or affected by any important pests or diseases and, in the case of seed, should have sufficient germination capacity for the conduct of a satisfactory examination.

2.5.3 Factors That May Affect the Expression of the Characteristics of a Variety

The expression of a characteristic or several characteristics of a variety may be affected by factors, such as pests and disease, chemical treatment (e.g. growth retardants or pesticides), effects of tissue culture, different rootstocks, scions taken from different growth phases of a tree, etc. In some cases (e.g. disease resistance), reaction to certain factors is intentionally used (see Chapter 4, section 4.6.1) as a characteristic in the DUS examination. However, where the factor is not intended for DUS examination, it is important that its influence does not distort the DUS examination. Accordingly, depending on the circumstances, the testing authority should ensure either that:

(a) the varieties under test are all free of such factors or,

(b) that all varieties included in the DUS test, including varieties of common knowledge, are subject to the same factor and that it has an equal effect on all varieties or,

(c) in cases where a satisfactory examination could still be undertaken, the affected characteristics are excluded from the DUS examination unless the true expression of the characteristic of the plant genotype can be determined, notwithstanding the presence of the factor.

CHAPTER 3 – COOPERATION IN DUS TESTING

3.1 Cooperation Between Testing Authorities

3.1.1 Cooperation with other members of the Union can reduce the overall time, expense and number of examiners involved in the DUS tests, and minimize the work involved in the maintenance of variety collections. For details of current international cooperation arrangements and a model administrative agreement for international cooperation in DUS testing, see document TGP/5, "Experience and Cooperation in DUS Testing."

3.1.2 The ultimate form of international cooperation is a "centralized" testing system, on a regional or global basis, where the entire examination is carried out by one authority on behalf of other members of the Union, regardless of the variety concerned or the breeder. This is possible if the environment, whether natural or controlled, is suitable for the examination of all the relevant varieties.

3.2 Cooperation with Breeders

3.2.1 In most countries, variety testing is administered by an official authority, although the breeders participate in the growing tests to varying degrees.

3.2.2 Close cooperation with breeders has always been promoted by UPOV, even in the case of members of the Union with a strict system of government-conducted testing. Some members of the Union have a system whereby breeders are asked to perform the whole test. They are required to conduct the DUS test and produce a test report in accordance with the principles contained in this document. The decision on DUS may be based entirely on the test report supplied by the breeder although the member of the Union may verify the results, for example, by independent examination and publication of the variety description.

3.2.3 UPOV has drawn up a list of conditions for the examination of a variety on the basis of DUS tests carried out by or on behalf of breeders. Details of the conditions are given in document TGP/6, "Arrangements for DUS Testing."

3.2.4 Document TGP/6, "Arrangements for DUS Testing" also gives useful information on the different possibilities of breeder involvement in the growing tests.

CHAPTER 4 – CHARACTERISTICS USED IN DUS TESTING

4.1 Characteristics as the Basis for DUS Testing

The basis for using characteristics for the examination of DUS is explained in Chapter 2, section 2.4. The purpose of this Chapter is to set out the critical aspects of characteristics and their applications.

4.2 Selection of Characteristics

4.2.1 The basic requirements that a characteristic should fulfill before it is used for DUS testing or producing a variety description are that its expression:

(a) results from a given genotype or combination of genotypes
(this requirement is specified in Article 1(vi) of the 1991 Act of the UPOV Convention but is a basic requirement in all cases);

(b) is sufficiently consistent and repeatable in a particular environment;

(c) exhibits sufficient variation between varieties to be able to establish distinctness;

(d) is capable of precise definition and recognition
(this requirement is specified in Article 6 of the 1961/1972 and 1978 Acts of the UPOV Convention, but is a basic requirement in all cases);

(e) allows uniformity requirements to be fulfilled;

(f) allows stability requirements to be fulfilled, meaning that it produces consistent and repeatable results after repeated propagation or, where appropriate, at the end of each cycle of propagation.

4.2.2 It should be noted that there is *no* requirement for a characteristic to have any intrinsic commercial value or merit. However, if a characteristic that is of commercial value or merit satisfies all the criteria for inclusion it may be considered in the normal way.

4.2.3 For inclusion in the Test Guidelines, further criteria are set out in section 4.8, “Functional Categorization of Characteristics” and in document TGP/7, “Development of Test Guidelines.” The characteristics included in the individual Test Guidelines are not necessarily exhaustive and may be expanded with additional characteristics if that proves to be useful and the characteristics meet the conditions set out above.

4.3 States of Expression of Characteristics

To enable varieties to be tested and a variety description to be established, the range of expression of each characteristic in the Test Guidelines is divided into a number of states for the purpose of description, and the wording of each state is attributed a numerical “Note.” The division into states of expression is influenced by the type of expression of the characteristic (see below). Where appropriate (see document TGP/7, “Development of Test Guidelines”), example varieties are provided in the Test Guidelines to clarify the states of expression of a characteristic.

4.4 Types of Expression of Characteristics

To enable the appropriate use of characteristics in DUS testing, it is important to understand the different ways in which characteristics can be expressed. The following section identifies the different types of expression and considers their application in DUS testing.

4.4.1 Qualitative Characteristics

"Qualitative characteristics" are those that are expressed in discontinuous states (e.g. sex of plant: dioecious female (1), dioecious male (2), monoecious unisexual (3), monoecious hermaphrodite (4)). These states are self-explanatory and independently meaningful. All states are necessary to describe the full range of the characteristic, and every form of expression can be described by a single state. The order of states is not important. As a rule, the characteristics are not influenced by environment.

4.4.2 Quantitative Characteristics

"Quantitative characteristics" are those where the expression covers the full range of variation from one extreme to the other. The expression can be recorded on a one-dimensional, continuous or discrete, linear scale. The range of expression is divided into a number of states for the purpose of description (e.g. length of stem: very short (1), short (3), medium (5), long (7), very long (9)). The division seeks to provide, as far as is practical, an even distribution across the scale. The Test Guidelines do not specify the difference needed for distinctness. The states of expression should, however, be meaningful for DUS assessment.

4.4.3 Pseudo-Qualitative Characteristics

In the case of "pseudo-qualitative characteristics," the range of expression is at least partly continuous, but varies in more than one dimension (e.g. shape: ovate (1), elliptic (2), circular (3), obovate (4)) and cannot be adequately described by just defining two ends of a linear range. In a similar way to qualitative (discontinuous) characteristics – hence the term "pseudo-qualitative" – each individual state of expression needs to be identified to adequately describe the range of the characteristic.

4.5 Observation of Characteristics

4.5.1 Trial Design

Where possible and useful, recommendations are given in the Test Guidelines for plot size, sample size, number of replications and the number of independent growing cycles in order that comparable and reliable results may be obtained by the various members of the Union.

4.5.2 Bulk Samples

If it is necessary to examine characteristics in the form of bulk samples, specific guidance is provided in documents TGP/9 "Examining Distinctness" and TGP/10, "Examining Uniformity."

4.6 Special Characteristics

4.6.1 Characteristics Expressed in Response to External Factors

Characteristics based on the response to external factors, such as living organisms (e.g. disease resistance characteristics) or chemicals (e.g. herbicide resistance characteristics), may be used provided that they fulfil the criteria specified in section 4.2. In addition, because of the potential for variation in such factors, it is important for those characteristics to be well defined and an appropriate method established which will ensure consistency in the examination. More details can be found in document TGP/12, "Special Characteristics."

4.6.2 Chemical Constituents

Characteristics based on chemical constituents may be accepted provided they fulfill the criteria specified in section 4.2. It is important for those characteristics to be well defined and an appropriate method established for examination. More details can be found in document TGP/12, "Special Characteristics."

4.6.3 Combined Characteristics

4.6.3.1 A combined characteristic is a simple combination of a small number of characteristics. Provided the combination is biologically meaningful, characteristics that are assessed separately may subsequently be combined, for example the ratio of length to width, to produce such a combined characteristic. Combined characteristics must be examined for distinctness, uniformity and stability to the same extent as other characteristics. In some cases, these combined characteristics are examined by means of techniques, such as Image Analysis. In these cases, the methods for appropriate examination of DUS are specified in document TGP/12, "Special Characteristics."

4.6.3.2 Combined characteristics are not to be confused with the application of methods, such as "multivariate analysis." The potential for use of multivariate analysis is considered in document TGP/9, "Examining Distinctness."

4.7 New Types of Characteristics

The use of new types of characteristics, including the possible use of molecular characteristics, is considered in document TGP/15, "New Types of Characteristics."

4.8 Functional Categorization of Characteristics

The following table categorizes the way in which characteristics can be used in the examination and the appropriate criteria.

TABLE. FUNCTIONAL CATEGORIES OF CHARACTERISTICS

Type	Function	Criteria
Standard Test Guidelines Characteristic	1. Characteristics that are accepted by UPOV for examination of DUS and from which members of the Union can select those suitable for their particular circumstances.	1. Must satisfy the criteria for use of any characteristic for DUS as set out in Chapter 4, section 4.2. 2. Must have been used to develop a variety description by at least one member of the Union. 3. Where there is a long list of such characteristics and, where considered appropriate, there may be an indication of the extent of use of each characteristic.
Asterisked Characteristic	1. Characteristics that are important for the international harmonization of variety descriptions.	1. Must be a characteristic included in the Test Guidelines. 2. Should always be examined for DUS and included in the variety description by all members of the Union except when the state of expression of a preceding characteristic or regional environmental conditions render this inappropriate. 3. Must be useful for function 1. 4. Particular care should be taken before selection of disease resistance characteristics.
Grouping Characteristic	1. Characteristics in which the documented states of expression, even where recorded at different locations, can be used to select, either individually or in combination with other such characteristics, varieties of common knowledge that can be excluded from the growing trial used for examination of distinctness. 2. Characteristics in which the documented states of expression, even where recorded at different locations, can be used, either individually or in combination with other such characteristics, to organize the growing trial so that similar varieties are grouped together.	1. (a) Qualitative characteristics or (b) Quantitative or pseudo-qualitative characteristics which provide useful discrimination between the varieties of common knowledge from documented states of expression recorded at different locations. 2. Must be useful for functions 1 and 2. 3. Should be an asterisked characteristic and/or included in the Technical Questionnaire or application form.
Additional Characteristic	1. To identify new characteristics, not included in the Test Guidelines, that have been used by members of the Union in the examination of DUS and which should be considered for inclusion in future Test Guidelines. 2. To facilitate harmonization in the development and use of new characteristics and provide opportunity for expert review.	1. Must satisfy the criteria for use of any characteristic for DUS as set out in Chapter 4, section 4.2 and evidence for this must be available from the submitting member of the Union. 2. Must have been used to establish DUS in at least one member of the Union. 3. Such characteristics should be submitted to UPOV for inclusion in document TGP/5, “Experience and Cooperation in DUS Testing.”

CHAPTER 5 – EXAMINING DISTINCTNESS

5.1 Requirements of the UPOV Convention

According to the UPOV Convention (Article 6 of the 1961/1972 and 1978 Acts, and Article 7 of the 1991 Act), to satisfy the requirement of distinctness, a variety must be clearly distinguishable from any other variety whose existence is a matter of common knowledge.

5.2 Varieties of Common Knowledge

Key aspects for determining whether a potential variety is, in fact, a variety and moreover whether its existence is a matter of common knowledge are set out below. These considerations apply equally to all types of variety, whether protected or not, and include plant material, such as ecotypes and landraces. Further developments and a more detailed explanation of the issues related to varieties of common knowledge are to be found in document TGP/3, "Varieties of Common Knowledge."

5.2.1 Criteria for a Variety

A variety whose existence is a matter of common knowledge must satisfy the definition of a variety set out in Article 1(vi) of the 1991 Act of the UPOV Convention, but this does not necessarily require fulfillment of the DUS criteria required for grant of a breeder's right under the UPOV Convention.

5.2.2 Common Knowledge

5.2.2.1 Specific aspects which should be considered to establish common knowledge include, among others:

(a) commercialization of propagating or harvested material of the variety, or publishing a detailed description;

(b) the filing of an application for the grant of a breeder's right or for the entering of a variety in an official register of varieties, in any country, which is deemed to render that variety a matter of common knowledge from the date of the application, provided that the application leads to the grant of a breeder's right or to the entering of the variety in the official register of varieties, as the case may be;

(c) existence of living plant material in publicly accessible plant collections.

5.2.2.2 Common knowledge is not restricted to national or geographical borders.

5.3 Clearly Distinguishing a New Variety

5.3.1 Comparing Varieties

5.3.1.1 It is necessary to examine distinctness in relation to all varieties of common knowledge. However, a systematic individual comparison may not be required with all varieties of common knowledge. For example, where a candidate variety is sufficiently different, in the expression of its characteristics, to ensure that it is distinct from a particular group (or groups) of varieties of common knowledge, it would not be necessary for a systematic individual comparison with the varieties in that group (or those groups).

5.3.1.2 In addition, certain supplementary procedures may be developed to avoid the need for a systematic individual comparison. For example, the publication of variety descriptions, inviting comment from interested parties, or cooperation between members of the Union, in the form of an exchange of technical information, could be considered as supplementary procedures. However, such an approach would only be possible where the supplementary procedures, in conjunction with the other procedures, provide an effective examination of distinctness overall. Such procedures may also be appropriate for consideration of varieties of common knowledge, for which living plant material is known to exist (see section 5.2.2) but where, for practical reasons, material is not readily accessible for examination. Any such procedures are set out in document TGP/9, "Examining Distinctness."

5.3.1.3 Further, where a candidate variety can be distinguished in a reliable way from varieties of common knowledge, by comparing documented descriptions, it is not necessary to include those varieties of common knowledge in a growing trial with the respective candidate variety. However, where there is no possibility of clearly distinguishing them from the candidate variety, the varieties should be compared with the candidate variety in a growing trial or other appropriate test. This emphasizes the importance of harmonization of variety descriptions in minimizing the workload of the DUS examiner.

5.3.1.4 To help in the process of examining varieties, certain information is requested from the breeder, usually through a Technical Questionnaire to be submitted with the application. The model Technical Questionnaire, included in the Test Guidelines, seeks information on specific characteristics of importance for distinguishing varieties, information on the breeding scheme of the variety and any other information which may help to distinguish the variety. It also requests the breeder to identify similar varieties and characteristics by which the candidate may be distinguished from these similar varieties.

5.3.1.5 Guidance for the management of variety collections is given in detail in document TGP/4, "Management of Variety Collections."

5.3.2 Clearly Distinguishing Varieties Using Characteristics

The basis for using characteristics in the examination of distinctness is explained in Chapter 2, section 2.4.

5.3.3 The Criteria for Distinctness Using Characteristics

The UPOV Convention does not elaborate the term "clearly distinguishable." However, in order to provide some guidance on the interpretation of the term, the following basis has been developed for the use of characteristics to clearly distinguish varieties. A variety may be considered to be clearly distinguishable if the difference in characteristics is:

(a) consistent, and
(b) clear.

5.3.3.1 Consistent Differences

5.3.3.1.1 One means of ensuring that a difference in a characteristic, observed in a growing trial, is sufficiently consistent is to examine the characteristic on at least two independent occasions. This can be achieved in both annual and perennial varieties by observations made on plantings in two different seasons or, in the case of other perennial varieties, by observations made in two different seasons after a single planting. Guidance on the possible use of other approaches, such as two different environments in the same year, is explored in document TGP/9, "Examining Distinctness."

5.3.3.1.2 However, in some circumstances the influence of the environment is not such that a second growing cycle is required to provide assurance that the differences observed between varieties are sufficiently consistent. For example, if the growing conditions of the crop are controlled, such as in a greenhouse with regulated temperature and light, it may not be necessary to observe two growing cycles. In addition, the differences observed between varieties could be so clear that a second growing cycle may not be necessary. In both these circumstances, the features of propagation of the variety and the quality of the plant material will need to be taken into account.

5.3.3.1.3 The individual Test Guidelines specify whether several independent growing cycles are required to show sufficient consistency, or whether, for certain species, the growing test could be made in one growing cycle.

5.3.3.2 Clear Differences

Determining whether a difference between two varieties is clear depends on many factors, and should consider, in particular, the type of expression of the characteristic (Chapter 4, section 4.4) being examined, i.e. whether it is expressed in a qualitative, quantitative, or pseudo-qualitative manner.

5.3.3.2.1 Qualitative Characteristics

In qualitative characteristics, the difference between two varieties may be considered clear if one or more characteristics have expressions that fall into two different states in the Test Guidelines. Varieties should not be considered distinct for a qualitative characteristic if they have the same state of expression.

5.3.3.2.2 Quantitative Characteristics

Quantitative characteristics are considered for distinctness according to the method of observation and the features of propagation of the variety concerned. The different approaches are considered later in this Chapter.

5.3.3.2.3 Pseudo-Qualitative Characteristics

A different state in the Test Guidelines may not be sufficient to establish distinctness (see also section 5.5.2.3). However, in certain circumstances, varieties described by the same state of expression may be clearly distinguishable.

5.3.3.3 Use of Parental Formula for Distinctness in Hybrid Varieties

Document TGP/9, “Examining Distinctness” provides guidance for the possible use of parental formulae in the examination of DUS of hybrid varieties.

5.3.3.4 Level of Uniformity

A difference only in the level of uniformity of a characteristic, without any resultant change in the overall expression of the characteristic in the variety, is not a basis for establishing distinctness.

5.4 Interpretation of Observations for the Assessment of Distinctness Without the Application of Statistical Methods

5.4.1 In cases where there is very little variation within varieties, the determination of distinctness is usually on the basis of a visual assessment, rather than by statistical methods.

5.4.2 As explained in section 5.3.3.2.1, "Qualitative Characteristics," for such characteristics the difference between two varieties may be considered clear if one or more characteristics have expressions that fall into two different states in the Test Guidelines.

5.4.3 For quantitative characteristics, a difference of two Notes often represents a clear difference, but that is not an absolute standard for assessment of distinctness. Depending on factors, such as the testing place, the year, environmental variation or range of expression in the variety collection, a clear difference may be more or less than two Notes. Guidance is provided in document TGP/9, "Examining Distinctness."

5.4.4 In the case of pseudo-qualitative characteristics, guidance for the interpretation of observations for the assessment of distinctness without the application of statistical methods, is provided in document TGP/9, "Examining Distinctness."

5.4.5 If the application of statistics is needed to assess distinctness, further guidance can be found in document TGP/9, "Examining Distinctness."

5.5 Interpretation of Observations for the Assessment of Distinctness with the Application of Statistical Methods

5.5.1 General

5.5.1.1 For measured characteristics as well as for visually assessed characteristics statistical methods can be applied. Appropriate methods have to be chosen for the interpretation of observations. The data structure and the type of scale from a statistical point of view (nominal, ordinal, interval or ratio) is decisive for the choice of appropriate methods. The data structure depends on the method of assessment (visual assessment or measurements, observation of plots or single plants) which is influenced by the type of characteristic, the features of propagation of the variety, the experimental design and other factors. DUS examiners should be aware of certain basic rules of statistics and especially the fact that their use is linked to mathematical assumptions and the use of experimental design practices, such as randomization. Therefore, those assumptions should be verified before applying statistical methods. Some statistical methods are quite robust, however, and can be used, with some caution, even if some assumptions are not fully met.

5.5.1.2 Document TGP/8, "Use of Statistical Procedures in DUS Testing," provides guidance on some appropriate statistical procedures for DUS assessment and includes keys for the choice of methods in relation to the data structure.

5.5.1.3 A combined characteristic should only be used for distinctness if the uniformity criteria for the combined characteristic itself, and not only its components, have been satisfied.

5.5.2 Visually Assessed Characteristics

Non-parametric statistics may be used when visually assessed characteristics have been recorded on a scale that does not fulfill the assumptions of the usual parametric statistics. The calculation of the mean value, for example, is only permitted if the Notes are taken on a graded scale

which shows equal intervals throughout the scale. In the case of non-parametric procedures, the use of a scale that has been established on the basis of example varieties representative of the different states of the characteristics is recommended. The same variety should then always receive about the same Note and thereby facilitate the interpretation of data. More details on the handling of visually assessed characteristics are given in document TGP/9, "Examining Distinctness."

5.5.2.1 Qualitative Characteristics

For visually assessed qualitative characteristics, different states of expression in direct comparisons are generally sufficient to assess distinctness. In most cases, therefore, no statistical methods are needed for the interpretation of the results.

5.5.2.2 Quantitative Characteristics

5.5.2.2.1 Quantitative characteristics are not necessarily assessed by measuring or counting and can be assessed visually. Where there is doubt regarding the use of a normally visually assessed quantitative characteristic as the distinguishing characteristic in relation to another variety, it should be measured, if that is possible with reasonable effort.

5.5.2.2.2 A direct comparison between two similar varieties is always recommended, since direct pairwise comparisons are the most reliable. In each comparison, a difference between two varieties is acceptable as soon as it can be assessed visually and could be measured, although such measurement might be impractical or require unreasonable effort.

5.5.2.2.3 The simplest case for establishing distinctness is when clear differences between varieties, in pair-wise comparisons, are of the same sign, provided these differences can be expected to recur in subsequent trials (e.g. variety A is consistently and sufficiently greater than B) and there are a sufficient number of comparisons. However, in most cases, establishing confidence that varieties are clearly distinguishable, is more complex. This is explained further in document TGP/9, "Examining Distinctness."

5.5.2.2.4 For more details on the handling of visually observed characteristics when assessing distinctness, see document TGP/9, "Examining Distinctness."

5.5.2.3 Pseudo-Qualitative Characteristics

The use of statistics for the assessment of pseudo-qualitative characteristics depends on the individual case, and no general recommendation can be made.

5.5.3 Measured Characteristics

The following paragraphs provide guidance on the typical methods for examining distinctness according to the particular features of propagation of the variety:

5.5.3.1 Self-Pollinated and Vegetatively Propagated Varieties

UPOV has endorsed several statistical methods for the handling of measured quantitative characteristics. One method established for self-pollinated and vegetatively propagated varieties is that varieties can be considered clearly distinguishable if the difference between two varieties equals or exceeds the Least Significant Difference (LSD) at a specified probability level with the same sign over an appropriate period, even if they are described by the same state of expression. This is a relatively simple method but is considered appropriate for self-pollinated and vegetatively propagated

varieties because the level of variation within such varieties is relatively low. Further details are provided in document TGP/9, "Examining Distinctness."

5.5.3.2 Cross-Pollinated Varieties

5.5.3.2.1 COYD

UPOV has developed a method known as the Combined Over Years Distinctness (COYD) analysis, which takes into account variations between years. Its main use is for cross-pollinated, including synthetic, varieties but, if desired, it can also be used for self-pollinated and vegetatively propagated varieties in certain circumstances. This method requires the size of the differences to be sufficiently consistent over the years and takes into account the variation between years. It is explained further in document TGP/9, "Examining Distinctness."

5.5.3.2.2 Refined COYD

A refinement to the COYD analysis, which is also provided, should be used to adjust the COYD analysis when environmental conditions cause a significant change in the spacing between variety means in a year, such as when a late spring causes the convergence of heading dates. It is supplemented by a further LSD method for cases where few varieties in the growing tests lead to less than about 20 degrees of freedom for the estimation of standard error.

5.5.3.2.3 Non-Parametric Procedures

Where COYD analysis cannot be used because the statistical criteria are not fulfilled, non-parametric procedures can be considered.

5.5.3.3 Further Guidance

For more details on the handling of measured quantitative characteristics, see document TGP/9, "Examining Distinctness."

5.6 General Guidelines for Determining Distinctness

Individual Members of the Union may develop their own systematic way of determining distinctness, based on the principles laid down in this document. The same general guidance on determining distinctness is applicable across many Test Guidelines and, for this reason, the general guidance is developed in a separate document TGP/9, "Examining Distinctness" and not reproduced in the individual Test Guidelines.

CHAPTER 6 – EXAMINING UNIFORMITY

6.1 Requirements of the UPOV Convention

According to Article 6(1)(c) of the 1961/1972 and 1978 Acts of the UPOV Convention, a variety is deemed uniform if it is "sufficiently homogeneous, having regard to the particular features of its sexual reproduction or vegetative propagation." Article 8 of the 1991 Act deems that a variety is uniform if, "subject to the variation that may be expected from the particular features of its propagation, it is sufficiently uniform in its relevant characteristics," thereby making it clear that characteristics are the basis for examination of uniformity.

6.2 Relevant Characteristics

At least for the purposes of the 1991 Act of the UPOV Convention it is necessary to clarify the meaning of relevant characteristics. Relevant characteristics of a variety include at least all characteristics used for the examination of DUS or included in the variety description established at the date of grant of protection of that variety. Therefore, any obvious characteristic may be considered relevant, irrespective of whether it appears in the Test Guidelines or not.

6.3 Level of Uniformity According to the Particular Features of Propagation

The UPOV Convention links the uniformity requirement for a variety to the particular features of its propagation. This means that the level of uniformity required for truly self-pollinated varieties, mainly self-pollinated varieties, inbred lines of hybrid varieties, vegetatively propagated varieties, cross-pollinated varieties, mainly cross-pollinated varieties, synthetic varieties and hybrid varieties will, in general, be different.

6.4 Methods for the Examination of Uniformity

Where all the plants of a variety are very similar, and in particular for vegetatively propagated and self-pollinated varieties, it is possible to assess uniformity by the number of obviously different plants – "off-types" – that occur. However, where the range of variation within a variety is larger, because of the features of its propagation, and in particular for cross-pollinated, including synthetic, varieties, the plants are not all very similar and it is not possible to visualize which plants should be considered as atypical or "off-types." In this case the uniformity can be assessed by considering the overall range of variation, observed across all the individual plants, to determine whether it is similar to comparable varieties. These two general approaches are explained below:

6.4.1 Self-Pollinated and Vegetatively Propagated Varieties

6.4.1.1 Determination of Off-Types by Visual Assessment

A plant is to be considered an off-type if it can be clearly distinguished from the variety in the expression of any characteristic of the whole or part of the plant that is used in the testing of distinctness, taking into consideration the particular features of its propagation. This definition makes it clear that, in the assessment of uniformity, the standard for distinctness between off-types and a candidate variety is the same as for distinctness between a candidate variety and other varieties (see Chapter 5, section 5.5.2).

6.4.1.2 Determination of Off-Types Using Measurements

Most characteristics of self-pollinated and vegetatively propagated varieties are observed visually, or by making a single measurement in a group of plants. However, where appropriate, methods of handling measurements from individual plants, in order to assess off-types in truly or mainly self-pollinated varieties and vegetatively propagated varieties, are set out in document TGP/10, "Examining Uniformity."

6.4.1.3 Statistical Basis for Setting Numbers of Off-Types

The acceptable number of off-types tolerated in samples of various sizes is often based on a fixed "population standard" and "acceptance probability." The "population standard" can be expressed as the percentage of off-types to be accepted if all individuals of the variety could be examined. The probability of correctly accepting that a variety is uniform is called the "acceptance probability." Based on statistical calculations for "population standards" and "acceptance probabilities," the recommended "population standard" and "acceptance probability" are stated in the individual Test Guidelines. The Test Guidelines also recommend the maximum number of off-types tolerated for a given sample size. More detailed information can be found in document TGP/10, "Examining Uniformity."

6.4.1.3.1 Vegetatively Propagated and Truly Self-Pollinated Varieties

Document TGP/10, "Examining Uniformity," sets out the acceptable number of off-types tolerated in samples of various sizes based on a specified "population standard" and "acceptance probability."

6.4.1.3.2 Mainly Self-Pollinated Varieties and Inbred Lines of Hybrid Varieties

For the purpose of DUS testing, mainly self-pollinated varieties are those that are not fully self-pollinated but are treated as self-pollinated for testing. For these, as well as for inbred lines of hybrid varieties, a higher tolerance of off-types can be accepted, compared to truly self-pollinated and vegetatively propagated varieties. This is explained further in document TGP/10, "Examining Uniformity."

6.4.2 Cross-Pollinated Varieties

Cross-pollinated varieties, including mainly cross-pollinated and synthetic varieties, generally exhibit wider variations within the variety than vegetatively propagated or self-pollinated varieties and inbred lines of hybrid varieties, and it is more difficult to determine off-types. Therefore, relative tolerance limits, for the range of variation, are set by comparison with comparable varieties, or types, already known. This means that the candidate variety should not be significantly less uniform than the comparable varieties. For more detailed information and guidance on setting standards for new types and species, see documents TGP/10, "Examining Uniformity" and TGP/13, "Guidance for New Types and Species."

6.4.2.1 Visually Observed Characteristics

For characteristics that are recorded by visual observation of single plants, the acceptable level of variation for the variety should not significantly exceed the level of variation found in comparable varieties already known. For more details on the handling of uniformity of visually assessed characteristics, see document TGP/10, "Examining Uniformity."

6.4.2.2 Measured Characteristics

6.4.2.2.1 For measured characteristics, the acceptable level of variation for the variety should not significantly exceed the level of variation found in comparable varieties already known. UPOV has proposed several statistical methods for dealing with uniformity in measured quantitative characteristics. One method, which takes into account variations between years, is the Combined Over Years Uniformity (COYU) method.

6.4.2.2.2 For more details on the handling of uniformity in measured quantitative characteristics, see document TGP/10, "Examining Uniformity."

6.4.3 Assessment of Uniformity in Hybrid Varieties

6.4.3.1 General

6.4.3.1.1 The assessment of uniformity in hybrid varieties depends on the type of hybrid, i.e. whether it is a single-cross hybrid or another type, and whether it is a hybrid resulting from inbred parent lines, vegetatively propagated lines, or from cross-pollinated parents.

6.4.3.1.2 The uniformity and stability of a hybrid variety may be assessed by examining the uniformity and stability of the hybrid itself or, under certain conditions, that of the progenitors and the hybrid.

6.4.3.2 Single-Cross Hybrid Varieties Resulting from Inbred Parent Lines

Single-cross hybrid varieties resulting from inbred lines are treated as mainly self-pollinated varieties. However, an additional tolerance is allowed for the occurrence of self-pollinated inbred parent plants. It is not possible to fix a percentage, as decisions differ according to the species and the method of propagation. However, the percentage of such plants should not be so high as to interfere with the trials. Where appropriate, a maximum number will be set in the Test Guidelines.

6.4.3.3 Single-Cross Hybrid Varieties Not Resulting Exclusively From Inbred Parent Lines

For hybrid varieties resulting from at least one cross-pollinated parent, relative tolerance limits should be used, and they should be treated as cross-pollinated or synthetic varieties as long as no other proof is given.

6.4.3.4 Multiple-Cross Hybrid Varieties

6.4.3.4.1 For other than single-cross hybrids (e.g. three-way crosses or double crosses), a segregation of certain characteristics is acceptable if it is compatible with the method of propagation of the variety. Therefore, if the heredity of a clear-cut segregating characteristic is known, it is required to behave in the predicted manner. If the heredity of the characteristic is not known, it is treated in the same way as other characteristics in cross-pollinated varieties, i.e. relative tolerance limits, for the range of variation, are set by comparison with comparable varieties, or types, already known (see section 6.4.2).

6.4.3.4.2 For setting a tolerance for the occurrence of self-pollinated parent plants, the same considerations apply as for a single-cross hybrid variety (see section 6.4.3.2).

6.5 Unrelated and Very Atypical Plants

The test material may contain plants that are very atypical or unrelated to those of the variety. These are not necessarily treated as off-types, or part of the variety, and may be disregarded, and the test may be continued, as long as the removal of these very atypical or unrelated plants does not result in an insufficient number of suitable plants for the examination, or make the examination impractical. In choosing the term "may be disregarded," UPOV makes it clear that it will depend on the judgment of the crop expert. In practice, in tests conducted with a small number of plants, just one single plant could interfere with the test, and therefore should not be disregarded.

CHAPTER 7 – EXAMINING STABILITY

7.1 Requirements of the UPOV Convention

Article 6 (1)(d) of the 1961/1972 and 1978 Acts of the UPOV Convention require that a variety "must be stable in its essential characteristics, that is to say, it must remain true to its description after repeated reproduction or propagation or, where the breeder has defined a particular cycle of reproduction or multiplication, at the end of each cycle." Similarly, Article 9 of the 1991 Act of the UPOV Convention requires that a variety "shall be deemed to be stable if its relevant characteristics remain unchanged after repeated propagation or, in the case of a particular cycle of propagation, at the end of each such cycle."

7.2 Relevant / Essential Characteristics

The relevant or essential characteristics include at least all characteristics used for the examination of DUS or included in the variety description established at the date of grant of protection of that variety. Therefore, all obvious characteristics may be considered, irrespective of whether they appear in the Test Guidelines or not.

7.3 Methods for the Examination of Stability

7.3.1 General

7.3.1.1 In practice, it is not usual to perform tests of stability that produce results as certain as those of the testing of distinctness and uniformity. However, experience has demonstrated that, for many types of variety, when a variety has been shown to be uniform, it can also be considered to be stable. Furthermore, if the variety is not stable, material produced will not conform to the characteristics of the variety, and where the breeder is unable to provide material conforming to the characteristics of the variety, the breeder's right may be cancelled.

7.3.1.2 Where appropriate, or in cases of doubt, stability may be 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 material supplied. Further guidance on the examination of stability is considered in document TGP/11, "Examining Stability."

7.3.2 Hybrid Varieties

The stability of a hybrid variety may, in addition to an examination of the hybrid variety itself, also be assessed by examination of the uniformity and stability of its parent lines.

CHAPTER 8 – COMPOSITION OF TEST GUIDELINES

8.1 Coverage of Individual Test Guidelines

In most cases, individual Test Guidelines are prepared for each species although, in some cases, it may be appropriate to prepare Test Guidelines covering a wider or narrower grouping of varieties. Different groups of varieties within a species can be dealt with in separate or subdivided Test Guidelines if the categories can be reliably separated on the basis of characteristics suitable for distinctness, or where an appropriate procedure has been developed to ensure that all varieties of common knowledge will be adequately considered for distinctness (see also Chapter 5, section 5.3.1). Where appropriate, such procedures are explained in document TGP/9, "Examining Distinctness."

8.2 Development of Test Guidelines

8.2.1 The individual Test Guidelines are prepared or, where appropriate, revised according to the procedures set out in document TGP/7, "Development of Test Guidelines." Once prepared by the appropriate Technical Working Party for the species concerned, a draft is sent for comments to the relevant international professional organizations and institutions working in the field of the species concerned. On the basis of the comments received, the draft Test Guidelines are finalized by the Technical Working Party concerned and presented to the UPOV Technical Committee for final adoption and publication.

8.2.2 Document TGP/2, "List of Test Guidelines Adopted by UPOV," contains a list of all Test Guidelines adopted by UPOV.

CHAPTER 9 – CONDUCT OF DUS TESTING IN THE ABSENCE OF TEST GUIDELINES

9.1 Introduction

A number of Test Guidelines have been developed and there are continual additions, an up-to-date list of which is provided in document TGP/2, "List of Test Guidelines Adopted by UPOV." However, UPOV recommends the following procedure to provide guidance on the testing of distinctness, uniformity and stability where there are no Test Guidelines for a given species.

9.2 DUS Testing Experience of Other Members of the Union

9.2.1 The examining office is invited to consult document TGP/5, "Experience and Cooperation in DUS Testing," to ascertain whether other UPOV members of the Union have already conducted DUS testing on the required species or have national test guidelines.

9.2.2 Where such experience is available or national test guidelines exist, countries are invited to approach the members of the Union concerned and, in accordance with the principles in the General Introduction, seek to harmonize their testing procedures as far as possible. As a next step, the members of the Union concerned are invited to inform UPOV of the existence of the harmonized testing procedure, according to the measures provided in document TGP/5, "Experience and Cooperation in DUS Testing," or, if appropriate, recommend that UPOV prepare Test Guidelines for the species concerned.

9.3 DUS Testing Procedures for New Species or Variety Groupings

9.3.1 Where neither practical testing experience nor national test guidelines are available in other countries for the species or variety grouping concerned, members of the Union should develop their own testing procedures as set out below.

9.3.2 When developing such testing procedures, offices are encouraged to align them on the principles set forth in this General Introduction, by following this document and the guidance for the development of Test Guidelines contained in document TGP/7, "Development of Test Guidelines."

9.3.3 The testing procedure should be documented, in accordance with the requirements of Test Guidelines, to the extent that experience and information permit.

9.3.4 The office should then inform UPOV of these developments according to the measures provided in document TGP/5, "Experience and Cooperation in DUS Testing," so that the information can then be passed on to all members of the Union and consideration can be given to the development of Test Guidelines.

[Annex follows]

ANNEX – ASSOCIATED DOCUMENTS

Document reference	Title
TGP/0	List of TGP Documents and Latest Issue Dates
TGP/1	General Introduction With Explanations
TGP/2	List of Test Guidelines Adopted by UPOV
TGP/3	Varieties of Common Knowledge
TGP/4	Management of Variety Collections
TGP/5	Experience and Cooperation in DUS Testing
TGP/6	Arrangements for DUS Testing
TGP/7	Development of Test Guidelines
TGP/8	Use of Statistical Procedures in DUS Testing
TGP/9	Examining Distinctness
TGP/10	Examining Uniformity
TGP/11	Examining Stability
TGP/12	Special Characteristics
TGP/13	Guidance for New Types and Species
TGP/14	Glossary of Technical, Botanical and Statistical Terms Used in UPOV Documents
TGP/15	New Types of Characteristics

[End of Annex and of document]