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DATE: March 6, 2000

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

TECHNICAL COMMITTEE

Thirty-Sixth Session
Geneva, April 3 to 5, 2000

DRAFTS OR OUTLINES FOR
DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION
TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND
STABILITY IN NEW VARIETIES OF PLANTS

Document compiled by the Office of the Union

1. During the last sessions of the different Technical Working Parties experts from the different Technical Working Parties offered to prepare one or several drafts for documents completing the draft for the general introduction to the assessment of distinctness, uniformity and stability in new varieties of plants as laid down in document TC/36/6.

2. Although it was agreed that the drafts would be prepared in the first instance as discussion papers for the next session of the respective Technical Working Party, it was agreed that the drafts would be ready before the end of January 2000 and also submitted to the Technical Committee for information to get an idea on what can be expected in that collection and on what further documents may be needed.

3. It is therefore not proposed that details of those documents be discussed in the Technical Committee but those discussions are planned to be held first in the Technical Working Parties.

4. The Technical Committee may, however, wish to express itself on the general structure and on whether some important subjects are missing in this collection or whether others included should better be taken out.

5. It is stressed that many of the attached drafts have only been prepared shortly before the printing of this document and that they have not been discussed in any UPOV body. Therefore the drafts represent only the opinion of the author and not the opinion of an UPOV Technical Working Party or of the UPOV Technical Committee.

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DRAFT FOR TGP/00
DATE:

UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
GENEVA

DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/00: LIST OF TGP DOCUMENTS AND LATEST ISSUE AND LIST OF ADDITIONAL DOCUMENTS CITED IN INDIVIDUAL TGP DOCUMENTS

LIST OF ADDITIONAL DOCUMENTS CITED IN THIS DOCUMENT

TC/36/6: Draft Revised Working Document for a New General Introduction to the Assessment of Distinctness, Uniformity and Stability in New Varieties of Plants

http://www.upov.int/eng/document/index: List of Adopted Test Guidelines

C/32/5: Cooperation in Examination

TC/36/5: Establishment of Tables of Characteristics in UPOV Test Guidelines, Harmonization of Characteristics and States of Expression

http://www.bioss.sari.ac.uk/upov//upemail.html: E-mail addresses of Technical Experts

TC/32/4: Sequential Analysis

TC/35/14: Harmonization of Terms and Drawings for Plane Shapes and Solid Shapes Used in the UPOV Test Guidelines

TWF/29/3: Some Observations and Suggestions on the Use of Explanatory Diagrams in Fruit Guidelines

TC/33/9: Harmonization of States of Expression and Notes of Characteristics Appearing in the UPOV Test Guidelines

TC/33/7: Combined-Over-Years Distinctness and Uniformity Criterion

TWC/15/17: Distinctness, Uniformity and Stability Trial Analysis System for Windows (DUSTW)

TC/34/5 Rev.: Testing of Uniformity of Self-Fertilized and Vegetatively Propagated Species Using Off-types

TWO/27/3: Grouping of Colors of the RHS Colour Chart

BMT/3/2: Identification Methods Based on Molecular Techniques

TWC/14/14: Similarity, Clustering and Dendrograms

TC/32/6: Level of Involvement of the Applicant in the Growing Tests

DRAFTS OR OUTLINES FOR
DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION
TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND
STABILITY IN NEW VARIETIES OF PLANTS

PLANNED DOCUMENT	PRESENT DOCUMENT	TITLE
TG/00	Annex of TC/36/6	List of TGP Documents and Latest Issue Dates
TGP/1	TC/36/6	General Introduction With Explanations
TGP/2	http://www.upov.int/eng/document/index or TC/36/2, Annex	List of Test Guidelines Adopted by UPOV
TGP/3		Varieties of Common Knowledge
(a):		The Concept of Varieties of Common Knowlege
(b):		The Notion of Breeder
TGP/4		Management of Reference Collections
(a):		General Management
(b):	To be prepared	Use of Hybrid Parentage in DUS Assessment
TGP/5		Available Knowledge on DUS Testing, Cooperation in Examination
(a):	C/32/5	Cooperation in Examination
(b):		Model Administrative Agreement for International Cooperation in the Testing of Varieties
(c):		UPOV Report on Technical Examination and UPOV Variety Description
(d):	TC/36/4	Notification of National Test Guidelines for Species for Which no UPOV Test Guidelines Exist List of Species in Which Practical Technical Knowledge has Been Acquired or for Which National Guidelines Have Been Established and E-mail Addresses
(e):	File to be prepared on the Website	Notification of Routine Characteristics not Included in UPOV Test Guidelines
(f):	http://www.bioss.sari.ac.uk/upov//upemail.html	E-mail addresses of Technical Experts
TGP/6		DUS Testing Done by the Applicant/Breeder
(a):	To be prepared	Practical Application
(b):		Conditions for the Examination of a Variety Based on Trials Carried Out by or on Behalf of Breeders
(c):	TC/32/4	Level of Involvement of the Applicant in the Growing Test

PLANNED DOCUMENT	PRESENT DOCUMENT	TITLE
TGP/7	TC/36/5	Establishing of Tables of Characteristics in UPOV Test Guidelines
	TC/33/9	Vocabulary for states of expression
TGP/8		Good Statistical Practices for DUS Assessment
(a):	To be prepared	Chapter I: measured data, checking of the truth of the assumptions, actions and methods when those assumptions were not proved true
(b):	To be prepared	Chapter II: outliers, adequate randomization, one tail and two tail distributions, sufficient replications and number of plants for individual plant recording
(c):	To be prepared	Chapter III: COY approach
TGP/9		Testing Distinctness
(a):	To be prepared by TWC	Without the application of statistical methods
(b):		With the application of statistical methods
(b1):	To be prepared by TWC	Visually Assessed Characteristics
		(i) Qualitative Characteristics (non-parametric methods)
		(ii) Pseudo-qualitative Characteristics (one observation per plant, per plot/row)
		(iii) Quantitative Characteristics (one observation per plant, per plot/row)
(b2):		Measured Characteristics
	To be prepared by TWC	(i) Self-fertilized and Vegetatively Propagated Species (LSD, other methods)
		(ii) Cross-fertilized Species
	TC/33/7	Combined-over-years Distinctness Criterion (COY)
	To be prepared	Summary on COYD
	TWC/15/17	Distinctness, Uniformity and Stability Trial Analysis System for Windows (DUSTW)
	http://www.bioss.sari.ac.uk/upov//pdus/coyd/sl/intro.htm	Screen-based Input Module for COYD
	To be prepared on the Website	Computer-generated Demonstration of COYD
	To be prepared	DUSTNT Computer Program
(c):	Other methods still to be listed by TWC	Application of Statistics in Non-randomized Plots

PLANNED DOCUMENT	PRESENT DOCUMENT	TITLE
TGP/10		Testing of Uniformity
(a):	To be prepared	Without the Application of Statistical Methods
(b):		With the Application of Statistical Methods
(b1):	To be prepared	Visually Assessed Characteristics
		(i) Qualitative Characteristics (one observation per plant)
		(ii) Pseudo-qualitative characteristics (one observation per plant)
		(iii) Quantitative Characteristics (one observation per plant)
(b2):		Measured Characteristics
	TC/34/5 Rev.	(i) Self-fertilized and Vegetatively Propagated Species
	TC/33/7 http://www.bioss.sari.ac.uk upov//pdus/coyu/sl/intro.htm	(ii) Cross-fertilized Species (COYU and Website)
TGP/11		Observation of Colors
(a):	To be prepared by TWO	Use of Color Charts, Connection, Munsel, etc. HCC, Color Pictures, no Use of Colorimeter
	To be prepared	Correspondence Between Different Color Charts, RHS Colour Chart, Japanese Color Standard for Horticultural Plants (JHS)
(b):		Grouping of Colors of the RHS Colour Chart
(c):		Standardization of Pictures
TGP/12		Non-traditional Non-morphological Characteristics and Methods for Variety Testing
(a):	To be prepared by TWC, TWF, TWO, TWV	Biochemical Characteristics, Electrophoresis, Molecular Marker, Digital Images, etc.
(b):		Image Analysis
(c):	BMT/3/2	Identification Methods Based on Molecular Techniques
(d):		Resistance to Diseases
(e):		DUS Assessment of Bulk Samples
(f):	To be prepared	Combining Characteristics in DUS Assessment
TGP/13		Relative Uniformity, Comparable Varieties, Guidance for New Types
(a):		Relative Uniformity, Comparable Varieties, Guidance for New Types
(b):		DUS Testing of New Species

PLANNED DOCUMENT	PRESENT DOCUMENT	TITLE
TGP/14		Other Statistical Methods
(a):	TWC/14/14	Similarity, Clustering and Dendrograms
(b):	TC/32/6 & new doc to be prepared	Sequential Analysis
TGP/15		Supporting Evidence
TGP/16	To be prepared	Model System for Determining Distinctness
TGP/17		Technical Questionnaire to be Completed in Connection with an Application for Plant Breeders' Rights
TGP/18	To be prepared by TWA, TWC, TWF, TWO, TWV	Definition of Technical, Botanical and Statistical Terms Used in UPOV Documents

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DRAFT FOR TGP/01
DATE:

UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
GENEVA

DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/01: GENERAL INTRODUCTION WITH EXPLANATIONS

The latest version of this draft can be found in document TC/36/6.

It covers the following subjects:

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OF DOCUMENT TC/36/6

ANNEX

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DRAFT FOR TGP/02
DATE:

UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
GENEVA

DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/02: LIST OF TEST GUIDELINES ADOPTED BY UPOV

The list of Test Guidelines adopted by UPOV can be found on the Internet under http://www.upov.int/eng/document/index or in the Annex to document TC/36/2 which also contains information on Draft Test Guidelines.

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DRAFT FOR TGP/03
DATE:

UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
GENEVA

DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/03: VARIETIES OF COMMON KNOWLEDGE

3.(A) THE CONCEPT OF VARIETIES OF "COMMON KNOWLEDGE," AS DISCUSSED AT THE TECHNICAL WORKING PARTY FOR ORNAMENTAL PLANTS AND FOREST TREES (TWO) 1999

3.(B) THE NOTION OF BREEDER IN THE PLANT VARIETY PROTECTION SYSTEM BASED UPON THE UPOV CONVENTION

3.(A) THE CONCEPT OF VARIETIES OF 'COMMON KNOWLEDGE', AS DISCUSSED AT THE TECHNICAL WORKING PARTY FOR ORNAMENTAL PLANTS AND FOREST TREES (TWO) 1999

(Drafted by Elizabeth Scott, Head of Ornamentals DUS,
NIAB,Cambridge CB3 0LE, United Kingdom)

I. COMMON KNOWLEDGE IS NOT DEFINED IN THE 1991 CONVENTION

The 1961 UPOV Convention, under Article 6, Conditions Required for Protection, states that 'the variety must be clearly distinguishable ... from any other variety whose existence is a matter of common knowledge at the time protection is applied for.' It then goes on to indicate how Common Knowledge may be established: '*... by reference to various factors such as: cultivation or marketing already in progress, entry in an official register of varieties already made or in the course of being made, inclusion in a reference collection, or precise description in a publication*.' (My italics).

The Convention as revised in 1991 says at Article 7, Distinctness, 'The variety shall be deemed to be distinct if it is clearly distinguishable from any other variety whose existence is a matter of common knowledge at the time of the filing of the application.' It then goes on to add the single comment that: *'In particular, the filing of an application for the granting of a breeder's right or for the entering of another variety in an official register of varieties, in any country, shall be deemed to render that other variety a matter of common knowledge from the date of the application, provided that the application leads to a granting of a breeder's right or to the entering of the said other variety in the official register of varieties, as the case may be*.' (My italics).

The records of the discussions which took place at the UPOV 1991 Diplomatic Conference make it clear that at paras 474-494 and 495-508 the intention of this sentence was to clarify a particular situation which might exist in the case of two 'competing' PBR applications in different countries (see para 505 in particular). It was not intended to be an exhaustive definition of what constitutes Common Knowledge, and the potential need for a much fuller set of examples was in fact raised (para 490).

Unfortunately, this suggestion was not followed up, and, as currently worded, the Article is being taken as a complete definition, which is giving rise to a number of misconceptions as to what constitutes a variety of Common Knowledge. Clearly although Common Knowledge is always a legal matter for the Authorities in the state or grouping of states concerned, there seems to be a need for harmonization and clarification.

This is particularly important in Ornamentals where, in most States, there are certain very significant differences in the way varieties are marketed compared to many agricultural crops:

1. Often only a small proportion of the total varieties in trade in one species are entered for PBR.

2. Varieties are not subject to National Listing or other forms of control and therefore can go on sale without restriction as soon as the breeder is ready.

3. In States or groupings of countries which have adapted their laws to allow one year's sale before application, varieties will frequently be very well known in trade before any PBR application is made.

This means that varieties of ornamental plants are subject to much less control than agricultural crops, varieties enter the market without statutory evaluation or before such evaluation is complete, and there is much less clarity over the exact date of introduction.

II. TOWARDS A DEFINITION OF COMMON KNOWLEDGE

Two important points should be considered before trying to define 'Common Knowledge':

(i) Definition of 'variety'

DUS work involves the assessment of varieties only. The 1991 UPOV Convention defines a variety as:

> a plant grouping within a single botanical taxon of the lowest known rank, which grouping, irrespective of whether the conditions for the grant of a breeders' right are fully met, can be …
>
> - defined by the expression of the characteristics resulting from a given genotype or combination of genotypes,
> - distinguished from any other plant grouping by the expression of at least one of the said characteristics and
> - considered as a unit with regard to its suitability for being propagated unchanged.

The underlined sentence is important because it confirms that varieties which do not fully meet the criteria for grant of PBR must still be considered as varieties for the purposes of DUS work provided they meet the other criteria of the definition. Therefore they also have to be considered as varieties of Common Knowledge if they also meet the criteria for the establishment of Common Knowledge - even if PBR has been refused.

The definition also covers cases such as, for example, marketed clonal material which meets all the criteria for definition of a variety even though it has never been named, and known and described variant forms of wild plants which, reproducing themselves vegetatively, are effectively clones.

Conversely, single plants do not constitute a variety, neither does the species as a whole, nor physical mixtures nor other groupings which do not fulfil the basic definition.

(ii) Novelty

Novelty and Common Knowledge are two different concepts which should not be confused. Candidates for PBR have to be both DUS and sufficiently novel, i.e. the novelty of the candidate must be established with reference to the first date of sale of the candidate, and

the distinctness of the candidate must be established by comparison with such other varieties which were found to be in Common Knowledge at the date of the application. The candidate itself can be in Common Knowledge at the time of the application (for example by being prominent in a public collection) but sufficiently novel for grant of PBR so long as it has not been on the market for longer than permitted by the relevant PBR legislation.

III. COMMON KNOWLEDGE: HOW IT IS ESTABLISHED

The following points summarize how varieties of Common Knowledge may be defined in practice:

(i) 'Variety' criteria

1. To be considered a 'variety of Common Knowledge', the variety must meet the definition of a variety set out in Article 1 (vi) of the UPOV Convention.

2. Living plant material must be available to ensure the variety meets the above definition and for direct comparison with the candidate variety.

3. All those existing varieties, whether named or not, which conform to the basic UPOV definition of a variety, should be considered in the investigation of the distinctness of a new candidate, regardless of their PBR status – if they are in Common Knowledge.

(ii) 'Common Knowledge' criteria

4. The concepts of 'novelty' (of the candidate) and 'Common Knowledge' (of the existing varieties) are not linked.

5. The basis on which Common Knowledge is established includes:

(a) Marketing plants of the variety, or publishing a detailed description.
Marketing includes selling to plant propagators or young plant companies, or otherwise within the horticultural trade, or selling to retailers or the public.

It is emphasized that Common Knowledge from marketing includes the professional world, i.e. once material of a variety has been sold outside a breeding company to plant propagation companies, it is marketed and in Common Knowledge even if it is not yet available to the general public.

(b) Entry of a variety for PBR or other registration, from the date of application, if the application is successful.

A variety which is entered for PBR or other registration, where the application fails or is withdrawn, will still be in Common Knowledge if it has been marketed and fulfils the basic definition of a variety.

(c) Existence of material in plant collections e.g. Botanic gardens, provided the material is known and described and constitutes a variety according to the UPOV definition.

6. Common Knowledge is not limited by national or geographic borders, especially in ornamentals. Notionally it is world-wide although practically it may be limited by what can be established with reasonable effort, and also by climatic zones in the case of field grown crops. For the latter if it can be established that different geoclimatic regions will produce different types of variety, it will not be necessary to make direct comparisons between them.

7. Many types of information may be used as sources to contribute towards the establishment of what existing varieties are in Common Knowledge (PBR and other official registers, catalogues, books, periodicals, internet etc.), but living plant material must always be available for direct comparison with the candidate variety.

8. States should co-operate as much as possible in the investigation of varieties of Common Knowledge.

Remark:

This document forms also Annex II of document CAJ/41/2 presented to the meeting of the Administrative and Legal Committee on April 6, 2000. Therefore, for information of the Technical Committee, Annex I of document CAJ/41/2 is reproduced in the following:

3.(B) THE NOTION OF BREEDER IN THE PLANT VARIETY PROTECTION SYSTEM BASED UPON THE UPOV CONVENTION

(Annex I of document CAJ/41/2 prepared by the Office of the Union for the Administrative and Legal Committee)

The Aims of Plant Variety Protection

1. The protection of plant varieties was primarily conceived with a view to the development of agriculture. That aim is set out as follows in the preamble to the original 1961 text of the UPOV Convention:

> "The Contracting States,
>
> "Convinced of the importance attaching to the protection of new varieties of plants not only for the development of agriculture in their territory but also for safeguarding the interests of breeders […]"

The Technical Bases for Plant Breeding and the Protection of New Plant Varieties

2. The subject matter of the protection system is, in all cases, a variety, that is to say a plant grouping within a single botanical taxon of the lowest known rank, such grouping being defined on the basis of agro-botanical criteria and characterized by the fact that it is distinct from other groupings and is sufficiently uniform and stable. The notion of variety covers a genetic structure theoretically corresponding to a single genotype (clone, line, F_1 hybrid) or a particular combination of genotypes (complex hybrid, synthetic variety, population variety, etc.).

3. The objective of plant breeding (plant improvement) is to produce such genetic structures. To do so, it must always start from genetic variability, which may be already existing or created.

Background

4. The invitation to participate in the first session of the International Conference, held in Paris from May 7 to 11, 1957, that was to lead to the signing of the UPOV Convention on December 2, 1961, was accompanied by an "Aide-mémoire on issues arising from the protection of new plant varieties" that had been drafted by the State Secretariat for Agriculture of France, and which asked *inter alia* the following questions as the basis for discussion in the Conference:

> "1. Is it desirable to grant to every person who is able to prove that he is the first to bring a new variety of plant into cultivation, a right analogous to that which is accorded to the person making an industrial invention?
>
> "2. Should the right granted to [this person] the "*obtenteur*" be limited or unlimited in time?
>
> "3. The following are generally considered as sources for the "*obtention*" of new varieties of plants:
>
> (a) bulk or pedigree selection within an existing population;

(b) the discovery of a natural mutation;
(c) the inducing of an artificial mutation using a specific method;
(d) chance cross-polination;
(e) deliberate cross-pollination;
(f) any combination of the above methods.

"Should one consider as true creations only those *obtentions* which result immediately and directly from a process acting on the genetic structure of the plant or should the concept be broadened?"

In the first session, delegates opted to adopt a broad interpretation of *obtention* without regard to the method of *obtention*. What mattered was the result achieved, which should be different from what was previously known. Delegates contrasted the proposed plant variety protection system, in which discoveries should be protectable, with the patent system, which protected inventions but not discoveries. It was necessary to devise a special (*sui generis*) system in order to encourage all forms of plant improvement including discoveries.

5. Paragraph 4 of the Final Act of that session stated that

"The Conference considers that, since the essential work of the *obtenteur* is that of improvement, protection should apply whatever the origin (natural or artificial) of the initial variation that eventually results in the new variety."

6. Subsequent sessions of the Committee of Experts set up by the first session of the Conference repeatedly studied the same subject. It noted that the reference to "improvement" in paragraph 4 of the Final Act did not imply that the grant of protection should be conditional upon the value for cultivation and use of the variety. The Committee also endeavored to identify an element of creative activity that should exist before the obtenteur would be entitled to protection. The possibilities of restricting protection to the fruits of "creative selection work" or "effective work on the part of the breeder" were proposed.

7. To some extent the subject was complicated by the language used. "Obtenteur" in French means a person who achieves a result particularly as a result of trials or research. It is usually translated into English as "breeder." "Breeding" in its strict sense connotes a process involving sexual reproduction as a source of variability but in practical usage the activity of plant breeding is much wider and includes, in particular, selection within pre-existing sources of variation. "Obtenteur" might be better translated into English as "plant improver" rather than breeder (subject to the reservation referred to above that "improvement" is not a condition of protection).

8. Perusal of the early chapters of Allard's classic "Principles of Plant Breeding" establishes that he considered all the methodologies described in the French *Aide-mémoire* to be part of the activity of plant breeding. [Allard would also have included "plant introduction" (the simple multiplication and testing of an existing variety in a different environment) as an appropriate activity for plant breeders. Such an activity was not listed as a source of *obtention* in the *Aide-mémoire*. It is clear that the "introducer" of a variety is not entitled to protection under the UPOV Convention since the introduced material will not be distinct from the existing known variety.]

9. It is also clear that, when the text of the UPOV Convention was eventually adopted in 1961, it established a system that was intended to provide protection for the fruits of all forms of plant improvement, including selections made within natural, that is to say, pre-existing

variation. Discoveries accordingly became eligible for protection as selections made within natural sources of variation.

The Text of the 1961 and 1978 Acts

10. The notions of "effective breeding work" or "creative selection" were not maintained by the second session of the International Conference that adopted the 1961 Act of the Convention, of which the principles and language were substantially maintained in the 1978 Act. The relevant provisions of the 1978 Act are as follows:

(a) Article 1(1):

"The purpose of this Convention is to recognize and to ensure to the breeder of a new plant variety or to his successor in title […] a right under the conditions hereinafter defined."

(b) Article 5(3):

"Authorization by the breeder shall not be required either for the utilization of the variety as an initial source of variation for the purpose of creating other varieties or for the marketing of such varieties. […]"

(c) Article 6(1) (a):

"Whatever may be the origin, artificial or natural, of the initial variation from which it has resulted, the variety must be clearly distinguishable by one or more important characteristics from any other variety whose existence is a matter of common knowledge at the time when protection is applied for. Common knowledge may be established by reference to various factors such as: cultivation or marketing already in progress, entry in an official register of varieties already made or in the course of being made, inclusion in a reference collection, or precise description in a publication. The characteristics which permit a variety to be defined and distinguished must be capable of precise recognition and description."

11. It should be noted that the 1978 Act contains no definition of "breeder" or "breeding" so that these words have their natural meaning and include all the classes of activity included in the French A*ide-mémoire*. There is equally no express reference to the protection of "discoveries." The protection of discoveries is inferred from the fact that the opening words of Article 6(1)(a) accept the possibility that the variety may result from a natural source of initial variation, for example, a mutation.

12. The fathers of the UPOV Convention therefore deliberately chose to open up the system of protection to all varieties, whatever their method of breeding (therefore including the varieties that are "discoveries"), and whatever the effort expended by the breeder to create the variety. The language of the Convention establishes that there should have been a source of variability, which may have been created by the breeder or be pre-existing and that the breeder's selection must be clearly distinguishable from any other commonly known variety.

13. The UPOV Convention differs from the patent system in its treatment of discoveries. Discoveries are not patentable. This difference is the logical result of the aim of the Convention which is to secure the development of agriculture. The "discovery" of mutations or variants in a population of cultivated plants is indeed a source of varieties of great

economic importance for agriculture. The UPOV Convention would have failed in its mission if it had excluded such varieties from protection and withheld from discoverers the incentive to preserve and propagate useful discoveries for the benefit of the world at large. The United States Congress adopted the same approach in 1930 when it made the plant patent available to "whoever invents or discovers and asexually reproduces any distinct and new variety…"

The Text of the 1991 Act

14. When the Convention was revised in 1991, notwithstanding the fact that the making of selections within pre-existing variation was regarded as a standard activity for plant breeders, it was thought to be useful to include a definition of breeder in order to emphasize the fact that the UPOV Convention also provided protection for varieties that had been "discovered". However, at the Diplomatic Conference, attention was drawn to the fact that the apparent protection of bare discoveries could be controversial in circles concerned with the definition of the ownership rights in genetic resources. Delegates were, however, conscious that, in practice, a discovery must be evaluated and propagated before it can be exploited and that the making available of discoveries was an important source of plant improvement that must be encouraged by the UPOV Convention. Intensive discussion led to the definition of "breeder" as the person who "bred, or discovered and developed" a variety. The reference to the "origin," artificial or nature of the initial variety from which [the variety] has resulted in Article 6(1)(a) of the 1978 Act no longer appears. In the 1991 Act "discovery" describes the activity of "selection within natural variation" while "development" describes the process of "propagation and evaluation."

> [Note: It has been suggested in one member State that the criterion of "development" is only satisfied if the discovered plant itself is subsequently changed in some way and that the propagation of the plant unchanged would not constitute "development." This approach would require the discovered plant to be propagated sexually and for a selection to be made in the progeny in order to demonstrate development. It is suggested that this approach cannot be correct since selection in the progeny would constitute "breeding." This approach would also deny protection to most mutations, since the mutation is usually propagated unchanged.]

15. The definition of breeder has made it possible to simplify the provision setting out what is meant by distinctness. The relevant provisions of the 1991 Act therefore read as follows:

(a) Article 1(iv):

"For the purposes of this Act:

[…]

> (iv) "breeder" means
> – the person who bred, or discovered and developed, a variety,"
> […]
>
> (vi) "variety" means a plant grouping within a single botanical taxon of the lowest known rank, which grouping, irrespective of whether the conditions for the grant of a breeder's right are fully met, can be
> - defined by the expression of the characteristics resulting from a given genotype or combination of genotypes,

- distinguished from any other plant grouping by the expression of at least one of the said characteristics and
- considered as a unit with regard to its suitability for being propagated unchanged

(b) Article 7:

"The variety shall be deemed to be distinct if it is clearly distinguishable from any other variety whose existence is a matter of common knowledge at the time of the filing of the application. […]"

(c) Article 15(1)(iii):

"The breeder's right shall not extend to

[…]

"(iii) acts done for the purpose of breeding other varieties and, except where the provisions of Article 14(5) apply, acts referred to in Article 14(1) to (4) in respect of such other varieties."

The Administrative Operation of the System of Protection

16. Protection is therefore available to the person(s) who claim(s) to be the breeder(s) of a variety, irrespective of its mode of creation. The breeder is usually required in a technical questionnaire that accompanies his application for protection to provide information concerning the breeding history and genetic origin of the variety.

17. In a very large number of States, an applicant who claims to be the breeder is assumed to be the owner of the right to protection, unless proved otherwise (only the successor in title is required to prove his title). The administrative procedure for the grant of protection typically includes a series of measures enabling concerned persons to rebut this assumption. These measures particularly include publicity (publication of a gazette, public inspection of files) and the possibility of filing observations, objections or opposition or, where a title has already been granted, of instituting an administrative or judicial procedure for annulment or judicial transfer.

18. A fundamental feature of the UPOV Convention, now embodied in Article 12 of the 1991 Act, is that protection shall only be granted after an examination to determine if the variety is novel, and clearly distinguishable from all other varieties that are a matter of common knowledge. The system of plant variety protection based on the UPOV Convention seeks to ensure, save error or omission on the part of the administrative services, that all varieties protected in the system are clearly distinguishable from all other varieties whose existence was a matter of common knowledge at the date of the application for protection. Each variety is also given a detailed description drawn up in accordance with standardized procedures and protocols.

19. Article 6(1)(a) of the 1978 Act (see paragraph 10) did not define "common knowledge" but provided a non-exhaustive list of examples of how a variety could become a matter of common knowledge. When the Convention was revised in 1991, it was noted that the list of examples included events which would not necessarily be known to the public, for example, the addition of a variety to a reference collection. Accordingly, the 1991 text leaves

"common knowledge" undefined and specifies only that certain acts (which are not likely to be known to the general public) shall be deemed to render varieties a matter of common knowledge. "Common knowledge" has its natural meaning. It is a worldwide test. A variety that is a candidate for protection must be clearly distinguishable from any variety that is a matter of common knowledge anywhere in the world. [Reference should be made to the revised General Introduction to the Assessment of Distinctness, Uniformity and Stability in New Varieties of Plants (document under preparation) to ascertain how this requirement is approached in practice.] [For the guidance of its member States, the Council of UPOV has published recommendations giving examples of the circumstances in which varieties should be considered to be a matter of common knowledge. The CAJ may wish to consider the usefulness of such recommendations.]

20. The definition of "variety" introduced in Article 1(vi) of the 1991 Act plays an important role in this context. The words "irrespective of whether the conditions for the grant of a breeder's right are fully met" makes it clear that commonly known varieties which are not clearly distinguishable from other known varieties, sufficiently uniform and stable so as to qualify technically for protection are still varieties from which a candidate variety must be clearly distinguished. This means, for example, that land races which are capable of satisfying the definition of "variety," and which can in consequence be defined and propagated unchanged should be regarded as varieties of common knowledge for distinctness purposes.

21. Since the UPOV Convention was created in 1961, it is thought that some 100,000 grants of protection have been made in UPOV member States. Some 9,000 grants of protection per annum are currently made. Certain organizations unsympathetic to the system of intellectual property rights have alleged that the UPOV system of plant variety protection permits or encourages the improper taking of plant material and its use as the basis for securing plant variety protection in UPOV member States. These allegations have not been substantiated.

22. The UPOV protection system seeks to protect varieties resulting from the various forms of plant improvement activity which have been of such benefit to humanity, particularly over the last century as an understanding of plant genetics has grown. The member States of UPOV emphatically reaffirm the notions of "breeder" and of activities which may legitimately result in the breeding, or discovery and development of a protectable variety outlined in this paper.

E

DRAFT FOR TGP/04
DATE:

UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/04: MANAGEMENT OF REFERENCE COLLECTIONS

4.(A) GENERAL MANAGEMENT

(i) The Management of Reference Collections

(ii) The Management of Reference Collections Related to DUS

(iii) The Management of Reference Collections in Cross-fertilized Species

4.(B) ASSESSMENT OF THE UNIFORMITY OF F1 HYBRIDS IN RELATION TO THEIR BREEDING HISTORY

4.(A) GENERAL MANAGEMENT

4.(a)(i) Management of reference collections
(Draft prepared by Mr. Joël Guiard, France)

The evaluation of a candidate variety, before the award of a breeder's right, is an important feature of the system of protection defined by the UPOV Convention. This evaluation provides a description of the plant material representative of the variety and is necessary to ensure that the material tested corresponds to a true and novel variety. The robustness of the rights awarded depends, in particular, on the existence of as complete a collection as possible of the known varieties of the species concerned, from which the new variety must be sufficiently different.

Thus, as reference collections form the basis for the protection of plant breeders' rights, it is important to examine the conditions under which these collections are set up and managed against a backdrop of major change.

In particular:

- The rapid increase in the number of member states of UPOV, in itself an indication of the value of this system of protection to breeders, demonstrates the necessity of having increasingly large reference collections, particularly for varieties with very large zones of diffusion. This trend is likely to continue, with the obligations to establish a system of specific protection now placed on states by the TRIPS agreements, to which the UPOV system can be seen as an effective response.

- It is important for the holder of the right to exploit a particular variety to be able to obtain effective protection with the smallest possible risk of finding that there is a precedent right to that variety or that the variety in which he has invested much research and development effort is not distinct enough.

- It is essential for UPOV and its member states to be able to limit as far as possible the risk of granting breeders' rights for material resulting from simple collection. This issue is very problematic for certain species for which consideration at the level of reference collections is very difficult. Although the UPOV system does not lead to gene appropriation, every case in which a certificate is wrongly issued for this reason is very damaging to the image of the protection of breeders' rights.

- In terms of the actual constitution and management of the collections, the costs entailed are also a major obstacle. It is often difficult to obtain representative samples of known varieties in some countries, limiting the constitution of the reference collection. The problems associated with the management of the collections are diverse, and the costs generated by any given technical department are such that the collections are limited. The problems encountered include the maintenance and replacement of seed samples, constraints concerning the maintenance of samples of vegetatively propagated varieties and those associated with the exchange of samples for species subject to phytosanitary regulations.

Finally, while considering costs, we must not forget the costs associated with the observation of the varieties in the collection, carried out within the framework of technical evaluations, annually for some species.

All these considerations raise questions about the way in which reference collections are managed on the international scale, especially by the UPOV member states. In particular, they suggest that we should try to find synergy in an attempt to limit costs and ensure greater efficacy in the technical evaluation of distinctness. The development of approaches using new techniques, in both varietal characterisation and information management, should enable us to achieve these objectives.

New Bases for Characterisation.

Currently, the description of the varieties that make up the reference collections is based exclusively on phenotypic characters. At the level of a particular country or agricultural and climatic zone, this makes it possible to carry out reliable distinctness tests provided that the variability within the species and the extent of genotype x environment interaction are known. Expertise therefore plays a determinant role.

It is possible to exchange such information between countries, but the list of useful characters very quickly becomes limited due to the genotype x environment interaction (it is not possible to compare results obtained in different environments) and the resulting low level of variability (phenotypic characters that interact very little with the environment generally present limited variability).

It is therefore necessary to look for new characters independent of environment, to make it possible to exchange data and thus to select the closest remaining varieties to compare in appropriate conditions.

The use of protein polymorphism (storage proteins and enzymes) detected by electrophoresis, is one possible way to increase the number of characters available for comparison, provided that the conditions for data collection (analytical protocols) and use of the results are well defined. However, in most cases, the level of variability observed is low and the laboratory effect (equivalent to an environmental effect) is a major obstacle to the development of these characters for testing.

The development of molecular markers is another, more promising way forward in that the extent of polymorphism detected is clearly much higher. By describing the structure of the DNA itself, rather than its expression in the form of proteins, access has been obtained to variability that was not previously available for analysis, greatly increasing the potential for characterisation within the species.

For almost ten years, UPOV has been considering how the elements of characterisation based on molecular markers could be included in the Test Guidelines of Distinctness - Uniformity - Stability (DUS). This is essential for the integration of this new basis of description into testing and to ensure the genuine protection of varieties.

The characterisation of varieties based on molecular markers could also be used in the structuring and management of reference collections. The aim is to define groups of varieties

sufficiently different genetically to make it possible to dispense with comparisons on the basis of phenotype.

The initial discussions at UPOV on the structuring of reference collections have focused on the following points:

- The need for standardised protocols for the characterisation of varieties, including a precise description of the techniques used with references. Such protocols are essential, whatever the end use of the results obtained, so that robust international databases can be produced without creating an «environmental effect».

- The need to define a method for creating groups of varieties within a species. The «grouping characteristics» approach currently recommended by UPOV for phenotypic characteristics cannot be used. This method is not appropriate because it implies that each new characteristic identified on the basis of molecular markers can be used as a basis for defining distinctness. Both UPOV and plant breeders have reservations concerning such a development.

This process of reflection has led to the idea that the approach used should be based on the genetic distance between varieties, combining information from the various molecular markers obtained using diverse methods, as a function of the structure of varieties, the method of labelling used and genetic maps. Work is underway in various species in a number of countries, to develop this approach further and to design methods for structuring collections.

The implementation of such an approach requires further methodological development and the systematic characterisation of varietal collections. Such work can only be carried out on a multilateral basis, with standardisation of methods and common definition of the databases containing the information. The search for markers evenly distributed throughout the genome, to optimise the measurement of variability, is particularly important in this respect. This type of characterisation is of common interest for all involved in plant breeding, both in terms of the creation of varieties itself and in terms of the protection of breeders' rights, with possible applications based on the notion of using genetic distance to assess possible derivation, and eventually, distinctness.

One of the key questions concerns the relationship between distinctness established on the basis of phenotypic characters and genetic distance calculated using molecular markers. Apart the case in which the marker is tightly linked to a phenotypic character, there is the necessity of studying in further detail this link between the two structuring methods. Methods combining the phenotypic and molecular approach should not be ruled out, the aim being, above all, to obtain a method of structuring that is robust and effective at an international level (and not to replace the phenotypic approach with a molecular approach at all costs).

New Ways of Managing Collections.

It is possible to envisage new ways of managing reference collections based on these new ways of structuring and testing:

- Plant material:

National or regional (several states) collections maintained by the authorities responsible for technical evaluation, with a range of common varieties at each centre to provide a reference for the validation of descriptions. Each authority responsible for the maintenance of varieties in this context would have to respect a list of requirements guaranteeing, in particular, the authenticity and viability of plant material for the varieties originating from the region concerned. Facilities including the maintenance of a duplicate of each collection could be set up to ensure maximum security. For certain species for which collecting all the varieties at the same site is not possible, the authority would be responsible for keeping a list of the sites at which the reference material is held.

- Descriptive data:

A common database with a standard structure, bringing together data for molecular markers and for phenotypic characters only weakly affected by the environment. The data thus collected would be available to all states facilitating identification of the varieties most similar to a new candidate variety. The database would also include elements concerning the antecedence of each variety and the extent to which it is known. It is essential that such a database be developed quickly in that much information is already available and the techniques used develop very rapidly. It is therefore essential to conserve data describing how they were obtained.

- Implementation of a tool for looking for very similar varieties:

To ensure homogeneity in the treatment of data when looking for very similar varieties, it is important to develop common tools that make it possible to use, for a given species, a well-defined genetic distance and to use standard ways of combining characters. Some work has already been carried out in this domain and UPOV should soon be able to come up with some suitable propositions.

- Implementation of a system for exchanging information and plant material:

The database and the tools for comparison must be available to all authorities granting plant breeders' rights. Means of exchanging and processing information should make it possible to disseminate data without major problems, provided that there is a structure with built-in norms and well established rules governing the functioning of the system. The exchange of material is necessary to make it possible to compare varieties directly at the same site.

Conclusion

The availability of the largest possible reference collections of well known varieties is essential to ensure the true efficacy of the system for granting plant breeders' rights certificates. In addition to its efforts to produce guidelines for the harmonisation of testing, UPOV must, as it develops, propose solutions for the effective constitution and management of such collections. This challenge is continually increasing due to the globalisation of varietal creation and the resulting exchanges of plant material, and debate concerning conservation and the appropriation of biodiversity.

Plant breeders have a particular interest in the constitution of these reference collections, which represent the genetic diversity among known varieties. These collections are the basis on which the exclusive rights of breeders to exploit the fruits of their research and to defend themselves are founded.

Given the potential importance of molecular markers in the characterisation and management of reference collections, it is important to keep a constant watch on the development of biotechnological tools in the domains of genomics, marker-assisted selection and genetic transformation and to anticipate their possible use in connected areas such as the protection of plant breeders' rights. Various teams are currently working on these aspects, in collaboration with the services responsible for DUS testing. It is also essential that UPOV ensures the relay from these teams, to integrate the products of this work into its recommendations while trying to preserve, and even to increase, the efficacy of plant breeders' rights certification.

4(a)(ii) The Management of Reference Collections Related to DUS
(Draft prepared by Mr. C. van Ettekoven, Netherlands)

Definition:

A reference collection is the complete set of varieties in common knowledge at the moment of application of a candidate variety. In general, it contains varieties with plant breeder's rights, varieties officially listed in one of the UPOV member States and applications for the above with priority to the candidate.

Material:

In general the material is seed, so it can be stored relatively easily.

Management:

For practically all crops the size of the total collection is very large. Too large to consider storing for any, let alone, all testing authorities.

Therefore the management has to be done on paper, but preferably using a database.

In this database all known information is stored in a form that enables easy management. The primary and secondary grouping characteristics have to be included to enable selection of the relevant comparing varieties for each candidate.

Physical storage applies to seed samples of all varieties with plant breeder's rights and/or listing position in the relevant member State. It is advisable to also store varieties meant to be grown in the same climatical conditions.

Missing comparing varieties can be obtained in the member State of listing/PBR. Seed material can easily be sent by post.

4.(a)(iii) The Management of Reference Collections in Cross-fertilized Species (Draft prepared by Mr. M. S. Camlin, United Kingdom)

1. INTRODUCTION

According to Article 7 of the 1991 Act of the Convention of UPOV (The International Union for the Protection of New Varieties of Plants), the distinctness of a new candidate variety has to be determined:

"from any other variety whose existence is a matter of common knowledge..…"

This statement could cause considerable difficulties for technical examinations if it were not possible, in most crops, to restrict the number of varieties in reference collections with which a new candidate variety has to be compared directly in growing tests.

2. REFERENCE COLLECTIONS

Theoretically, the full reference collection to be used for comparison purposes for any candidate variety is the known worldwide collection of varieties of the same species and crop. However, in practice, the number of varieties which has be included in a growing test can often be reduced by the careful selection of those reference varieties only from similar environmental regions and of the same crop type. The selection can usually be further narrowed down to only the most closely similar varieties by using the variety description and the information on the most similar varieties supplied by the breeder in the Technical Questionnaire. This information allows the testing authority or crop expert to use the grouping characteristics set out in the relevant UPOV Technical Guideline to limit the number of varieties from the reference collection which must be used as control varieties in the growing test. This significantly reduces workloads and the attendant costs.

3. GROUPING

The selection of closely similar control varieties from the reference collection for inclusion in the growing test is a critical step in the examination of the distinctness of a new candidate variety and, in the accurate completion of the Technical Questionnaire, the breeder has an important role to play. The Technical Questionnaire includes information on the origin, maintenance and reproduction of the variety and provides a preliminary description based on the most important descriptor characteristics, for use by the testing authority for grouping purposes in advance of the organization of the growing tests. Information is also provided on the most similar varieties to the candidate variety. This information is useful to confirm the descriptive information given for grouping purposes and can also be used to direct the testing authority towards the most appropriate varieties to be selected from the reference collection for use as control varieties in the growing tests.

Of course it is important to check that the information supplied by the breeder about the most similar varieties is accurate. This will become clear once the initial grouping exercise has been completed and preliminary examinations undertaken on the submitted plant material, if applicable, or alternatively, when the first series of growing trials has been completed. Once the essential descriptor characteristics of the new candidate variety have been determined independently by the crop expert, it should then be possible to confirm the

original choice of control varieties. If this is found not to cover the correct range then a more representative set of control varieties must be selected to be grown together with the candidate variety in further growing tests.

Such methods generally work well in clonal and self-fertilized crops and also with most hybrid crops. This is because there are usually a number of discontinuous grouping characteristics available which can be used in parallel with an accurate breeder's description of the new candidate variety, often also with a preliminary examination of submitted plant material, to impose a series of definitive splits in the reference collection. However, for the continuously expressed and measured characteristics which normally predominate in cross-fertilized varieties there are often major difficulties.

4. CROSS-FERTILIZED CROPS

With the cross-fertilized crops, problems occur because the number of truly discontinuous characteristics available for grouping is usually extremely limited. The continuous and measured characteristics which predominate in these crops have two major shortcomings for use in grouping - firstly, they do not normally provide definitive splits in reference collections and, secondly, they are very easily influenced by environmental conditions.

As a consequence, the first problem often encountered by both the breeder and the testing authority or crop expert is that it is not possible to obtain a sufficiently robust and accurate variety description of the new candidate variety to be able give a reliable indication of the appropriate closely similar control varieties from within the reference collection. In these circumstances, to avoid the danger of omitting an important control variety, the crop expert usually has to select a significant number of control varieties to associate with each new candidate variety in the growing test. These control varieties are selected to cover a range clustered around the breeder's description of the new candidate variety across the key descriptor characteristics included in the Technical Questionnaire.

The problems are not so great in crops where there is only a small reference collection in existence as, in these circumstances, grouping often has only minor consequences for reducing the already quite small workloads involved in the growing tests. Even when the reference collection is quite large, if there are only a small number of new candidate varieties it is usually possible, even with only a limited use of grouping, to make significant reductions in the number of control varieties required for growing tests. In these circumstances, the assistance of the breeder in providing further supplementary information, additional to that in the Technical Questionnaire, can often help the crop expert target a smaller group of close control varieties.

In crops where information from the breeder is robust and reliable then, even with discontinuous characteristics, there are methods of using such information, together with data from the reference collection varieties, to reduce the number of controls to be used in growing tests. The maintenance of an over-years data-set for reference varieties, even if incomplete, can be used to produce fitted constant descriptor means for these varieties which can then be compared with the description of each new candidate variety. Such comparisons for each characteristic, either directly on the data or after conversion to UPOV descriptive states can reduce the number of close control varieties needed. Multivariate techniques can also be used to calculate similarity coefficients for the selection of a cluster of the most similar varieties for

each new candidate. Such methods must be inclusive and positive evidence of dissimilarity is required before excluding any reference varieties from use as controls in the growing tests. Where there is insufficient data on any reference cultivar, it should always be included in the growing test.

Major problems arise for those crops where breeder information is less robust and where there are both large reference collections in place and large numbers of new candidate varieties being submitted every year. When each of a large number of new candidate varieties has to be grown with a cluster of potentially close control varieties, these clusters often overlap so much that, effectively, the whole reference collection is usually represented within the growing test. While the broad grouping of new candidate varieties into ploidy or utilization types is still useful for the organization of the otherwise unmanageably large growing tests it normally does not provide any significant reductions in the overall number of control varieties that have to be used. Such crops therefore normally require all reference and candidate varieties to be planted in successive growing tests for comparison purposes over a two or three year period.

5. CYCLIC PLANTING AND COMPENSATED DATA SYSTEMS

While the planting of new candidate varieties together with the full reference collection each year imposes a significant workload, it has one advantage which is often overlooked. This is that there is a large and robust historical database which is being continually expanded with each new test year. This means that the use of data on the control varieties from this historical database provides the opportunity to plant only a proportion of these varieties in each new growing test. The missing data can be compensated for by use of historical information from the database.

This system is illustrated in Figure 1. By the structured allocation of the control varieties into three groups it is possible to produce a cyclic design and to omit up to one-third of the control varieties from each year's growing test. The level of one third provides a balanced matrix and is considered to be a suitable proportion of varieties to omit each year to avoid the data matrix becoming too unstable.

Distinctness in a Compensated Data System

For the assessment of distinctness, while the data matrix is complete for the new candidate varieties, it is incomplete for the control varieties and compensated data, adjusted by the Modified Joint Regression Analysis (MJRA), is used for the analysis (see TGP/9; TWC 17/11). Within the test period for any new candidate variety, each missing year's data for a control variety with which it is being compared is compensated for by the use of two year's data from earlier years. While many additional years of historical data are available within the matrix, these are not used to avoid reducing the stringency of the distinctness test below current levels. The mathematical details of the distinctness model for this system are presented in Annex 1.

Uniformity in a Compensated Data System

For the assessment of uniformity, the COYU method is used (see TGP/10). Within variety standard deviations (SD) for all available control varieties are provided over years, taking into account the magnitude of the variety means, to provide a uniformity standard against which to compare the standard deviations of the new candidate varieties. It is not possible to make a correction for these standard deviations beyond the range of years in which the new candidate variety is present. Therefore, only uniformity data from the control varieties from within the two or three year test period is used to set the uniformity standards.

6. SUMMARY

The management of reference collections by the use of grouping methods to reduce workloads in growing tests is not as easy for cross-fertilized crops as for other clonal, self-fertilized or hybrid crops. This means that large scale growing tests often have to be used, with new candidate varieties compared against a large number of control varieties taken from the reference collection.

However, this system leads to the assimilation of a large and robust historical database which, in a cyclic planting system with compensated data, can be used to reduce the number of control varieties that have to be planted each year. This new system is being included as an alternative trial design in the new suite of DUST programs for Windows, available from Dr. Sally Watson, DARD, United Kingdom (e-mail sally.watson@dardni.gov.uk).

FIGURE 1. GROWING TEST MATRIX FOR A CYCLIC PLANTING AND COMPENSATED DATA SYSTEM

Test Years	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Control (Reference) Varieties										
Cycle 1					(-)			(-)		
Cycle 2						(-)			(-)	
Cycle 3							(-)			(-)
New Candidate Varieties										
Yr 2000 Final Reports (Cycle 3)			Normal 2/3-year DUS test				(-)			(-)
Yr 2001 Final Reports (Cycle 1)				Normal 2/3-year DUS test				(-)		
Yr 2002 Final Reports (Cycle 2)					Normal 2/3-year DUS test				(-)	

NB: All new candidate varieties are retained in growing tests for four full years before entering the cyclic control system. This provides a more complete data set for these varieties as they become control varieties and are assimilated into the test matrix.

Annex 1: The Distinctness Model in a Cyclic Planting and Compensated Data System

Over years data arising from DUS growing tests are strongly influenced by year effects. Thus in a late year the range of the dominant character, heading date, is very much reduced compared with its range in an early year. Other characters are affected similarly. This suggests that the variety effects should be modified by a constant having the value of unity for a medium year and taking values above and below unity for other years depending on their earliness This constant therefore reflects the slope of the variety means on a character in a single year against standard variety values determined over several years. It is therefore assumed for distinctness purposes that for n_v varieties in n_y years the data arising from the proposed trial scheme will follow the modified joint regression analysis (MJRA) model:

$$c_{ij} = \mu + y_j + \beta_j v_i + \varepsilon_{ij} \quad \text{.....(1)}$$

where c_{ij} is the value on a character for variety i in year j, where

$i = 1,...,n_v$ *and* $j = 1,....,n_y$

v_i is the effect of the ith variety with $v_i = 0$

y_j is the effect of the jth year with $y_j = 0$

β_j is the slope of variety means in year j against variety means over all years and is referred to as the sensitivity of year j.

ε_{ij} is a random error associated with variety i in year j

Solving the MJRA model

Equation (1) is non linear and hence cannot be fitted directly to the data. Therefore to make progress it is necessary to solve it iteratively as follows:

Step 1: Assume $\beta_j = 1, (j = 1,...,n_y)$ in equation (1) and solve for $v_i (i = 1,...,n_v)$ and $y_j (j = 1,...,n_y)$ by multiple regression.

Step 2: Substitute the v_i values derived at step 1 into equation (1) and solve for $\beta_j (j = 1,...,n_y)$ and $y_j (j = 1,...,n_y)$.

Step 3: Substitute the β_j values derived at step 2 into equation (1) and solve for $v_i (i = 1,...,n_v)$ and $y_j (j = 1,...,n_y)$.

Repeat from step 2 until the ratio of residual sum of squares between 2 cycles is greater than a defined constant e.g. 0.999.

Comparisons between variety pairs

Having obtained convergence between the above cycles use is made of the resulting variance-covariance matrix between estimated effects to compare particular variety means. This variance-covariance matrix of effects is given by:

$$(X'X)^{-1}\sigma^2 \quad \text{.....(2)}$$

where *X* is the design matrix at an odd step number and X' is its transpose. Also σ^2 is the residual mean square. From terms in the variance-covariance matrix the variance between means of two varieties i and k is

$$\text{var}(i,k) = (v_{ii} + v_{kk} - 2v_{ik})\sigma^2 \quad \text{.....(3)}$$

where $v_{ii}\sigma^2$ and $v_{kk}\sigma^2$ are the variety variances and $v_{ik}\sigma^2$ is the covariance of the variety pair

4.(B) ASSESSMENT OF THE UNIFORMITY OF F1 HYBRIDS IN RELATION TO THEIR BREEDING HISTORY

(Draft prepared by Mr. J. Barendrecht, Netherlands)

INTRODUCTION

The breeding formula of F1 hybrids can be very multiform varying from a crossing between totally inbred parent lines to a crossing between partly inbred lines, whereas the parents can be propagated either by seed or vegetatively. In the case of vegetative propagation of the parents one can distinguish between vegetative propagation of the whole parent population and propagation of one distinct plant in that population (clonal propagation). Breeding systems where the one parent is propagated clonally (originating from 1 plant) and the other one by seed are also known in ornamentals (e.g. in Bromeliads). All these aspects have to be taken into consideration when assessing the uniformity of hybrids.
On the above mentioned facts the following possibilities can occur:

- **Parents lines**: • purely inbred : both (pure F1 hybrid)
  • purely inbred : one, the other partially
  • partly inbred : both
  • just a random choice on good combining ability between the two parents.

- **Reproduction of parent lines:** - by seed
  - clonally

PROPOSAL FOR RULES

- As far as the first possibility is concerned (both parents totally inbred) the already existing recommendation can be used: the same standard as for clones and self pollinators with some tolerance for selfed plants.

- In the other situations different levels of uniformity can exist often within the same crop.

  Before discussing a proposal for rules an answer should be given to some questions:
  - Could one always consider the information given by the applicant as a reliable one?
  - If the answer to the above question is more or less negative:
  - Can the information given by the breeder be checked?
  - If the answer to the above question is more or less positive:
  - Who has to prove the correctness of that information: the applicant or the testing authority?

  And:
  - Who has to pay for that?

- As has been stated elsewhere in TGP/12 in assessing the uniformity and in fixing standards for that, one should take into consideration the genitical makeup of the variety, the way of reproduction and the uniformity of the parent polulations.

- Another point also mentioned in TGP/12 - is the standard for uniformity must not be set to high thus hindering breeding development, on the other hand, it should not be set to low leaving to less variability for further breeding progress.

  Balancing the above mentioned aspects against each other the following schedule could give a workable system:
  Schedule:

Parent lines (Group)	Reproduction of Parents
1. Both purely inbred	a. seed x seed
2. Purely inbred / partly inbred	b. clone *x seed
3. Both partly inbred	c. clone *x clone
4. Combining ability	

  * Clone should be understood here as one vegetatively propagated individial out of an inbred population.

- Group 1: the current rules for 'pure'F1 hybrids should be followed.

- Group 2: the uniformity should exceed in any case the uniformity of the polulations out of which the parent lines were developed and also the uniformity of the partially inbred line when seed propagated.

- Although the genetical make up under the a-b-c- possibilities is not the same it does not seem unreasonable to handle them in the same way when assessing standards for uniformity: a standard somewhere in between the standard for a cross pollinator and the standard for a pure F1 hybrid.

- Group 3: Uniformity standards should be set at a lower level than in group 2. However, when both systems are used in the same crop it might be not recommendable to have two different standards for uniformity especially not if the breeding formula could not be checked at all or not be checked in an easy way.

- Group 4: These techniques are sometimes used in ornamentals. The parents are more or less chosen at random searching for a good combining ability. Hardly any other rule than relative uniformity depending on the special situation can be given here.

  This survey does not have the pretension to be an exhaustive one, it is meant as a building block for setting up the rules.

E

DRAFT FOR TGP/05
DATE:

UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
GENEVA

DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/05: AVAILABLE KNOWLEDGE ON DUS TESTING, COOPERATION IN EXAMINATION

5.(A) COOPERATION IN EXAMINATION

5.(B) MODEL ADMINISTRATIVE AGREEMENT FOR INTERNATIONAL COOPERATION IN THE TESTING OF VARIETIES

5.(C) UPOV REPORT ON TECHNICAL EXAMINATION AND UPOV VARIETY DESCRIPTION

5.(c)(i) UPOV Report on Technical Examination

5(c)(ii) UPOV Variety Description

5.(D) NOTIFICATION OF NATIONAL TEST GUIDELINES FOR SPECIES FOR WHICH NO UPOV TEST GUIDELINES EXIST AND LIST OF SPECIES IN WHICH PRACTICAL TECHNICAL KNOWLEDGE HAS BEEN ACQUIRED OR FOR WHICH NATIONAL GUIDELINES HAVE BEEN ESTABLISHED AND E-MAIL ADDRESSES

5.(E) NOTIFICATION OF ROUTINE CHARACTERISTICS NOT INCLUDED IN UPOV TEST GUIDELINES

5.(F) E-MAIL ADDRESSES OF TECHNICAL EXPERTS

5.(A) COOPERATION IN EXAMINATION

Document C/32/5 contains a synopsis of offers for cooperation in examination made by member States, of cooperation already established between member States and of any envisaged cooperation, with additional indications on the eligibility for protection. It is updated annually. The information on the state of cooperation in examination is given in a table with the following columns:

No.	Taxon	Offering/ examining States	States receiving examination reports	States exchanging examination reports
	1	2	3	4

The meaning of the columns is as follows:

Column 1 contains the Latin, English, French and German names of the taxa. For ease of reference the taxa have been numbered in a separate column. Where the Latin name of a taxon is marked with the sign $^{+}$, the following entries which relate to subdivisions of the taxon concerned should also be consulted.

Column 2 contains the names of the States carrying out examinations for the States mentioned in column 3 on the same line or on the subsequent line or lines on which there is no entry in column 2. The State mentioned in column 2 has not received any acceptance of its offer if no State is mentioned on the same line in column 3. Germany and Poland included a general clause, which is not reflected in this column, on the former's submission of test results to the latter in their agreement.

Column 4 contains the names of the States that have agreed to take over (unless an exception is made in a particular case) examination reports from any other State mentioned on the same line. General clauses on the taking over of test results, which are not reflected in this column, have been included in the agreements between: Belgium and Germany; Germany and Japan; Israel and Japan; Japan and the Netherlands; Japan and the United Kingdom; Poland and Slovakia.

Where names of States are between parentheses, this indicates that those States intend to conclude a bilateral agreement with the corresponding States in column 2 or 4.

An asterisk (*) following the name of a State indicates that the State does not (yet) protect the taxon concerned.

The Arabic figures appearing in the columns refer to notes which will be found at the end of the document.

5.(B) MODEL ADMINISTRATIVE AGREEMENT FOR INTERNATIONAL COOPERATION IN THE TESTING OF VARIETIES

(adopted by the Council on October 29, 1993 and reproduced from C/27/15, Annex III)

- CONSCIOUS of the importance attaching to cooperation between the members of the International Union for the Protection of New Varieties of Plants (UPOV) in the examination of the distinctness, uniformity and stability of the varieties that are the subject of an application for a breeder's right, as a means of optimizing the functioning of their plant variety protection systems,

- CONSIDERING that cooperation may take various forms depending on the special biological, technical and economic features of each botanical taxon,

- CONVINCED that the centralization of the examination and the standardization of the technical procedures brought about by other forms of cooperation have a beneficial effect on international trade in the field of plant varieties and seeds,

- CONSIDERING that, where the centralization of the examination has not been achieved, it may be desirable that the examination of the distinctness, uniformity and stability of a variety being the subject of an application in more than one State be undertaken once only,

- CONSIDERING that this Agreement must be conceived in such a way that it may also serve as the basis for cooperation in areas related to the protection of new plant varieties, in particular in the administration of the lists of varieties admitted to trade,

- CONSIDERING that the parties are also desirous to conclude comparable agreements with other members of the Union, and that it is therefore necessary to base this Agreement on the Model Administrative Agreement for International Cooperation in the Testing of Varieties drawn up by UPOV and adopted by its Council at the twenty-seventh ordinary session, on October 29, 1993,

- CONSIDERING that any agreement in this field must necessarily be reviewed, evaluated and adjusted periodically,

Party A

and

Party B

have agreed as follows:

Article 1

(1) Authority A shall provide the following services to Authority B, at the latter's request, in respect of the varieties which are the subject of an application for a breeder's right filed with Authority B in accordance with the International Convention for the Protection of New Varieties of Plants, or for entry in the national list of varieties admitted to trade:

(i) for the genera and species whose list is given in Annex A.1, it shall undertake the examination for distinctness, uniformity and stability of the variety concerned;

(ii) for the genera and species whose list is given in Annex A.2 [or A.2/B.2], it shall undertake the part of the examination specified in the said Annex;

(iii) for the genera and species whose list is given in Annex A.3, it shall supervise the examination of the variety, where such examination is undertaken on its territory by the applicant, or by a third party on his behalf, and evaluate the results thereof.

(iv) for the genera and species whose list is given in Annex A.4 [or A.4/B.4], it shall supply the results of the examination or supervision which it has undertaken or agreed to undertake on the basis of a prior application;

(2) Authority B shall, under the same conditions, provide the aforementioned services to Authority A, for the genera and species whose list is given in Annexes B.1, B.2 [or A.2/B.2], B.3 and B.4 [or A.4/B.4], respectively.

(3) The authorities may agree, on an ad hoc basis, to apply this Agreement to a variety from a genus or species not listed in the relevant Annex.

(4) For the purposes of this Agreement:

(i) "Executing Authority" means the Authority which provides one of the services specified in subparagraphs (i) to (iv) of paragraph (1) above;

(ii) "Receiving Authority" means the Authority to which one of the aforementioned services is provided.

Article 2

Where the Council of UPOV has adopted Test Guidelines for the conduct of the testing of a species subject to this Agreement, the examination shall be conducted according to those Test Guidelines. In the absence of such Guidelines the Authorities shall adopt the testing methods by mutual consent before this Agreement is applied to the species in question.

Article 3

(1) For each variety the Executing Authority shall submit to the Receiving Authority, as the case may be:

(i) the reports relating to each testing period and a final examination report;

(ii) the reports relating to the part of the examination entrusted to it;

(iii) the reports relating to the supervision of the examination undertaken by the applicant, or by a third party on his behalf, and to the evaluation of the results thereof, and a final examination report.

(2) The final examination report shall detail the results of the examination concerning the characteristics of the variety and shall state the opinion of the Executing Authority on the distinctness, uniformity and stability of the variety. When those requirements are considered to be fulfilled or when the Receiving Authority asks for it, a description of the variety shall be added to the report.

(3) Reports and descriptions shall be written in ... (language).

(4) Any emerging problems shall be notified immediately to the Receiving Authority.

(5) With respect to the distinctness, uniformity and stability criteria, the Receiving Authority shall decide on the application, in principle, on the basis of the final examination report, or with due regard being given to the partial reports of the Executing Authority. Where exceptional circumstances require it, the Receiving Authority may carry out supplementary tests and trials. If it chooses to do so, it shall inform the Executing Authority thereof.

Article 4

(1) The Authorities shall take all necessary steps to safeguard the rights of the applicant.

(2) Except with the specific authorization of the Receiving Authority and the applicant, the Executing Authority shall refrain from passing on to a third person any material of the varieties for which testing has been requested.

(3) Access to the documents and the test plots shall be given only to:

(i) the Receiving Authority, the applicant and any duly authorized person;

(ii) the necessary staff of the institution that carries out the testing and special experts called in who are bound to secrecy in public service. Those special experts shall have access to the formulae of hybrid varieties only if it is strictly necessary and if the applicant does not object.

This paragraph does not exclude general access to test plots by visitors, provided due regard is had to paragraph (1) above.

(4) If another authority is a receiving authority under a similar agreement, access may be granted in accordance with the rules applicable under that agreement.

Article 5

Where, in the case of a service specified in Article 1(1)(iv) above, the prior application is rejected or withdrawn, the Authorities may agree on the continuation of the examination or supervision on behalf of the Receiving Authority.

Article 6

Practical details arising out of this Agreement--regarding in particular the provisions relating to the considerations, application forms, technical questionnaires and requirements as to propagating material, testing methods, exchange of reference samples, maintenance of reference collections and the presentation of the results--shall be settled between the authorities by correspondence.

Article 7

(1) The Receiving Authority shall pay to the Executing Authority the consideration agreed upon under Article 6.

(2) (i) In the case of a service specified in Article 1(1)(iv) above, an administrative consideration equivalent to 350 Swiss Francs or of an amount agreed upon by correspondence between the Authorities shall be charged.

(ii) Where the prior application has been rejected or withdrawn and where, pursuant to Article 5 above, the Authorities have agreed on the continuation of the examination or supervision on behalf of the Receiving Authority, the amount payable shall be equal to the additional cost resulting from the continuation of the examination or supervision.

(3) Payments shall be effected within three months of receipt of an invoice specifying their amount.

Article 8

Each Authority shall make available any information, facilities or services of experts that the other Authority may need additionally, on condition that the latter undertakes to pay the costs involved.

Article 9

(1) This Agreement shall enter into force on ... (date) [and shall replace the Agreement of ... (date) on cooperation in the examination of plant varieties].

(2) This Agreement and its Annexes may be amended by mutual agreement.

(3) Any party wishing to revoke this Agreement in whole or in part shall give the other party notice to that effect.

(4) Unless the parties agree otherwise, any such revocation shall take effect only after observance of two years' notice, completion of pending tests and transmittal of the relevant reports.

5.(C) UPOV REPORT ON TECHNICAL EXAMINATION AND UPOV VARIETY DESCRIPTION

5.(c)(i) UPOV Report on Technical Examination
(adopted by the Technical Committee on October 6, 1989 and reproduced from the Annex of TC/XXV/12)

1. Reference number of reporting authority .....
2. Requesting authority .....
3. Reference number of requesting authority .....
4. Breeder's reference .....
5. Date of application in requesting State .....
6. Applicant (name and address) .....
7. Agent (name and address)(if applicable) .....

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8. Botanical name of taxon .....
9. Common name of taxon .....
10. Variety denomination .....
11. Breeder (name and address) .....
12. Testing authority .....
13. Testing station(s) and place(s) .....
14. Period of testing 19.....
15. Date and place of issue of document .....

16. RESULTS OF THE TECHNICAL EXAMINATION AND CONCLUSION

(a) Report on Distinctness

The variety
- is clearly distinguishable from any other variety ☞
- is not clearly distinguishable from all varieties ☞

whose existence is known to us.

(b) Report on Uniformity

The variety
- is sufficiently homogeneous ☞
- is not sufficiently homogeneous ☞

having regard to the particular features of its sexual reproduction or vegetative propagation.

(c) Report on Stability

The variety
- is stable ☞
- is not stable ☞

in its essential characteristics.

In the case of a positive conclusion, a description of the variety is given as annex to this report.

17. Remarks .....

.....

18. Signature .....

5.(c)(ii) UPOV Variety Description
(adopted by the Technical Committee on October 12, 1990, and reproduced from Annex I of TC/26/6)

1. Reference number of reporting authority .....
2. Reference number of requesting authority (bilateral agreements only) .....
3. Breeder's reference .....
4. Applicant (name and address) .....

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5. Botanical name of taxon .....
6. Common name of taxon .....
7. Variety denomination .....
8. Date and document number of UPOV Test Guidelines .....
9. Date and/or document number of National Test Guidelines .....
10. Testing authority .....
11. Testing station(s) and place(s) .....
12. Period of testing 19.....
13. Date and place of issue of document .....

UPOV No.	National No.	Characteristics	States of Expression	Note	Remarks

---

14. Group: (if characteristics of number 15 are used for grouping, they are marked with a G in that number)

Reference number of reporting authority .....

UPOV No.	National No.	Characteristics	States of Expression	Note	Remarks

15. Characteristics Included in the UPOV Test Guidelines or National Test Guidelines

16. Similar Varieties and Differences from These Varieties

Denomination of similar variety	Characteristic in which the similar variety is different°)	State of expression of similar variety	State of expression of candidate variety

°) In the case of identical states of expression of both varieties, please indicate the size of the difference.

17. Additional Information

(a) Additional Data

(b) Remarks

18. Explanatory Notes to the UPOV Variety Description Form

(a) General

The reference number of the reporting authority should be repeated on each page of the report.

(b) Ad Number 14

Only information on the group to which the variety belonged should be given or information on groupings other than by characteristics listed in Number 15. Grouping by characteristics mentioned in Number 15 should be indicated simply by marking the respective characteristic in Number 15 with the letter "G" before the number of the characteristic.

(c) Ad Number 15

(i) All characteristics of the UPOV Test Guidelines should be reproduced, including those which are not applicable and those which have not been recorded. Those not applicable should be marked "not applicable," those not recorded, "not recorded."

(ii) The asterisks from the UPOV Test Guidelines should be repeated on the form.

(iii) Additional national characteristics should not be placed after the UPOV characteristics, but in their sequence according to the UPOV rules, as the main purpose of the form is still for national use. They do not need to be specially marked as they are sufficiently identified by the national number.

(iv) The list contains only a small column for brief remarks or for a reference to lengthier remarks which should be reproduced in a footnote.

(d) Ad Number 16

Only those characteristics that show sufficient differences to establish distinctness should be given. Information on differences between two varieties should always contain the states of expression with their notes for both varieties; if possible, in columns if more varieties are mentioned.

5.(D) NOTIFICATION OF NATIONAL TEST GUIDELINES FOR SPECIES FOR WHICH NO UPOV TEST GUIDELINES EXIST AND LIST OF SPECIES IN WHICH PRACTICAL TECHNICAL KNOWLEDGE HAS BEEN ACQUIRED OR FOR WHICH NATIONAL GUIDELINES HAVE BEEN ESTABLISHED AND E-MAIL ADDRESSES

The information is contained in document TC/36/4 which is annually updated for the session of the Technical Committee.

The list is established in the alphabetical order of the Latin names. The International Standardization Organization (ISO) two-letter code has been used to identify States and is followed by (a) and/or (b) indicating whether

(a) the Office (or any contracting institution of the Office) has acquired practical technical knowledge resulting from current or past testing, and/or

(b) national Test Guidelines have been established.

To facilitate the reading of the document, the ISO Codes of the UPOV member States is used.

5.(E) NOTIFICATION OF ROUTINE CHARACTERISTICS NOT INCLUDED IN UPOV TEST GUIDELINES

This document has still to be prepared.

5.(F) E-MAIL ADDRESSES OF TECHNICAL EXPERTS

The e-mail addresses of all experts can be found on the Internet under: http://www.bioss.sair.ac.uk/upov//upemail.html. A printout of February 9, 2000 of the e-mail addresses of the Technical Committee is reproduced on the next page. In addition a printout is made for each session of the TWC made. The last printout can be found in document TWC/17/7.

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E

DRAFT FOR TGP/06
DATE:

UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
GENEVA

DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/06: DUS TESTING DONE BY THE APPLICANT/BREEDER

6.(A) DUS TESTING BY OR ON BEHALF OF THE BREEDER

6.(B) DECLARATION ON THE CONDITIONS FOR THE EXAMINATION OF A VARIETY BASED UPON TRIALS CARRIED OUT BY OR ON BEHALF OF THE BREEDER

6.(C) LEVEL OF INVOLVEMENT OF THE APPLICANT IN THE GROWING TEST

6.(A) DECLARATION ON THE CONDITIONS FOR THE EXAMINATION OF A VARIETY BASED UPON TRIALS CARRIED OUT BY OR ON BEHALF OF THE BREEDER

(adopted by the Council on October 29, 1993 and reproduced from Annex II of document C/27/15)

The Council of the International Union for the Protection of New Varieties of Plants,

Pursuant to Article 21(h) of the 1978 Act of the International Convention for the Protection of New Varieties of Plants;

Considering Article 7(1) of the 1978 Act of the Convention, under which: "Protection shall be granted after examination of the variety in the light of the criteria defined in Article 6. Such examination shall be appropriate to each botanical genus or species";

Considering Article 12 of the 1991 Act of the Convention, under which: "Any decision to grant a breeder's right shall require an examination for compliance with the conditions under Articles 5 to 9. 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. For the purposes of examination, the authority may require the breeder to furnish all the necessary information, documents or material";

Recognizing that Article 7(1) of the 1978 Act and Article 12 of the 1991 Act permit but do not require the authority to base its examination upon growing and other necessary tests carried out by or on behalf of the breeder;

Declares that a system for the examination of applications based upon such tests carried out by or on behalf of the breeder and on the information submitted by him on the basis of those tests will be considered in keeping with the provisions of the Convention if:

1. The growing tests and other necessary tests are conducted according to guidelines established or accepted by the authority;

2. The testing arrangement is maintained--in order to permit the checking of data or the collecting of further data--until a decision has been made on the application or until the authority has informed the breeder that the arrangement is no longer necessary;

3. Access to the tests by persons properly authorized by the authority is provided;

4. The breeder, when requested to do so, deposits in a designated place, and within a time limit set by the authority, a sample of propagating material representing the variety.

6.(B) DUS TESTING BY OR ON BEHALF OF THE BREEDER (Draft prepared by Mr. T. Hossain, Australia)

INTRODUCTION

In granting of Plant Breeder's Rights (PBR), an examination process is essential in confirming that a new variety meets the technical criteria of Distinctness, Uniformity and Stability (DUS). In most UPOV member states, DUS testing is predominantly done by the relevant official testing authorities at some centralized testing facilities. However, Article 7(1) of the 1978 revision of the UPOV Convention (UPOV 78) and the Article 12 of the 1991 revision of the UPOV Convention (UPOV 91) do not strictly require that the testing should be conducted by the official testing authorities but anticipate that other testing methods could be used.

One such method is the so-called "breeder testing" system where the breeder (or applicant or contractor to the breeder) becomes involved in or undertakes the DUS trial. The level of involvement of the breeder in a breeder testing system varies depending on national circumstances.

The use of some form of breeder testing is growing and a number of member states regularly use breeder testing in one form or another for testing varieties in a narrow or wide range of species. Some member states use both centralized testing for certain groups of plants and rely on breeder testing for the remainder.

A summary of the extent of involvement of the breeder or the applicant in DUS testing is given in TC/32/4.

For breeder testing to be accepted as equivalent to centralized testing certain scientific and administrative conditions must be met.

CONDITIONS FOR THE USE OF BREEDER TESTING

The UPOV has prepared a list of conditions for the examination of a variety based upon trials conducted by or on behalf of the breeders (UPOV Publication No. 644(E), Section 16). These are:

The growing tests and other necessary tests are conducted according to the guidelines established or accepted by the authority;

The testing arrangements are maintained – in order to permit the checking of data or the collecting of further data – until a decision has been made on the application or until the authority has informed the breeder that the arrangement is no longer necessary;

Access to the tests by persons properly authorized by the authority is provided;

The breeder, when requested to do so, deposits in a designated place, and within a time limit set by the authority, a sample of propagating material representing the variety.

Provided the above conditions are fulfilled then the relevant national authorities may accept the data obtained from the test in support of the DUS of the new variety.

The breeder testing system places the onus on the breeder to conduct the trial in accordance with the prescribed Test Guidelines and maintain the trial until the final decision is made by the authorities. The conduct of the trial may include the planting and maintenance of the trial as well as the recording and analysis of the results.

Criteria 2 and 3 allow the competent authority to undertake an independent assessment of the growing trial. Usually this assessment including measurements and analysis is undertaken by an examiner from the authority or by a contractor to the authority with sufficient knowledge about the species to ensure the technical rigor of the testing method and data.

FACTORS THAT MAY INFLUENCE THE ADOPTION OF A BREEDER TESTING SYSTEM

The following factors may influence a member country's decision to consider a breeder testing system:

1. there is wide diversity of environments under which different varieties need to be tested (tropical to desert; coastal to alpine) but for which there is no recognized testing establishment,

2. there is a regular and ongoing need to access knowledge and expertise, not held in the PBR office, but necessary to efficiently test the large number of diverse varieties for which protection could be granted,

3. new schemes require easy and speedy implementation to allow key varieties to be introduced from overseas,

4. the competent authority intends to place the burden of proof that the new variety meets DUS criteria on the beneficiary of the grant (i.e. the breeder or applicant),

5. the need to minimize the cost of the examinations process to both the applicant and the government, especially where minimum administration/infra-structure is available,

6. the need to win public confidence in the grant of rights by making it as transparent as possible.

ENSURING RIGOR IN BREEDER TESTING

Confidence in the breeder testing system relies on two important components: (1) demonstrated scientific rigor and (2) public/peer group scrutiny.

Before deciding on whether the variety meets all the requirements of DUS, the national authorities referees the scientific methods/data/analyses and undertakes where necessary an independent evaluation of the comparative trial in the form of a field examination.

Public scrutiny is a critical important factor in breeder testing as it offsets the loss of ‘total control’ of the DUS test available under centralized testing. The veracity of any breeder testing system depends largely on public scrutiny of the testing process and the opportunity to

comment or object before the grant of rights to a particular variety is made. It is usually achieved by publishing a detailed description and photograph of each variety before grant. Publication allows a breeder's peers (and others knowledgeable in the species, including other member states) to object to the granting of PBR; informs industry of potential new varieties; and gives the public an opportunity to comment on individual applications. This will ensure the transparency of breeder testing systems.

ADVANTAGES AND DISADVANTAGES OF BREEDER TESTING

The breeder testing system is an efficient system because it makes the widest use of knowledge and expertise for any particular crop or variety through peer review. Consequently it is a low risk system. No other method is as flexible for the applicant and as easy to implement for the Government. The transparency of the system adds to the confidence of both public and the breeder. It is a low cost system that allows even the smallest of breeders to participate in a national and international scheme.

However, there are always some points of contention. Because there is no absolute control in the process, those who use centralized testing worry that the breeder may interfere with the comparative trial, which could alter the results. This argument does not bear scrutiny because if the variety does not exhibit its distinctive characteristics in the market place then the legal basis of the grant can be challenged. As the breeders are the ultimate beneficiary of the grant it is their best interest to conduct the trial properly in accordance with the prescribed Test Guidelines.

BREEDER TESTING IN ASSOCIATION WITH CENTRALIZED TESTING (A HYBRID SYSTEM)

Some UPOV member states (e.g. Australia) have adopted a "hybrid" system which allows a combination of Breeder Testing and Centralized Testing. Some nominated genera are tested at a 'Centralized Testing Centre' (CTC) while the others are tested by the breeder or applicant. The CTCs are not necessarily governmental facilities. If certain requirements are met then the private companies may also have their facilities recognized as CTCs.

COMPARISON OF BREEDER TESTING WITH OTHER TESTING REGIMES

Provided the technical rigor of the trial is maintained, Breeder Testing is comparable with the Centralized Testing (see Table 1) in its power to determine compliance with DUS requirements.

Table 1: A comparison of important features of different DUS testing procedures

Category	Breeder's involvement	Cost	Administration	Infra - structure	Risk of mistakenly granting rights	Flexibility for applicants
Centralized Testing	Low	High	High	High	Low	Low
Breeder Testing	High	Low	Low	Low	Low	High
Hybrid System	Variable	Variable	Moderate	Variable	Low	Variable

DEPOSIT OF PROPAGATIVE MATERIAL

The UPOV convention is silent on the need to deposit a representative sample of the propagating material of each new variety. However, in order to provide material for future testing and varietal identification, national laws often require material to be maintained at least for the duration of the grant. In the absence of centralized facilities, breeder testing schemes can allow applicants either to deposit material in an "official" germplasm repository or store it on their own premises. Article 10 of UPOV 78 allows for the forfeit of the breeder's right when the breeder is no longer in a position to supply propagative material that complies with the variety's description.

CONCLUSION

Close cooperation with the breeders has always been promoted by the UPOV, even in the case of member states with a strict system of centralized official testing system. The rapid expansion in the number of countries that are now offering plant variety protection in conjunction with UPOV 91 mandate to extend potential protection all of the plant kingdom is encouraging member states to seriously consider alternative trialing methods including breeder testing.

6.(C) LEVEL OF INVOLVEMENT OF THE APPLICANT IN THE GROWING TEST

At the request of the Technical Working Party for Agricultural Crops (TWA), the Office of the Union asked in 1994 for information on the level of involvement of the applicant in the growing tests. The summary of the answers received was included in document TWA/23/7. The Technical Committee decided to repeat the survey and to cover also non-agricultural species in order to have full details of the testing systems in the individual member States.

Document TC/32/4 contains a summary table with information received in response to a Circular issued by the Office of the Union. For those countries which have different systems for different groups of species, the information on each of the different groups is indicated in separate numbered columns.

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DRAFT FOR TGP/07
DATE:

UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
GENEVA

DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/07: ESTABLISHMENT OF TABLES OF CHARACTERISTICS IN UPOV TEST GUIDELINES HARMONIZATION OF CHARACTERISTICS AND STATES OF EXPRESSION

The draft for document TGP/07 is contained in document TC/36/5 prepared by the Office of UPOV in cooperation with experts from South Africa and the United Kingdom. It gives information on the following subjects:

Document TC/33/9 on the harmonization of states of expression and notes of characteristics appearing in the UPOV Test Guidelines gives a draft collection of the majority of the cases of the use of states of expression and Notes for the characteristics appearing in the UPOV Test Guidelines that may arise. It is intended to be of help in the preparation of new Test Guidelines. The list gives, in the English alphabetical order, keywords of characteristics used, or recommended to be used, in UPOV Guidelines and their possible states of expression. In the case of more than one set of states of expression being given for the same keyword, drafters of new Test Guidelines should choose the most appropriate one. For the Notes of states of expression, it is advisable to refer to document TC/36/5, which contains a summary of the basic rules which determine the Notes under different circumstances.

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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
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DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/08: GOOD STATISTICAL PRACTICES FOR DUS ASSESSMENT

8.(A) CHAPTER I: MEASURED DATA, CHECKING OF THE TRUTH OF THE ASSUMPTIONS, ACTIONS AND METHODS WHEN THOSE ASSUMPTIONS WERE NOT PROVED TRUE

8.(B) CHAPTER II: OUTLIERS, ADEQUATE RANDOMIZATION, ONE TAIL AND TWO TAIL DISTRIBUTIONS, SUFFICIENT REPLICATIONS AND NUMBER OF PLANTS FOR INDIVIDUAL PLANT RECORDING

8.(C) CHAPTER III: COY APPROACH

8.(A) CHAPTER I: MEASURED DATA, CHECKING OF THE TRUTH OF THE ASSUMPTIONS, ACTIONS AND METHODS WHEN THOSE ASSUMPTIONS WERE NOT PROVED TRUE

Document still to be prepared.

8.(B) CHAPTER II: OUTLIERS, ADEQUATE RANDOMIZATION, ONE TAIL AND TWO TAIL DISTRIBUTIONS, SUFFICIENT REPLICATIONS AND NUMBER OF PLANTS FOR INDIVIDUAL PLANT RECORDING

Document still to be prepared.

8.(C) CHAPTER III: COY APPROACH

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DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/09: TESTING DISTINCTNESS

9.(A) TESTING DISTINCTNESS WITHOUT THE APPLICATION OF STATISTICAL METHODS

9.(B) TESTING DISTINCTNESS WITH THE APPLICATION OF STATISTICAL METHODS

9.(B1) TESTING DISTINCTNESS IN VISUALLY ASSESSED CHARACTERISTICS

(i) Testing Distinctness in Qualitative Characteristics (non-parametric methods)

(ii) Testing Distinctness in Pseudo-qualitative Characteristics (one observation per plant, per plot/row)

(iii) Testing Distinctness in Quantitative Characteristics (one observation per plant, per plot/row)

9.(B2) TESTING DISTINCTNESS IN MEASURED CHARACTERISTICS

(i) Testing Distinctness in Self-fertilized and Vegetatively Propagated Species (LSD, other methods)

(ii) Testing Distinctness in Cross-fertilized Species

1. Combined-over-years Distinctness Criterion (COYD)

2. Distinctness, Uniformity and Stability Trial Analysis System for Windows (DUSTW)

3. Screen-based Input Module for COYD and Computer-generated Demonstration of COYD

(iii) Application of Statistics in Non-randomized Plots

9.(A) TESTING DISTINCTNESS WITHOUT THE APPLICATION OF STATISTICAL METHODS

Document still to be prepared.

9.(B) TESTING DISTINCTNESS WITH THE APPLICATION OF STATISTICAL METHODS

9.(B1) TESTING DISTINCTNESS IN VISUALLY ASSESSED CHARACTERISTICS

Document still to be prepared.

9.(B2) TESTING DISTINCTNESS IN MEASURED CHARACTERISTICS

9.(b2)(i) Testing Distinctness in Self-fertilized and Vegetatively Propagated Species (LSD, other methods)

Document still to be prepared.

9.(b2)(ii) Testing Distinctness in Cross-fertilized Species

1. Combined-over-years Distinctness Criterion (COYD)

Document TC/33/7 gives details on the COYD Analysis.

To distinguish varieties on the basis of a measured characteristic we need to establish a minimum allowable distance between varieties so that a pair of varieties showing a difference greater than the minimum might be regarded as "distinct" in respect of that characteristic. There are several possible ways of establishing minimum distances from Distinctness, Uniformity and Stability (DUS) trials data. UPOV has agreed on what is known as the Combined-Over-Years Distinctness (COYD) criterion.

The COYD method involves:

– for each characteristic, taking the variety means from the two or three years of trials for candidates and established varieties and producing over-year means for the varieties;

– applying the technique of analysis of variance to the variety-by-years table in order to calculate a least significant difference (LSD) for comparing variety means;
– if the over-years mean difference between two varieties is greater than the LSD then the varieties are said to be distinct in respect of that characteristic.

The main advantages of the COYD method are:

– it combines information from several seasons into a single criterion in a simple and straightforward way;

– it ensures that judgements about distinctness will be reproducible in other seasons; in other words, the same genetic material should give similar results within reasonable limits from season-to-season.

– the risks of making a wrong judgement about distinctness are constant for all characteristics.

Document TC/33/7 describes:

– the principles underlying the COYD method;
– details of ways in which the procedure can be adapted to deal with special circumstances;
– UPOV recommendations on the application of COYD to individual species;
– the computer software which is available to apply the procedure.

The COYD method aims to establish for each characteristic a minimum difference, or distance, which if achieved by two varieties in trials over a period of two or three years, it should be possible to say that those varieties are clearly distinct with a specified degree of confidence.

The method uses variation in variety expression of a characteristic from year-to-year to establish the minimum distance. Thus, characteristics which show consistency in variety

ranking between years will have smaller minimum distances than those with marked changes in ranking.

Calculation of the COYD criterion involves an analysis of variance of a variety-by-year table of means for each characteristic. Data for all candidate and established varieties which appeared in trials over the two or three years are included in the table.

COYD is recommended for use in assessing distinctness of varieties

– when observations are made on a plant (or plot) basis over two or more years;

– when there are some differences between plants (or plots) of a variety but, nevertheless, this variation is sufficiently small to allow us to distinguish between varieties;

– in general COYD is recommended for use in the testing of allogamous (cross-fertilized) varieties.

A pair of varieties is considered to be distinct if their over-years means differ by more than the COYD LSD in at least one characteristic.

It has been agreed to operate the COYD LSD at the 1% level for grass species for both two and three-year tests. Experience with spring onion has shown that a 5% level may be appropriate (Laidig 1988) and with leek the 1% level has been found to be acceptable (van der Heijden and van Marrewijk 1989).

9.(b2)(ii) Testing Dinstinctness in Cross-fertilized Species

2. Distinctness, Uniformity and Stability Trial Analysis System for Windows (DUSTW)

Document TWC/15/17 explains a computer program developed by the United Kingdom for the DUS testing which is freely available to member States.

The DUST system comprises a series of modules or programs linked by data files and has been specifically developed to allow the user to manage and analyze data arising from Distinctness, Uniformity and Stability (DUS) trials for cross pollinating crops such as herbage and vegetable crops. The flow of data through the core DUST modules is shown in Figure 1.

DUS trials are field trials in which candidate and established varieties of a particular crop are grown as spaced plants in order to determine if the candidate varieties are distinct, uniform and stable. Data are recorded in the field at several times during the growing season. On each occasion a different set of characters are measured on all the plants. Each of these sets of plant data are stored in a different file.

DUST provides modules to summarize each file of plant data into a file of plot data and possibly transform the data. Another module allows the files of plot data to be accumulated into a single file containing plot data on all the characters recorded on a trial in a year. If this file is then analyzed by an analysis-of-variance module, the files of variety means and within plot standard deviations it produces may be analyzed by a further module to determine whether the candidate varieties are distinct and uniform on the basis of the single year's data. This is used to provide the breeder with information on a variety in its first year of trialling. The files of variety means and within plot standard deviations may also be pooled with those from other years and analyzed by different modules to determine whether the candidate varieties that have been in trial for 2 or more years are distinct and uniform according to the COYD and COYU criteria respectively.

As the DUST system is modular, it has been possible to also include modules for:

- Multivariate analyses, which may help to further interpret the data and to possibly identify character combinations that will show problem pairs of varieties to be distinct.

- Single or over year distinctness analyses using estimates of error variation which incorporate data from other years. This would be used when otherwise there would be insufficient data for reliable testing.

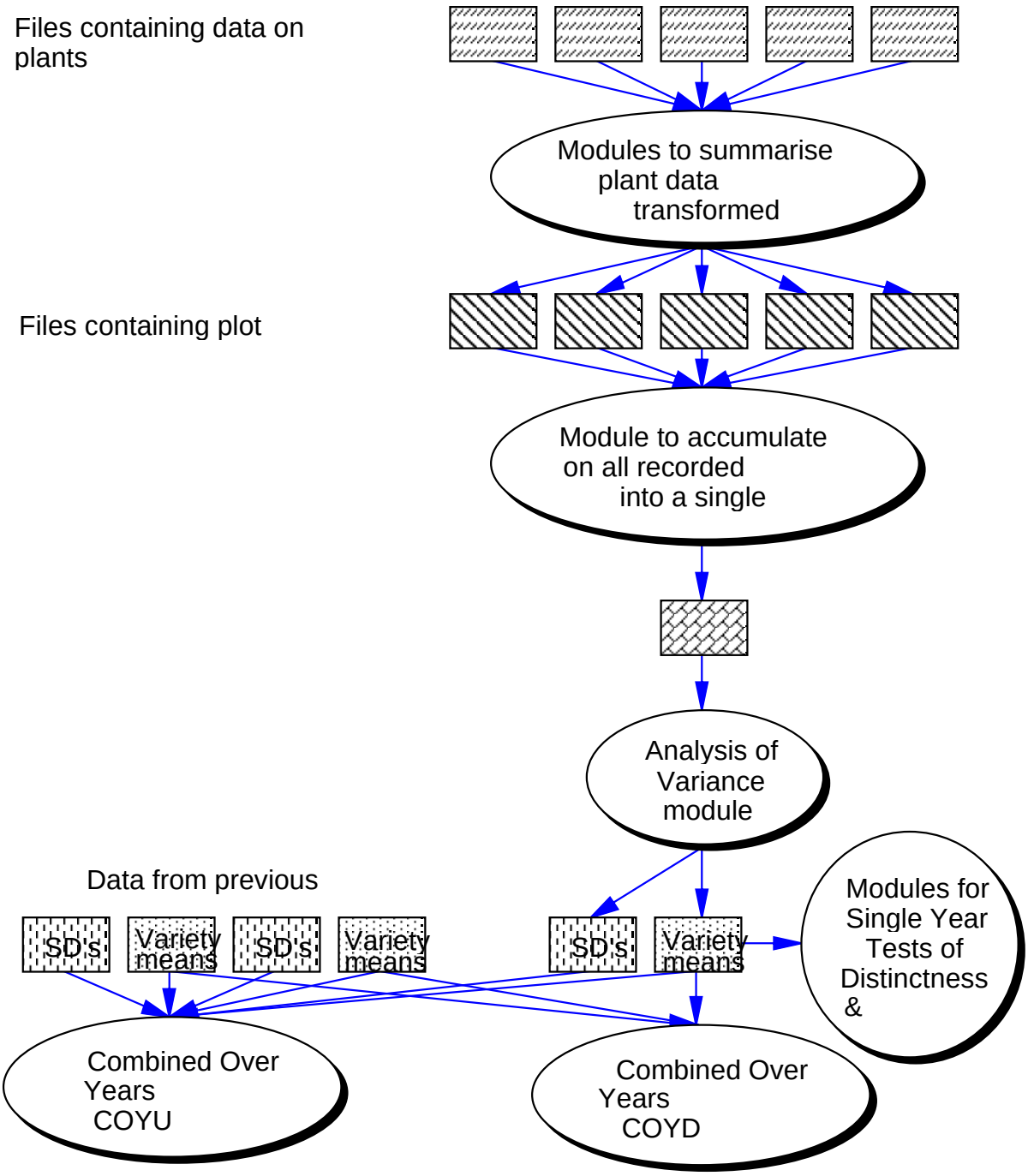
- Analyses to provide variety descriptions.

- Various miscellaneous purposes.

The DUST system is currently available as a DOS based package of FORTRAN 90 programs called DUST9 which will run on 386, 486 and Pentium PC's (where an SX chip is used, a maths coprocessor is recommended). DUST9 has replaced DUSTX, which was the previous version of DUST. Since 1999 the program is also available as DUSTW to run under Window.

Below the flow of data between the core DUST modules is explained in a diagram.

Showing the flow of data between the core DUST modules



A Windows version of DUST called DUSTW is being developed in 1999 which will run on 386, 486 and Pentium PC's under Windows 3.1 or Windows 95 (where an SX chip is used, a maths coprocessor is recommended).

Both DUST9 and a prototype version of DUSTW are available free to member States of UPOV and may be obtained by contacting the following address: Sally Watson, Biometrics Division, DANI, Newforge Lane, Belfast, BT9 5PX, United Kingdom. E-mail: Sally.Watson@dani.gov.uka

9.(b2)(ii) Testing Distinctness in Cross-fertilized Species

3. Screen-based Input Module for COYD and Computer-generated Demonstration of COYD

A screen-based input module for COYD and a computer-generated demonstration of COY can be found on the Internet under http://www.bioss.sari.uk/upov//pdus/coyd/sl/intro.htm.

9.(b2)(iii) Application of Statistics in Non-randomized Plots

Document still to be prepared.

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DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/10: TESTING OF UNIFORMITY

10.(A) TESTING UNIFORMITY WITHOUT THE APPLICATION OF STATISTICAL METHODS

10.(B) TESTING UNIFORMITY WITH THE APPLICATION OF STATISTICAL METHODS

10.(B1) TESTING UNIFORMITY IN VISUALLY ASSESSED CHARACTERISTICS

(i) Testing Uniformity in Qualitative Characteristics (one observation per plant)

(ii) Testing Uniformity in Pseudo-qualitative characteristics (one observation per plant)

(iii) Testing Uniformity in Quantitative Characteristics (one observation per plant)

10.(B2) TESTING UNIFORMITY IN MEASURED CHARACTERISTICS

(i) Testing Uniformity in Self-fertilized and Vegetatively Propagated Species

(ii) Testing Uniformity in Cross-fertilized Species (COYU and Website)

10.(A) TESTING UNIFORMITY WITHOUT THE APPLICATION OF STATISTICAL METHODS

Document to be prepared.

10.(B) TESTING UNIFORMITY WITH THE APPLICATION OF STATISTICAL METHODS

10.(B1) TESTING UNIFORMITY IN VISUALLY ASSESSED CHARACTERISTICS

Documents to be prepared

10.(B2) TESTING UNIFORMITY IN MEASURED CHARACTERISTICS

10.(b2)(i) Testing Uniformity of Self-fertilized and Vegetatively Propagated Species Using Off-types

Document TC/34/5 Rev. explains in detail the testing of uniformity of self-fertilized and vegetatively propagated species using off-types.

Uniformity of candidate varieties of self-fertilized and vegetatively propagated species is normally assessed on a basis of the number of off-types recorded in tests. The question is now: how many off-types should we accept? This number should be chosen such that the probability of rejecting a candidate variety, which meets the standard of that species, is small. On the other hand the probability of accepting a candidate variety that has many more off-types than the standard of that species should also be low.

The methods described in document TC/34/5 address the problem of choosing the number of acceptable off-types for different standards and sample sizes so that the probability of making errors is known and acceptable. The methods involve establishing the standard for the species in question and then choosing the sample size and the number of off-types which best satisfy the risks that can be tolerated.

The document also outlines procedures when more than one single test (more than one year for instance) is done and also mentions the possibility of using sequential tests to minimize testing effort. The methods are intended to be applied at the time of preparation of new or revised Test Guidelines to help the experts to fix a strategy for testing for off-types.

When testing for uniformity on the basis of a sample, there will always be some risk of making a wrong decision. The risks can be reduced by increasing the sample size but at a greater cost. The aim of the statistical procedure described is to achieve an acceptable balance between risks.

The procedures given here require the user to define an acceptable standard (called the population standard) for the species in question and then the methods described enable him/her to determine the sample size and the maximum number of off-types allowed for various levels of risks.

10.(b2)(ii) Testing Uniformity in Cross-fertilized Species

Document TC/33/7 gives detailed information on the testing of uniformity in cross-fertilized species with the help of the combined-over-years uniformity criterion. Document TC/33/7 is complemented by information on the Internet under http://www.bioss.sari.ac.uk/upov//pdus/coyu/sl/intro.htm.

When the uniformity of plants of a variety is to be judged on the basis of measurements then the standard deviation (SD) can be used to summarize the spread of the observations. A new variety can then be tested for uniformity by comparing its SD with that of reference varieties. However, uniformity is often related to the expression of a character. For example, in some species varieties with larger plants tend to be less uniform in size than those with smaller plants. If the same standard is applied to all varieties then it is possible that some may have to meet very strict criteria while others face standards which are easy to satisfy.

The Combined-Over-Years Uniformity (COYU) criterion addresses this problem by adjusting for any relationship that exists between uniformity, as measured by the plant-to-plant SD, and the expression of the characteristic, as measured by the variety mean, before setting a standard.

The technique involves ranking reference and candidate varieties by the mean value of the character. Each variety's SD is taken and the mean SD of the varieties most similar, i.e. those varieties which are ranked with it most closely, is subtracted. This procedure gives for each variety a measure of its uniformity expressed relative to that of comparable varieties. The results for each year are combined by forming a variety-by-years table of adjusted SDs and applying an analysis of variance. The mean adjusted SD for the candidate is compared with the mean for the reference varieties using a standard t-test.

COYU, in effect, compares the uniformity of a candidate with that of the reference varieties most similar in relation to the character being assessed. The main advantages of COYU are that all varieties can be compared on the same basis and that information from several years of testing may be combined into a single criterion.

Between-plant uniformity is often related to the expression of a characteristic. For example, in some species varieties with larger plants tend to be less uniform than those with smaller plants. If a fixed uniformly standard is applied to all varieties then it is possible that some may have to meet very strict criteria while others face standards which are easy to satisfy.

The Combined-Over-Years Uniformity (COYU) criterion addresses this problem by adjusting for the relationship between uniformity, as measured by the plant-to-plant standard deviation (SD), and the expression of the characteristic, as measured by the variety mean.

The technique involves ranking reference and candidate varieties by the mean value of the characteristic The varieties are then taken in groups starting with those ranked 1 to 9 and their mean SD is calculated. This mean SD is subtracted from the variety ranked 5 (and higher). The same process is carried out on varieties ranked 2 to 10 and their mean SD is subtracted from that of variety 6. This procedure is continued to give for each variety a measure of its uniformity relative to the nine most similar varieties.

The results for each year are combined by forming variety-by-years tables of adjusted SDs and applying an analysis of variance. The mean adjusted SD for the candidate is compared with the mean for the reference varieties using a standard test.

The COYU procedure in effect compares the uniformity of a candidate with that of the reference varieties most similar in relation to the characteristic being assessed. The main advantages of COYU are that all varieties can be compared on the same basis and that information from several years of testing may be combined into a single criterion.

Uniformity of plants of a cross fertilized variety is a multiple concept comprising several aspects. In practice the assessment of uniformity is based on the univariate measures of features such as plant size. The aim is to ensure that the distribution of measurements on individual plants of a new variety is not excessive when compared with that of reference varieties.

To describe uniformity the procedure has been adopted of calculating the standard deviation of observations on individual plants within a plot. The within-plot SDs are averaged over all plots of the variety to give an average measure of uniformity for each variety.

The advantages of the COYU procedure are:

(a) it provides a method for assessing uniformity which is largely independent of the varieties that are under test; it should be possible to use all reference varieties as uniformity standards;

(b) standards based on the method are likely to be stable over time;

(c) the method combines information from several trials to form a single criterion for uniformity;

(d) the statistical model on which it is based reflects the main sources of variation which influence uniformity.

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DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/11: OBSERVATION OF COLORS

11.(A) USE OF COLOR CHARTS, CONNECTION, MUNSEL, ETC. HCC, COLOR PICTURES, NO USE OF COLORIMETER

11.(B) CORRESPONDENCE BETWEEN DIFFERENT COLOR CHARTS, RHS COLOUR CHART, Japanese Color Standard for Horticultural Plants (JHS)

(i) Translation of Color Groups

(ii) Grouping of Colors of the RHS Colour Chart

11.(A) USE OF COLOR CHARTS, CONNECTION, MUNSEL, ETC. HCC, COLOR PICTURES, NO USE OF COLORIMETER

Document still to be prepared.

11.(B) CORRESPONDENCE BETWEEN DIFFERENT COLOR CHARTS, RHS COLOUR CHART, JAPANESE COLOR STANDARD FOR HORTICULTURAL PLANTS (JHS)

11.(b)(i) Translation of Color Groups

The following translations of frequent color groups have been prepared by the TWO in order to facilitate the preparation of Test Guidelines and the understanding of discussions in English

1.	yellow green	vert-jaune	gelbgrün	verde amarillento
2.	yellow	jaune	gelb	amarillo
3.	light yellow	jaune clair	hellgelb	amarillo claro
4.	yellow orange	orange-jaune	gelborange	naranja amarillento
5.	light yellow orange	orange-jaune clair	hellgelborange	naranja amarillento claro
6.	orange	orange	orange	naranja
7.	orange pink	rose-orangé	orangerosa	rosa anaranjado
8.	orange red	rouge orangé	orangerot	rojo anaranjado
9.	red	rouge	rot	rojo
10.	light red pink	rose-rouge clair	hellrotrosa	rojo rosado claro
11.	red pink	rose-rouge	rotrosa	rojo rosado
12.	dark pink red	rouge-rose foncé	dunkelrosarot	rojo rosado oscuro
13.	purple red	rouge-pourpre	pupurrot	rojo púrpura
14.	dark purple red	rouge-pourpre foncé	dunkelpurpurrot	rojo púrpura oscuro
15.	purple	pourpre	purpur	púrpura
16.	light blue pink	rose-bleu clair	hellblaurosa	rosa azulado claro
17.	blue pink	rose-bleu	blaurosa	rosa azulado
18.	violet	violet	violett	violeta
19.	light blue violet	violet-bleu clair	hellblauviolett	violeta azulado claro
20.	dark violet	violet foncé	dunkelviolett	violeta oscuro
21.	blue violet	violet-bleu	blauviolett	violeta azulado
22.	violet blue	bleu-violet	violettblau	azul violeta
23.	light violet blue	bleu-violet clair	hellviolettblau	azul violeta claro
24.	blue	bleu	blau	azul
25.	dark blue	bleu foncé	dunkelblau	azul oscuro
26.	light blue	bleu clair	hellblau	azul claro
27.	light green blue	bleu-vert clair	hellgrünblau	azul verdoso claro
28.	green blue	bleu-vert	grünblau	azul verdoso
29.	light blue green	vert-bleu clair	hellblaugrün	verde azulado claro
30.	grey blue	bleu-gris	graublau	azul grisáceo
31.	blue green	vert-bleu	blaugrün	verde azulado
32.	grey green	vert-gris	graugrün	verde grisáceo
33.	green	vert	grün	verde
34.	light green	vert clair	hellgrün	verde claro
35.	brown green	vert-brun	braungrün	verde pardo
36.	green brown	brun-vert	grünbraun	marrón verdoso
37.	dark green	vert foncé	dunkelgrün	verde oscuro
38.	grey brown	brun-gris	graubraun	marrón grisáceo

39.	yellow brown	brun-jaune	gelbbraun	marrón amarillento
40.	orange brown	brun-orangé	orangebraun	marrón anaranjado
41.	light brown	brun clair	hellbraun	marrón claro
42.	brown	brun	braun	marrón
43.	brown red	rouge-brun	braunrot	rojo pardo
44.	brown purple	pourpre-brun	braunpurpur	púrpura pardo
45.	dark brown	brun foncé	dunkelbraun	marrón oscuro
46.	light yellow brown	brun-jaune clair	hellgelbbraun	marrón amarillento claro
47.	grey	gris	grau	gris
48.	green grey	gris-vert	grüngrau	gris verdoso
49.	black	noir	schwarz	negro
50.	white	blanc	weiss	blanco

11.(b)(ii) Grouping of Colors of the RHS Colour Chart

The following lists have been prepared by the TWO in 1994 (document TWO/27/3) in order to harmonize the wording of colors in the RHS Colour Chart):

List 1: Grouping of RHS Color Charts by RHS Chart Number
List 2: Grouping of RHS Color Charts by Color Groups

List 1: Grouping of RHS Color Charts by RHS Chart Number

English		français		deutsch	
1A	Yellow	1A	jaune	1A	gelb
1B	Yellow-Green	1B	vert jaune	1B	gelbgrün
1C	Yellow-Green	1C	vert jaune	1C	gelbgrün
1D	Yellow-Green	1D	vert jaune	1D	gelbgrün
2A	Yellow	2A	jaune	2A	gelb
2B	Yellow	2B	jaune	2B	gelb
2C	Yellow-Green	2C	vert jaune	2C	gelbgrün
2D	Yellow-Green	2D	vert jaune	2D	gelbgrün
3A	Yellow	3A	jaune	3A	gelb
3B	Yellow	3B	jaune	3B	gelb
3C	Yellow	3C	jaune	3C	gelb
3D	Yellow-Green	3D	vert jaune	3D	gelbgrün
4A	Yellow	4A	jaune	4A	gelb
4B	Yellow	4B	jaune	4B	gelb
4C	Yellow-Green	4C	vert jaune	4C	gelbgrün
4D	light Yellow	4D	jaune clair	4D	hellgelb
5A	Yellow	5A	jaune	5A	gelb
5B	Yellow	5B	jaune	5B	gelb
5C	Yellow	5C	jaune	5C	gelb
5D	light Yellow	5D	jaune clair	5D	hellgelb
6A	Yellow	6A	jaune	6A	gelb
6B	Yellow	6B	jaune	6B	gelb
6C	Yellow	6C	jaune	6C	gelb
6D	light Yellow	6D	jaune clair	6D	hellgelb
7A	Yellow	7A	jaune	7A	gelb
7B	Yellow	7B	jaune	7B	gelb
7C	Yellow	7C	jaune	7C	gelb
7D	Yellow	7D	jaune	7D	gelb
8A	Yellow	8A	jaune	8A	gelb
8B	light Yellow	8B	jaune clair	8B	hellgelb
8C	light Yellow	8C	jaune clair	8C	hellgelb
8D	light Yellow	8D	jaune clair	8D	hellgelb
9A	Yellow	9A	jaune	9A	gelb
9B	Yellow	9B	jaune	9B	gelb
9C	light Yellow	9C	jaune clair	9C	hellgelb
9D	light Yellow	9D	jaune clair	9D	hellgelb
10A	light Yellow	10A	jaune clair	10A	hellgelb
10B	light Yellow	10B	jaune clair	10B	hellgelb
10C	light Yellow	10C	jaune clair	10C	hellgelb

10D	light Yellow	10D	jaune clair	10D	hellgelb
11A	Yellow-Orange	11A	orange jaune	11A	gelborange
11B	light Yellow	11B	jaune clair	11B	hellgelb
11C	light Yellow	11C	jaune clair	11C	hellgelb
11D	light Yellow-Orange	11D	orange jaune clair	11D	hellgelborange
12A	Yellow	12A	jaune	12A	gelb
12B	Yellow	12B	jaune	12B	gelb
12C	light Yellow	12C	jaune clair	12C	hellgelb
12D	light Yellow	12D	jaune clair	12D	hellgelb
13A	Yellow-Orange	13A	orange jaune	13A	gelborange
13B	Yellow-Orange	13B	orange jaune	13B	gelborange
13C	Yellow-Orange	13C	orange jaune	13C	gelborange
13D	light Yellow	13D	jaune clair	13D	hellgelb
14A	Yellow-Orange	14A	orange jaune	14A	gelborange
14B	Yellow-Orange	14B	orange jaune	14B	gelborange
14C	Yellow-Orange	14C	orange jaune	14C	gelborange
14D	light Yellow	14D	jaune clair	14D	hellgelb
15A	Yellow-Orange	15A	orange jaune	15A	gelborange
15B	Yellow-Orange	15B	orange jaune	15B	gelborange
15C	Yellow-Orange	15C	orange jaune	15C	gelborange
15D	light Yellow	15D	jaune clair	15D	hellgelb
16A	Yellow-Orange	16A	orange jaune	16A	gelborange
16B	Yellow-Orange	16B	orange jaune	16B	gelborange
16C	Yellow-Orange	16C	orange jaune	16C	gelborange
16D	light Yellow	16D	jaune clair	16D	hellgelb
17A	Yellow-Orange	17A	orange jaune	17A	gelborange
17B	Yellow-Orange	17B	orange jaune	17B	gelborange
17C	Yellow-Orange	17C	orange jaune	17C	gelborange
17D	Yellow-Orange	17D	orange jaune	17D	gelborange
18A	Yellow-Orange	18A	orange jaune	18A	gelborange
18B	light Yellow-Orange	18B	orange jaune clair	18B	hellgelborange
18C	light Yellow-Orange	18C	orange jaune clair	18C	hellgelborange
18D	light Yellow-Orange	18D	orange jaune clair	18D	hellgelborange
19A	Yellow-Orange	19A	orange jaune	19A	gelborange
19B	light Yellow-Orange	19B	orange jaune clair	19B	hellgelborange
19C	light Yellow-Orange	19C	orange jaune clair	19C	hellgelborange
19D	light Yellow-Orange	19D	orange jaune clair	19D	hellgelborange
20A	Yellow-Orange	20A	orange jaune	20A	gelborange
20B	Yellow-Orange	20B	orange jaune	20B	gelborange
20C	light Yellow-Orange	20C	orange jaune clair	20C	hellgelborange
20D	light Yellow-Orange	20D	orange jaune clair	20D	hellgelborange
21A	Yellow-Orange	21A	orange jaune	21A	gelborange
21B	Yellow-Orange	21B	orange jaune	21B	gelborange
21C	Yellow-Orange	21C	orange jaune	21C	gelborange
21D	light Yellow-Orange	21D	orange jaune clair	21D	hellgelborange
22A	Yellow-Orange	22A	orange jaune	22A	gelborange
22B	light Yellow-Orange	22B	orange jaune clair	22B	hellgelborange
22C	light Yellow-Orange	22C	orange jaune clair	22C	hellgelborange
22D	light Yellow-Orange	22D	orange jaune clair	22D	hellgelborange
23A	Yellow-Orange	23A	orange jaune	23A	gelborange

23B	Yellow-Orange	23B	orange jaune	23B	gelborange
23C	light Yellow-Orange	23C	orange jaune clair	23C	hellgelborange
23D	light Yellow-Orange	23D	orange jaune clair	23D	hellgelborange
24A	Orange	24A	orange	24A	orange
24B	Orange	24B	orange	24B	orange
24C	Orange	24C	orange	24C	orange
24D	Orange	24D	orange	24D	orange
25A	Orange	25A	orange	25A	orange
25B	Orange	25B	orange	25B	orange
25C	Orange	25C	orange	25C	orange
25D	Orange	25D	orange	25D	orange
26A	Orange	26A	orange	26A	orange
26B	Orange	26B	orange	26B	orange
26C	Orange	26C	orange	26C	orange
26D	Orange	26D	orange	26D	orange
27A	Orange-Pink	27A	rose orangé	27A	orangerosa
27B	Orange-Pink	27B	rose orangé	27B	orangerosa
27C	Orange-Pink	27C	rose orangé	27C	orangerosa
27D	Orange-Pink	27D	rose orangé	27D	orangerosa
28A	Orange-Red	28A	rouge orangé	28A	orangerot
28B	Orange	28B	orange	28B	orange
28C	Orange	28C	orange	28C	orange
28D	Orange	28D	orange	28D	orange
29A	Orange	29A	orange	29A	orange
29B	Orange	29B	orange	29B	orange
29C	Orange-Pink	29C	rose orangé	29C	orangerosa
29D	Orange-Pink	29D	rose orangé	29D	orangerosa
30A	Orange-Red	30A	rouge orangé	30A	orangerot
30B	Orange-Red	30B	rouge orangé	30B	orangerot
30C	Orange-Red	30C	rouge orangé	30C	orangerot
30D	Orange	30D	orange	30D	orange
31A	Orange-Red	31A	rouge orangé	31A	orangerot
31B	Orange-Brown	31B	brun orangé	31B	orangebraun
31C	Orange-Brown	31C	brun orangé	31C	orangebraun
31D	Orange-Pink	31D	rose orangé	31D	orangerosa
32A	Orange-Red	32A	rouge orangé	32A	orangerot
32B	Orange-Red	32B	rouge orangé	32B	orangerot
32C	Orange-Brown	32C	brun orangé	32C	orangebraun
32D	Orange-Pink	32D	rose orangé	32D	orangerosa
33A	Red	33A	rouge	33A	rot
33B	Orange-Red	33B	rouge orangé	33B	orangerot
33C	Orange-Brown	33C	brun orangé	33C	orangebraun
33D	Orange-Pink	33D	rose orangé	33D	orangerosa
34A	Red	34A	rouge	34A	rot
34B	Orange-Brown	34B	brun orangé	34B	orangebraun
34C	Orange-Brown	34C	brun orangé	34C	orangebraun
34D	Orange-Brown	34D	brun orangé	34D	orangebraun
35A	Orange-Brown	35A	brun orangé	35A	orangebraun
35B	Orange-Red	35B	rouge orangé	35B	orangerot
35C	Orange-Pink	35C	rose orangé	35C	orangerosa

35D	light Red-Pink	35D	rose rouge clair	35D	hellrotrosa
36A	light Red-Pink	36A	rose rouge clair	36A	hellrotrosa
36B	light Red-Pink	36B	rose rouge clair	36B	hellrotrosa
36C	light Red-Pink	36C	rose rouge clair	36C	hellrotrosa
36D	light Red-Pink	36D	rose rouge clair	36D	hellrotrosa
37A	Orange-Pink	37A	rose orangé	37A	orangerosa
37B	Orange-Pink	37B	rose orangé	37B	orangerosa
37C	light Red-Pink	37C	rose rouge clair	37C	hellrotrosa
37D	light Red-Pink	37D	rose rouge clair	37D	hellrotrosa
38A	light Red-Pink	38A	rose rouge clair	38A	hellrotrosa
38B	light Red-Pink	38B	rose rouge clair	38B	hellrotrosa
38C	light Red-Pink	38C	rose rouge clair	38C	hellrotrosa
38D	light Red-Pink	38D	rose rouge clair	38D	hellrotrosa
39A	Orange-Red	39A	rouge orangé	39A	orangerot
39B	Orange-Red	39B	rouge orangé	39B	orangerot
39C	light Red-Pink	39C	rose rouge clair	39C	hellrotrosa
39D	light Red-Pink	39D	rose rouge clair	39D	hellrotrosa
40A	Red	40A	rouge	40A	rot
40B	Red	40B	rouge	40B	rot
40C	Orange-Red	40C	rouge orangé	40c	orangerot
40D	Orange-Red	40D	rouge orangé	40D	orangerot
41A	Red	41A	rouge	41A	rot
41B	Orange-Red	41B	rouge orangé	41B	orangerot
41C	Orange-Red	41C	rouge orangé	41C	orangerot
41D	light Red-Pink	41D	rose rouge clair	41D	hellrotrosa
42A	Red	42A	rouge	42A	rot
42B	Red	42B	rouge	42B	rot
42C	Red	42C	rouge	42C	rot
42D	orange-Red	42D	rouge orangé	42D	orangerot
43A	Red	43A	rouge	43A	rot
43B	Red	43B	rouge	43B	rot
43C	Red-Pink	43C	rose rouge	43C	rotrosa
43D	Red-Pink	43D	rose rouge	43D	rotrosa
44A	Red	44A	rouge	44A	rot
44B	Red	44B	rouge	44B	rot
44C	Red	44C	rouge	44C	rot
44D	Orange-Red	44D	rouge orangé	44D	orangerot
45A	Red	45A	rouge	45A	rot
45B	Red	45B	rouge	45B	rot
45C	Red	45C	rouge	45C	rot
45D	dark Pink-Red	45D	rouge rose foncé	45D	dunkelrosarot
46A	dark Purple-Red	46A	rouge pourpre foncé	46A	dunkelpurpurrot
46B	Red	46B	rouge	46B	rot
46C	Red	46C	rouge	46C	rot
46D	dark Pink-Red	46D	rouge rose foncé	46D	dunkelrosarot
47A	Red	47A	rouge	47A	rot
47B	Red	47B	rouge	47B	rot
47C	dark Pink-Red	47C	rouge rose foncé	47C	dunkelrosarot
47D	Red-Pink	47D	rose rouge	47D	rotrosa
48A	dark Pink-Red	48A	rouge rose foncé	48A	dunkelrosarot

48B	Red-Pink	48B	rose rouge	48B	rotrosa
48C	Red-Pink	48C	rose rouge	48C	rotrosa
48D	Red-Pink	48D	rose rouge	48D	rotrosa
49A	Red-Pink	49A	rose rouge	49A	rotrosa
49B	light Red-Pink	49B	rose rouge clair	49B	hellrotrosa
49C	light Red-Pink	49C	rose rouge clair	49C	hellrotrosa
49D	light Red-Pink	49D	rose rouge clair	49D	hellrotrosa
50A	Red	50A	rouge	50A	rot
50B	dark Pink-Red	50B	rouge rose foncé	50B	dunkelrosarot
50C	Red-Pink	50C	rose rouge	50C	rotrosa
50D	light Red-Pink	50D	rose rouge clair	50D	hellrotrosa
51A	dark Pink-Red	51A	rouge rose foncé	51A	dunkelrosarot
51B	dark Pink-Red	51B	rouge rose foncé	51B	dunkelrosarot
51C	Red-Pink	51C	rose rouge	51C	rotrosa
51D	Red-Pink	51D	rose rouge	51D	rotrosa
52A	dark Pink-Red	52A	rouge rose foncé	52A	dunkelrosarot
52B	Red-Pink	52B	rose rouge	52B	rotrosa
52C	Red-Pink	52C	rose rouge	52C	rotrosa
52D	Red-Pink	52D	rose rouge	52D	rotrosa
53A	dark Purple-Red	53A	rouge pourpre foncé	53A	dunkelpurpurrot
53B	dark Purple-Red	53B	rouge pourpre foncé	53B	dunkelpurpurrot
53C	dark Pink-Red	53C	rouge rose foncé	53C	dunkelrosarot
53D	dark Pink-Red	53D	rouge rose foncé	53D	dunkelrosarot
54A	Purple-Red	54A	rouge pourpre	54A	purpurrot
54B	Purple-Red	54B	rouge pourpre	54B	purpurrot
54C	Purple-Red	54C	rouge pourpre	54C	purpurrot
54D	light Blue-Pink	54D	rose bleu clair	54D	hellblaurosa
55A	Purple-Red	55A	rouge pourpre	55A	purpurrot
55B	Purple-Red	55B	rouge pourpre	55B	purpurrot
55C	light Blue-Pink	55C	rose bleu clair	55C	hellblaurosa
55D	light Blue-Pink	55D	rose bleu clair	55D	hellblaurosa
56A	light Blue-Pink	56A	rose bleu clair	56A	hellblaurosa
56B	light Blue-Pink	56B	rose bleu clair	56B	hellblaurosa
56C	light Blue-Pink	56C	rose bleu clair	56C	hellblaurosa
56D	light Blue-Pink	56D	rose bleu clair	56D	hellblaurosa
57A	Purple-Red	57A	rouge pourpre	57A	purpurrot
57B	Purple-Red	57B	rouge pourpre	57B	purpurrot
57C	Purple-Red	57C	rouge pourpre	57C	purpurrot
57D	Purple-Red	57D	rouge pourpre	57D	purpurrot
58A	Purple	58A	pourpre	58A	purpur
58B	Purple-Red	58B	rouge pourpre	58B	purpurrot
58C	Purple-Red	58C	rouge pourpre	58C	purpurrot
58D	Purple-Red	58D	rouge pourpre	58D	purpurrot
59A	dark Purple-Red	59A	rouge pourpre foncé	59A	dunkelpurpurrot
59B	dark Purple-Red	59B	rouge pourpre foncé	59B	dunkelpurpurrot
59C	Purple	59C	pourpre	59C	purpur
59D	Purple-Red	59D	rouge pourpre	59D	purpurrot
60A	dark Purple-Red	60A	rouge pourpre foncé	60A	dunkelpurpurrot
60B	dark Purple-Red	60B	rouge pourpre foncé	60B	dunkelpurpurrot
60C	Purple	60C	pourpre	60C	purpur

60D	Purple-Red	60D	rouge pourpre	60D	purpurrot
61A	Purple	61A	pourpre	61A	purpur
61B	Purple	61B	pourpre	61B	purpur
61C	Purple-Red	61C	rouge pourpre	61C	purpurrot
61D	Purple-Red	61D	rouge pourpre	61D	purpurrot
62A	Blue-Pink	62A	rose bleu	62A	blaurosa
62B	light Blue-Pink	62B	rose bleu clair	62B	hellblaurosa
62C	light Blue-Pink	62C	rose bleu clair	62C	hellblaurosa
62D	light Blue-Pink	62D	rose bleu clair	62D	hellblaurosa
63A	Purple-Red	63A	rouge pourpre	63A	purpurrot
63B	Blue-Pink	63B	rose bleu	63B	blaurosa
63C	Blue-Pink	63C	rose bleu	63C	blaurosa
63D	light Blue-Pink	63D	rose bleu clair	63D	hellblaurosa
64A	Purple	64A	pourpre	64A	purpur
64B	Purple	64B	pourpre	64B	purpur
64C	Blue-Pink	64C	rose bleu	64C	blaurosa
64D	Blue-Pink	64D	rose bleu	64D	blaurosa
65A	Blue-Pink	65A	rose bleu	65A	blaurosa
65B	light Blue-Pink	65B	rose bleu clair	65B	hellblaurosa
65C	light Blue-Pink	65C	rose bleu clair	65C	hellblaurosa
65D	light Blue-Pink	65D	rose bleu clair	65D	hellblaurosa
66A	Purple-Red	66A	rouge pourpre	66A	purpurrot
66B	Purple-Red	66B	rouge pourpre	66B	purpurrot
66C	Blue-Pink	66C	rose bleu	66C	blaurosa
66D	Blue-Pink	66D	rose bleu	66D	blaurosa
67A	Purple	67A	pourpre	67A	purpur
67B	Blue-Pink	67B	rose bleu	67B	blaurosa
67C	Blue-Pink	67C	rose bleu	67C	blaurosa
67D	Blue-Pink	67C	rose bleu	67D	blaurosa
68A	Blue-Pink	68A	rose bleu	68A	blaurosa
68B	Blue-Pink	68B	rose bleu	68B	blaurosa
68C	Blue-Pink	68C	rose bleu	68C	blaurosa
68D	light Blue-Pink	68D	rose bleu clair	68D	hellblaurosa
69A	light Blue-Pink	69A	rose bleu clair	69A	hellblaurosa
69B	light Blue-Pink	69B	rose bleu clair	69B	hellblaurosa
69C	light Blue-Violett	69C	violet bleu clair	69C	hellblauviolett
69D	light Blue-Violett	69D	violet bleu clair	69D	hellblauviolett

70A	Purple	70A	pourpre	70A	purpur
70B	Purple	70B	pourpre	70B	purpur
70C	Blue-Pink	70C	rose bleu	70C	blaurosa
70D	light Blue-Pink	70D	rose bleu clair	70D	hellblaurosa
71A	Purple	71A	pourpre	71A	purpur
71B	Purple	71B	pourpre	71B	purpur
71C	Purple	71C	pourpre	71C	purpur
71D	Blue-Pink	71D	rose bleu	71D	blaurosa
72A	Purple	72A	pourpre	72A	purpur
72B	Purple	72B	pourpre	72B	purpur
72C	Blue-Pink	72C	rose bleu	72C	blaurosa
72D	Blue-Pink	72D	rose bleu	72D	blaurosa
73A	Blue-Pink	73A	rose bleu	73A	blaurosa

73B	Blue-Pink	73B	rose bleu	73B	blaurosa
73C	light Blue-Pink	73C	rose bleu clair	73C	hellblaurosa
73D	light Blue-Pink	73D	rose bleu clair	73D	hellblaurosa
74A	Purple	74A	pourpre	74A	purpur
74B	Purple	74B	pourpre	74B	purpur
74C	Purple	74C	pourpre	74C	purpur
74D	Blue-Pink	74D	rose bleu	74D	blaurosa
75A	Violett	75A	violet	75A	violett
75B	Violett	75B	violet	75B	violett
75C	Violett	75C	violet	75C	violett
75D	Violett	75D	violet	75D	violett
76A	light Blue-Violett	76A	violet bleu clair	76A	hellblauviolett
76B	light Blue-Violett	76B	violet bleu clair	76B	hellblauviolett
76C	light Blue-Violett	76C	violet bleu clair	76C	hellblauviolett
76D	light Blue-Violett	76D	violet bleu clair	76D	hellblauviolett
77A	Violett	77A	violet	77A	violett
77B	Violett	77B	violet	77B	violett
77C	Violett	77C	violet	77C	violett
77D	Violett	77D	violet	77D	violett
78A	Violett	78A	violet	78A	violett
78B	Violett	78B	violet	78B	violett
78C	Violett	78C	violet	78C	violett
78D	Violett	78D	violet	78D	violett
79A	dark Violett	79A	violet foncé	79A	dunkelviolett
79B	dark Violett	79B	violet foncé	79B	dunkelviolett
79C	dark Violett	79C	violet foncé	79C	dunkelviolett
79D	dark Violett	79D	violet foncé	79D	dunkelviolett
80A	Violett	80A	violet	80A	violett
80B	Violett	80B	violet	80B	violett
80C	Violett	80C	violet	80C	violett
80D	Violett	80D	violet	80D	violett
81A	Violett	81A	violet	81A	violett
81B	Violett	81B	violet	81B	violett
81C	Violett	81C	violet	81C	violett
81D	Violett	81D	violet	81D	violett
82A	Violett	82A	violet	82A	violett
82B	Violett	82B	violet	82B	violett
82C	Violett	82C	violet	82C	violett
82D	Violett	82D	violet	82D	violett
83A	dark Violett	83A	violet foncé	83A	dunkelviolett
83B	dark Violett	83B	violet foncé	83B	dunkelviolett
83C	Blue-Violett	83C	violet bleu	83C	blauviolett
83D	Blue-Violett	83D	violet bleu	83D	blauviolett
84A	Violett	84A	violet	84A	violett
84B	Violett	84B	violet	84B	violett
84C	light Blue-Violett	84C	violet bleu clair	84C	hellblauviolett
84D	light Blue-Violett	84D	violet bleu clair	84D	hellblauviolett
85A	light Blue-Violett	85A	violet bleu clair	85A	hellblauviolett
85B	light Blue-Violett	85B	violet bleu clair	85B	hellblauviolett
85C	light Blue-Violett	85C	violet bleu clair	85C	hellblauviolett

85D	light Blue-Violett	85D	violet bleu clair	85D	hellblauviolett
86A	dark Violett	86A	violet foncé	86A	dunkelviolett
86B	Blue-Violett	86B	violet bleu	86B	blauviolett
86C	Blue-Violett	86C	violet bleu	86C	blauviolett
86D	Blue-Violett	86D	violet bleu	86D	blauviolett
87A	Violett	87A	violet	87A	violett
87B	Violett	87B	violet	87B	violett
87C	Violett	87C	violet	87C	violett
87D	Violett	87D	violet	87D	violett
88A	Blue-Violett	88A	violet bleu	88A	blauviolett
88B	Blue-Violett	88B	violet bleu	88B	blauviolett
88C	Blue-Violett	88C	violet bleu	88C	blauviolett
88D	Violett	88D	violet	88D	violett
89A	Violett-Blue	89A	bleu violet	89A	violettblau
89B	Violett-Blue	89B	bleu violet	89B	violettblau
89C	Blue-Violett	89C	violet bleu	89C	blauviolett
89D	Blue-Violett	89D	violet bleu	89D	blauviolett
90A	Blue-Violett	90A	violet bleu	90A	blauviolett
90B	Blue-Violett	90B	violet bleu	90B	blauviolett
90C	Blue-Violett	90C	violet bleu	90C	blauviolett
90D	Blue-Violett	90D	violet bleu	90D	blauviolett
91A	Violett-Blue	91A	bleu violet	91A	violettblau
91B	light Violett-Blue	91B	bleu violet clair	91B	hellviolettblau
91C	light Violett-Blue	91C	bleu violet clair	91C	hellviolettblau
91D	light Violett-Blue	91D	bleu violet clair	91D	hellviolettblau
92A	Violett-Blue	92A	bleu violet	92A	violettblau
92B	light Violett-Blue	92B	bleu violet clair	92B	hellviolettblau
92C	light Violett-Blue	92C	bleu violet clair	92C	hellviolettblau
92D	light Violett-Blue	92D	bleu violet clair	92D	hellviolettblau
93A	Violett-Blue	93A	bleu violet	93A	violettblau
93B	Violett-Blue	93B	bleu violet	93B	violettblau
93C	Violett-Blue	93C	bleu violet	93C	violettblau
93D	light Violett-Blue	93D	bleu violet clair	93D	hellviolettblau
94A	Violett-Blue	94A	bleu violet	94A	violettblau
94B	Violett-Blue	94B	bleu violet	94B	violettblau
94C	Violett-Blue	94C	bleu violet	94C	violettblau
94D	light Violett-Blue	94D	bleu violet clair	94D	hellviolettblau
95A	Violett-Blue	95A	bleu violet	95A	violettblau
95B	Violett-Blue	95B	bleu violet	95B	violettblau
95C	Violett-Blue	95C	bleu violet	95C	violettblau
95D	light Violett-Blue	95D	bleu violet clair	95D	hellviolettblau
96A	Violett-Blue	96A	bleu violet	96A	violettblau
96B	Violett-Blue	96B	bleu violet	96B	violettblau
96C	Violett-Blue	96C	bleu violet	96C	violettblau
96D	Violett-Blue	96D	bleu violet	96D	violettblau
97A	Violett-Blue	97A	bleu violet	97A	violettblau
97B	light Violett-Blue	97B	bleu violet clair	97B	hellviolettblau
97C	light Violett-Blue	97C	bleu violet clair	97C	hellviolettblau
97D	light Violett-Blue	97D	bleu violet clair	97D	hellviolettblau

98A	Blue	98A	bleu	98A	blau
98B	Blue	98B	bleu	98B	blau
98C	Blue	98C	bleu	98C	blau
98D	Blue	98D	bleu	98D	blau
99A	dark Blue	99A	bleu foncé	99A	dunkelblau
99B	dark Blue	99B	bleu foncé	99B	dunkelblau
99C	Blue	99C	bleu	99C	blau
99D	Blue	99D	bleu	99D	blau
100A	Blue	100A	bleu	100A	blau
100B	Blue	100B	bleu	100B	blau
100C	Blue	100C	bleu	100C	blau
100D	light Violett-Blue	100D	bleu violet clair	100D	hellviolettblau
101A	Blue	101A	bleu	101A	blau
101B	Blue	101B	bleu	101B	blau
1010	Blue	101C	bleu	101C	blau
101D	light Blue	101D	bleu clair	101D	hellblau
102A	dark Blue	102A	bleu foncé	102A	dunkelblau
102B	Blue	102B	bleu	102B	blau
102C	Blue	102C	bleu	102C	blau
102D	Blue	102D	bleu	102D	blau
103A	dark Blue	103A	bleu foncé	103A	dunkelblau
103B	dark Blue	103B	bleu foncé	103B	dunkelblau
103C	dark Blue	103C	bleu foncé	103C	dunkelblau
103D	Blue	103D	bleu	103D	blau
104A	Blue	104A	bleu	104A	blau
104B	Blue	104B	bleu	104B	blau
104C	Blue	104C	bleu	104C	blau
104D	light Blue	104D	bleu clair	104D	hellblau
105A	Blue	105A	bleu	105A	blau
105B	Blue	105B	bleu	105B	blau
105C	Blue	105C	bleu	105C	blau
105D	Blue	105D	bleu	105D	blau
106A	Blue	106A	bleu	106A	blau
106B	light Blue	106B	bleu clair	106B	hellblau
106C	light Blue	106C	bleu clair	106C	hellblau
106D	light Blue	106D	bleu clair	106D	hellblau
107A	Blue	107A	bleu	107A	blau
107B	Blue	107B	bleu	107B	blau
107C	light Blue	107C	bleu clair	107C	hellblau
107D	light Blue	107D	bleu clair	107D	hellblau
108A	light Blue	108A	bleu clair	108A	hellblau
108B	light Blue	108B	bleu clair	108B	hellblau
108C	light Blue	108C	bleu clair	108C	hellblau
108D	light Blue	108D	bleu clair	108D	hellblau
109A	Blue	109A	bleu	109A	blau
109B	Blue	109B	bleu	109B	blau
109C	Blue	109C	bleu	109C	blau
109D	light Blue	109D	bleu clair	109D	hellblau
110A	Blue	110A	bleu	110A	blau
110B	Blue	110B	bleu	110B	blau
110C	light Green-Blue	110C	bleu vert clair	110C	hellgrünblau
110D	light Green-Blue	110D	bleu vert clair	110D	hellgrünblau

111A	Green-Blue	111A	bleu vert	111A	grünblau
111B	Green-Blue	111B	bleu vert	111B	grünblau
111C	light Green-Blue	111C	bleu vert clair	111C	hellgrünblau
111D	light Green-Blue	111D	bleu vert clair	111D	hellgrünblau
112A	light Blue	112A	bleu clair	112A	hellblau
112B	light Blue	112B	bleu clair	112B	hellblau
112C	light Green-Blue	112C	bleu vert clair	112C	hellgrünblau
112D	light Green-Blue	112D	bleu vert clair	112D	hellgrünblau
113A	Green-Blue	113A	bleu vert	113A	grünblau
113B	Green-Blue	113B	bleu vert	113B	grünblau
113C	light Green-Blue	113C	bleu vert clair	113C	hellgrünblau
113D	light Green-Blue	113D	bleu vert clair	113D	hellgrünblau
114A	Green-Blue	114A	bleu vert	114A	grünblau
114B	Green-Blue	114B	bleu vert	114B	grünblau
114C	Green-Blue	114C	bleu vert	114C	grünblau
114D	Green-Blue	114D	bleu vert	114D	grünblau
115A	Green-Blue	115A	bleu vert	115A	grünblau
115B	Green-Blue	115B	bleu vert	115B	grünblau
115C	Grey-Blue	115C	bleu gris	115C	graublau
115D	Grey-Blue	115D	bleu gris	115D	graublau
116A	Green-Blue	116A	bleu vert	116A	grünblau
116B	Green-Blue	116B	bleu vert	116B	grünblau
116C	Green-Blue	116C	bleu vert	116C	grünblau
116D	Green-Blue	116D	bleu vert	116D	grünblau
117A	light Green-Blue	117A	bleu vert clair	117A	hellgrünblau
117B	light Green-Blue	117B	bleu vert clair	117B	hellgrünblau
117C	light Green-Blue	117C	bleu vert clair	117C	hellgrünblau
117D	light Green-Blue	117D	bleu vert clair	117D	hellgrünblau
118A	Green-Blue	118A	bleu vert	118A	grünblau
118B	Green-Blue	118B	bleu vert	118B	grünblau
118C	light Green-Blue	118C	bleu vert clair	118C	hellgrünblau
118D	light Green-Blue	118D	bleu vert clair	118D	hellgrünblau
119A	Green-Blue	119A	bleu vert	119A	grünblau
119B	Grey-Blue	119B	bleu gris	119B	graublau
119C	Grey-Blue	119C	bleu gris	119C	graublau
119D	light Green-Blue	119D	bleu vert clair	119D	hellgrünblau
120A	light Blue-Green	120A	vert bleu clair	120A	hellblaugrün
120B	light Blue-Green	120B	vert bleu clair	120B	hellblaugrün
120C	light Blue-Green	120C	vert bleu clair	120C	hellblaugrün
120D	light Green-Blue	120D	bleu vert clair	120D	hellgrünblau
121A	Green-Blue	121A	bleu vert	121A	grünblau
121B	light Blue-Green	121B	vert bleu clair	121B	hellblaugrün
121C	light Green-Blue	121C	bleu vert clair	121C	hellgrünblau
121D	light Green-Blue	121D	bleu vert clair	121D	hellgrünblau
122A	Grey-Blue	122A	bleu gris	122A	graublau
122B	Grey-Blue	122B	bleu gris	122B	graublau
122C	Grey-Blue	122C	bleu gris	122C	graublau
122D	light Green-Blue	122D	bleu vert clair	122D	hellgrünblau
123A	light Blue-Green	123A	vert bleu clair	123A	hellblaugrün
123B	light Blue-Green	123B	vert bleu clair	123B	hellblaugrün

123C	light Blue-Green	123C	vert bleu clair	123C	hellblaugrün
123D	light Blue-Green	123D	vert bleu clair	123D	hellblaugrün
124A	Green	124A	vert	124A	grün
L24B	Blue-Green	124B	vert bleu	124B	blaugrün
124C	light Blue-Green	124C	vert bleu clair	124C	hellblaugrün
124D	light Blue-Green	124D	vert bleu clair	124D	hellblaugrün
125A	Green	125A	vert	125A	grün
125B	Green	125B	vert	125B	grün
125C	Blue-Green	125C	vert bleu	125C	blaugrün
125D	Blue-Green	125D	vert bleu	125D	blaugrün
126A	Grey-Green	126A	vert gris	126A	graugrün
126B	Grey-Green	126B	vert gris	126B	graugrün
126C	Grey-Green	126C	vert gris	126C	graugrün
126D	Blue-Green	126D	vert bleu	126D	blaugrün
127A	Grey-Green	127A	vert gris	127A	graugrün
127B	Green	127B	vert	127B	grün
127C	Green	127C	vert	127C	grün
127D	Blue-Green	127D	vert bleu	127D	blaugrün
128A	Green	128A	vert	128A	grün
128B	Blue-Green	128B	vert bleu	128B	blaugrün
128C	Blue-Green	128C	vert bleu	128C	blaugrün
128D	Blue-Green	128D	vert bleu	128D	blaugrün
129A	Green	129A	vert	129A	grün
129B	Blue-Green	129B	vert bleu	129B	blaugrün
129C	Blue-Green	129C	vert bleu	129C	blaugrün
129D	Blue-Green	129D	vert bleu	129D	blaugrün
130A	Green	130A	vert	130A	grün
130B	Green	130B	vert	130B	grün
130C	Blue-Green	130C	vert bleu	130C	blaugrün
130D	Blue-Green	130D	vert bleu	130D	blaugrün
131A	dark Green	131A	vert foncé	131A	dunkelgrün
131B	dark Green	131B	vert foncé	131B	dunkelgrün
131C	dark Green	131C	vert foncé	131C	dunkelgrün
131D	Green	131D	vert	131D	grün
132A	dark Green	132A	vert foncé	132A	dunkelgrün
132B	dark Green	132B	vert foncé	132B	dunkelgrün
132C	Green	132C	vert	132C	grün
132D	Green	132D	vert	132D	grün
133A	dark Green	133A	vert foncé	133A	dunkelgrün
133B	Grey-Green	133B	vert gris	133B	graugrün
133C	Grey-Green	133C	vert gris	133C	graugrün
133D	Grey-Green	133D	vert gris	133D	graugrün
134A	Green	134A	vert	134A	grün
134B	Green	134B	vert	134B	grün
134C	Green	134C	vert	134C	grün
134D	light Green	134D	vert clair	134D	hellgrün
135A	dark Green	135A	vert foncé	135A	dunkelgrün
135B	dark Green	135B	vert foncé	135B	dunkelgrün
135C	Green	135C	vert	135C	grün
135D	light Green	135D	vert clair	135D	hellgrün

136A	dark Green	136A	vert foncé	136A	dunkelgrün
136B	dark Green	136B	vert foncé	136B	dunkelgrün
136C	Brown-Green	136C	vert brun	136C	braungrün
136D	light Green	136D	vert clair	136D	hellgrün
137A	dark Green	137A	vert foncé	137A	dunkelgrün
137B	Brown-Green	137B	vert brun	137B	braungrün
137C	Brown-Green	137C	vert brun	137C	braungrün
137D	Brown-Green	137D	vert brun	137D	braungrün
138A	Brown-Green	138A	vert brun	138A	braungrün
138B	Brown-Green	138B	vert brun	138B	braungrün
138C	light Green	138C	vert clair	138C	hellgrün
138D	light Green	138D	vert clair	138D	hellgrün
139A	dark Green	139A	vert foncé	139A	dunkelgrün
139B	Brown-Green	139B	vert brun	139B	braungrün
139C	Brown-Green	139C	vert brun	139C	braungrün
139D	light Green	139D	vert clair	139D	hellgrün

140A	Green	140A	vert	140A	grün
140B	Green	140B	vert	140B	grün
140C	light Green	140C	vert clair	140C	hellgrün
140D	light Green	140D	vert clair	140D	hellgrün
141A	dark Green	141A	vert foncé	141A	dunkelgrün
141B	dark Green	141B	vert foncé	141B	dunkelgrün
141C	dark Green	141C	vert foncé	141C	dunkelgrün
141D	light Green	141D	vert clair	141D	hellgrün
142A	Green	142A	vert	142A	grün
142B	light Green	142B	vert clair	142B	hellgrün
142C	light Green	142C	vert clair	142C	hellgrün
142D	light Green	142D	vert clair	142D	hellgrün
143A	dark Green	143A	vert foncé	143A	dunkelgrün
143B	dark Green	143B	vert foncé	143B	dunkelgrün
143C	dark Green	143C	vert foncé	143C	dunkelgrün
143D	light Green	143D	vert clair	143D	hellgrün
144A	dark Green	144A	vert foncé	144A	dunkelgrün
144B	light Green	144B	vert clair	144B	hellgrün
144C	light Green	144C	vert clair	144C	hellgrün
144D	light Green	144D	vert clair	144D	hellgrün
145A	light Green	145A	vert clair	145A	hellgrün
145B	light Green	145B	vert clair	145B	hellgrün
145C	light Green	145C	vert clair	145C	hellgrün
145D	light Green	145D	vert clair	145D	hellgrün
146A	Brown-Green	146A	vert brun	146A	braungrün
146B	Brown-Green	146B	vert brun	146B	braungrün
146C	Brown-Green	146C	vert brun	146C	braungrün
146D	Brown-Green	146D	vert brun	146D	braungrün
147A	dark Green	147A	vert foncé	147A	dunkelgrün
147B	Brown-Green	147B	vert brun	147B	braungrün
147C	Brown-Green	147C	vert brun	147C	braungrün
147D	Brown-Green	147D	vert brun	147D	braungrün
148A	Brown-Green	148A	vert brun	148A	braungrün
148B	Brown-Green	148B	vert brun	148B	braungrün

148C	Brown-Green	148C	vert brun	148C	braungrün
148D	Brown-Green	148D	vert brun	148D	braungrün
149A	Yellow-Green	149A	vert jaune	149A	gelbgrün
149B	light Green	149B	vert clair	149B	hellgrün
149C	light Green	149C	vert clair	149C	hellgrün
149D	light Green	149D	vert clair	149D	hellgrün
150A	Yellow-Green	150A	vert jaune	150A	gelbgrün
150B	Yellow-Green	150B	vert jaune	150B	gelbgrün
150C	Yellow-Green	150C	vert jaune	150C	gelbgrün
150D	Yellow-Green	150D	vert jaune	150D	gelbgrün
151A	Green-Brown	151A	brun vert	151A	grünbraun
115B	Green-Brown	151B	brun vert	151B	grünbraun
151C	Green-Brown	151C	brun vert	151C	grünbraun
151D	Green-Brown	151D	brun vert	151D	grünbraun
152A	Green-Brown	152A	brun vert	152A	grünbraun
152B	Green-Brown	152B	brun vert	152B	grünbraun
152C	Green-Brown	152C	brun vert	152C	grünbraun
152D	Green-Brown	152D	brun vert	152D	grünbraun
153A	Green-Brown	153A	brun vert	153A	grünbraun
153B	Green-Brown	153B	brun vert	153B	grünbraun
153C	Green-Brown	153C	brun vert	153C	grünbraun
153D	Green-Brown	153D	brun vert	153D	grünbraun
154A	Yellow-Green	154A	vert jaune	154A	gelbgrün
154B	Yellow-Green	154B	vert jaune	154B	gelbgrün
154C	Yellow-Green	154C	vert jaune	154C	gelbgrün
154D	Yellow-Green	154D	vert jaune	154D	gelbgrün
155A	White	155A	blanc	155A	weiss
155B	White	155B	blanc	155B	weiss
155C	White	155C	blanc	155C	weiss
155D	White	155D	blanc	155D	weiss
156A	Grey	156A	gris	156A	grau
156B	Grey	156B	gris	156B	grau
156C	Grey	156C	gris	156C	grau
156D	Grey	156D	gris	156D	grau
157A	Grey	157A	gris	157A	grau
157B	Grey	157B	gris	157B	grau
157C	Grey	157C	gris	157C	grau
157D	White	157D	blanc	157D	weiss
158A	light Yellow-Brown	158A	brun jaune clair	158A	hellgelbbraun
158B	light Yellow-Brown	158B	brun jaune clair	158B	hellgelbbraun
158C	light Yellow-Brown	158C	brun jaune clair	158C	hellgelbbraun
158D	light Yellow-Brown	158D	brun jaune clair	158D	hellgelbbraun
159A	light Yellow-Brown	159A	brun jaune clair	159A	hellgelbbraun
159B	light Yellow-Brown	159B	brun jaune clair	159B	hellgelbbraun
159C	light Yellow-Brown	159C	brun jaune clair	159C	hellgelbbraun
159D	light Yellow-Brown	159D	brun jaune clair	159D	hellgelbbraun
160A	light Yellow-Brown	160A	brun jaune clair	160A	hellgelbbraun
160B	light Yellow-Brown	160B	brun jaune clair	160B	hellgelbbraun
160C	light Yellow-Brown	160C	brun jaune clair	160C	hellgelbbraun
160D	light Yellow-Brown	160D	brun jaune clair	160D	hellgelbbraun

161A	light Yellow-Brown	161A	brun jaune clair	161A	hellgelbbraun
161B	light Yellow-Brown	161B	brun jaune clair	161B	hellgelbbraun
161C	light Yellow-Brown	161C	brun jaune clair	161C	hellgelbbraun
161D	light Yellow-Brown	161D	brun jaune clair	161D	hellgelbbraun
162A	light Yellow-Brown	162A	brun jaune clair	162A	hellgelbbraun
162B	light Yellow-Brown	162B	brun jaune clair	162B	hellgelbbraun
162C	light Yellow-Brown	162C	brun jaune clair	162C	hellgelbbraun
162D	light Yellow-Brown	162D	brun jaune clair	162D	hellgelbbraun
163A	Yellow-Brown	163A	brun jaune	163A	gelbbraun
163B	light Yellow-Brown	163B	brun jaune clair	163B	hellgelbbraun
163C	light Yellow-Brown	163C	brun jaune clair	163C	hellgelbbraun
163D	light Yellow-Brown	163D	brun jaune clair	163D	hellgelbbraun
164A	Yellow-Brown	164A	brun jaune	164A	gelbbraun
164B	Yellow-Brown	164B	brun jaune	164B	gelbbraun
164C	Yellow-Brown	164C	brun jaune	164C	gelbbraun
164D	light Yellow-Brown	164D	brun jaune clair	164D	hellgelbbraun
165A	Brown	165A	brun	165A	braun
165B	Yellow-Brown	165B	brun jaune	165B	gelbbraun
165C	Yellow-Brown	165C	brun jaune	165C	gelbbraun
165D	light Yellow-Brown	165D	brun jaune clair	165D	hellgelbbraun
166A	Brown	166A	brun	166A	braun
166B	Brown	166B	brun	166B	braun
166C	light Brown	166C	brun clair	166C	hellbraun
166D	light Brown	166D	brun clair	166D	hellbraun
167A	Yellow-Brown	167A	brun jaune	167A	gelbbraun
167B	Yellow-Brown	167B	brun jaune	167B	gelbbraun
167C	Yellow-Brown	167C	brun jaune	167C	gelbbraun
167D	Yellow-Brown	167D	brun jaune	167D	gelbbraun

168A	Orange-Brown	168A	brun orangé	168A	orangebraun
168B	Orange-Brown	168B	brun orangé	168B	orangebraun
168C	Yellow-Brown	168C	brun jaune	168C	gelbbraun
168D	Yellow-Brown	168D	brun jaune	168D	gelbbraun
169A	Orange-Brown	169A	brun orangé	169A	orangebraun
169B	Orange-Brown	169B	brun orangé	169B	orangebraun
169C	Orange-Brown	169C	brun orangé	169C	orangebraun
169D	Orange-Brown	169D	brun orangé	169D	orangebraun
170A	Orange-Brown	170A	brun orangé	170A	orangebraun
170B	Orange-Brown	170B	brun orangé	170B	orangebraun
170C	Orange-Brown	170C	brun orangé	170C	orangebraun
170D	Orange-Brown	170D	brun orangé	170D	orangebraun
171A	Brown	171A	brun	171A	braun
171B	Orange-Brown	171B	brun orangé	171B	orangebraun
171C	Orange-Brown	171C	brun orangé	171C	orangebraun
171D	Orange-Brown	171D	brun orangé	171D	orangebraun
172A	Brown	172A	brun	172A	braun
172B	Brown	172B	brun	172B	braun
172C	Orange-Brown	172C	brun orangé	172C	orangebraun
172D	Orange-Brown	172D	brun orangé	172D	orangebraun
173A	Brown	173A	brun	173A	braun
173B	Orange-Brown	173B	brun orangé	173B	orangebraun

173C	light Brown	173C	brun clair	173C	hellbraun
173D	light Brown	173D	brun clair	173D	hellbraun
174A	Brown	174A	brun	174A	braun
174B	light Brown	174B	brun clair	174B	hellbraun
174C	light Brown	174C	brun clair	174C	hellbraun
174D	light Brown	174D	brun clair	174D	hellbraun
175A	Brown	175A	brun	175A	braun
175B	Brown	175B	brun	175B	braun
175C	Brown	175C	brun	175C	braun
175D	Brown	175D	brun	175D	braun
176A	Brown	176A	brun	176A	braun
176B	Brown	176B	brun	176B	braun
176C	Brown	176C	brun	176C	braun
176D	light Brown	176D	brun clair	176D	hellbraun
177A	Brown	177A	brun	177A	braun
177B	Brown	177B	brun	177B	braun
177C	light Brown	177C	brun clair	177C	hellbraun
177D	light Brown	177D	brun clair	177D	hellbraun
178A	Brown-Purple	178A	pourpre brun	178A	braunpurpur
178B	Brown-Purple	178B	pourpre brun	178B	braunpurpur
178C	Brown-Red	178C	rouge brun	178C	braunrot
178D	Brown-Red	178D	rouge brun	178D	braunrot
179A	Brown-Red	179A	rouge brun	179A	braunrot
179B	Brown-Red	179B	rouge brun	179B	braunrot
179C	Orange-Brown	179C	brun orangé	179C	orangebraun
179D	Orange-Pink	179D	rose orangé	179D	orangerosa
180A	Brown-Red	180A	rouge brun	180A	braunrot
180B	Brown-Red	180B	rouge brun	180B	braunrot
180C	Brown-Red	180C	rouge brun	180C	braunrot
180D	Brown-Red	180D	rouge brun	180D	braunrot
181A	Brown-Red	181A	rouge brun	181A	braunrot
181B	Brown-Red	181B	rouge brun	181B	braunrot
181C	Brown-Red	181C	rouge brun	181C	braunrot
181D	Brown-Red	181D	rouge brun	181D	braunrot
182A	Brown-Red	182A	rouge brun	182A	braunrot
182B	Brown-Red	182B	rouge brun	182B	braunrot
182C	Brown-Red	182C	rouge brun	182C	braunrot
182D	Brown-Red	182D	rouge brun	182D	braunrot
183A	Brown-Purple	183A	pourpre brun	183A	braunpurpur
183B	Brown-Purple	183B	pourpre brun	183B	braunpurpur
183C	Brown-Purple	183C	pourpre brun	183C	braunpurpur
183D	Brown-Purple	183D	pourpre brun	183D	braunpurpur
184A	Brown-Purple	184A	pourpre brun	184A	braunpurpur
184B	Brown-Purple	184B	pourpre brun	184B	braunpurpur
184C	Brown-Purple	184C	pourpre brun	184C	braunpurpur
184D	Brown-Purple	184D	pourpre brun	184D	braunpurpur
185A	dark Purple-Red	185A	rouge pourpre foncé	185A	dunkelpurpurrot
185B	Brown-Purple	185B	pourpre brun	185B	braunpurpur
185C	Brown-Purple	185C	pourpre brun	185C	braunpurpur
185D	Brown-Purple	185D	pourpre brun	185D	braunpurpur

186A	Brown-Purple	186A	pourpre brun	186A	braunpurpur
186B	Brown-Purple	186B	pourpre brun	186B	braunpurpur
186C	Blue-Pink	186C	rose bleu	186C	blaurosa
186D	Blue-Pink	186D	rose bleu	186D	blaurosa
187A	Brown-Purple	187A	pourpre brun	187A	braunpurpur
187B	dark Purple-Red	187B	rouge pourpre foncé	187B	dunkelpurpurrot
187C	dark Purple-Red	187C	rouge pourpre foncé	187C	dunkelpurpurrot
187D	dark Purple-Red	187D	rouge pourpre foncé	187D	dunkelpurpurrot
188A	Green-Grey	188A	gris vert	188A	grüngrau
188B	Green-Grey	188B	gris vert	188B	grüngrau
188C	Green-Grey	188C	gris vert	188C	grüngrau
188D	Green-Grey	188D	gris vert	188D	grüngrau
189A	Brown-Green	189A	vert brun	189A	braungrün
189B	Green-Grey	189B	gris vert	189B	grüngrau
189C	Green-Grey	189C	gris vert	189C	grüngrau
189D	Green-Grey	189D	gris vert	189D	grüngrau
190A	Green-Grey	190A	gris vert	190A	grüngrau
190B	Green-Grey	190B	gris vert	190B	grüngrau
190C	Green-Grey	190C	gris vert	190C	grüngrau
190D	Green-Grey	190D	gris vert	190D	grüngrau
191A	Brown-Green	191A	vert brun	191A	braungrün
191B	Brown-Green	191B	vert brun	191B	braungrün
191C	Green-Grey	191C	gris vert	191C	grüngrau
191D	Green-Grey	191D	gris vert	191D	grüngrau
192A	Green-Grey	192A	gris vert	192A	grüngrau
192B	Green-Grey	192B	gris vert	192B	grüngrau
192C	Green-Grey	192C	gris vert	192C	grüngrau
192D	Green-Grey	192D	gris vert	192D	grüngrau
193A	Brown-Green	193A	vert brun	193A	braungrün
193B	Brown-Green	193B	vert brun	193B	braungrün
193C	Green-Grey	193C	gris vert	193C	grüngrau
193D	Green-Grey	193D	gris vert	193D	grüngrau
194A	Brown-Green	194A	vert brun	194A	braungrün
194B	Brown-Green	194B	vert brun	194B	braungrün
194C	Brown-Green	194C	vert brun	194C	braungrün
194D	Grey	194D	gris	194D	grau
195A	Grey	195A	gris	195A	grau
195B	Grey	195B	gris	195B	grau
195C	Grey	195C	gris	195C	grau
195D	Grey	195D	gris	195D	grau
196A	Grey	196A	gris	196A	grau
196B	Grey	196B	gris	196B	grau
196C	Grey	196C	gris	196C	grau
196D	Grey	196D	gris	196D	grau
197A	Grey	197A	gris	197A	grau
197B	Grey	197B	gris	197B	grau
197C	Grey	197C	gris	197C	grau
197D	Grey	197D	gris	197D	grau
198A	Grey	198A	gris	198A	grau
198B	Grey	198B	gris	198B	grau

198C	Grey	198C	gris	198C	grau
198D	Grey	198D	gris	198D	grau
199A	Grey-Brown	199A	brun gris	199A	graubraun
199B	Grey-Brown	199B	brun gris	199B	graubraun
199C	Grey-Brown	199C	brun gris	199C	graubraun
199D	Grey-Brown	199D	brun gris	199D	graubraun
200A	dark Brown	200A	brun foncé	200A	dunkelbraun
200B	dark Brown	200B	brun foncé	200B	dunkelbraun
200C	dark Brown	200C	brun foncé	200C	dunkelbraun
200D	Brown	200D	brun	200D	braun
201A	Grey	201A	gris	201A	grau
201B	Grey	201B	gris	201B	grau
201C	Grey	201C	gris	201C	grau
201D	Grey	201D	gris	201D	grau
202A	Black	202A	noir	202A	schwarz
202B	Grey	202B	gris	202B	grau
202C	Grey	202C	gris	202C	grau
202D	Grey	202D	gris	202D	grau

List 2: Grouping of RHS Colour Charts by Color Groups

1. Yellow-green/vert jaune/gelbgrün

1B	1C	1D	2C	2D	3D	4C	149A	150A	150B
150C	150D	154A	154B	154C	154D				

2. Yellow/jaune/gelb

1A	2A	2B	3A	3B	3C	4A	4B	5A	5B
5C	6A	6B	6C	7A	7B	7C	7D	8A	9A
9B	12A	12B							

3. Light yellow/jaune clair/hellgelb

10C	10D	8B	8C	8D	9D	10A	10B	4D	5D
6D	9C	11B	11C	12C	12D	13D	14D	15D	16D

4. Yellow-orange/orange jaune/gelborange

11A	13A	13B	13C	14A	14B	14C	15A	15B	15C
16A	16B	16C	17A	17B	17C	17D	18A	19A	20A
20B	21A	21B	21C	22A	23A	23B			

5. Light yellow-orange/orange jaune clair/hellgelborange

11D	18B	18C	18D	19B	19C	19D	20C	20D	21D
22B	22C	22D	23C	23D					

6. Orange/orange/orange

24A	24B	24C	24D	25A	25B	25C	25D	26A	26B
26C	26D	28B	28C	28D	29A	29B	30D		

7. Orange-pink/rose orangé/orangerosa

27A	27B	27C	27D	29C	29D	31D	32D	33D	35C
37A	37B	179D							

8. Orange-red/rouge orangé/orangerot

28A	30A	30B	30C	31A	32A	32B	33B	35B	39A
39B	40C	40D	41B	41C	42D	44D			

9. Red/rouge/rot

33A	34A	40A	40B	41A	42A	42B	42C	43A	43B
44A	44B	44C	45A	45B	45C	46B	46C	47A	47B
50A									

10. Light red-pink/rose rouge clair/hellrotrosa

37D	35D	36A	36B	36C	36D	37C	38A	38B	38C
38D	39C	39D	41D	49B	49C	49D	50D		

11. Red-pink/rose rouge/rotrosa

43C	43D	47D	48B	48C	48D	49A	50C	51C	51D
52B	52C	52D							

12. Dark pink-red/rouge rose foncé/dunkelrosarot

45D	46D	47C	48A	50B	51A	51B	52A	53C	53D

13. Purple-red/rouge pourpre/purpurrot

54A	54B	54C	55A	55B	57A	57B	57C	57D	58B
58C	58D	59D	60D	61C	63A	66A	66B	61D	

14. Dark purple-red/rouge pourpre foncé/dunkelpurpurrot

46A	53A	53B	59A	59B	60A	60B	185A	187B	187C
187D									

15. Purple/pourpre/purpur

58A	59C	60C	61A	61B	64A	64B	67A	70A	70B
71A	71B	71C	72A	72B	74A	74B	74C		

16. Light blue-pink/rose bleu clair/hellblaurosa

54D	55C	55D	56A	56B	56C	56D	68D	69A	69B
70D	73C	73D	62B	62C	62D	63D	65B	65C	65D

17. Blue-pink/rose bleu/blaurosa

68C	64C	64D	62A	63B	63C	65A	66C	66D	67B
67C	67D	68A	68B	70C	71D	72C	72D	73A	73B
74D	186C	186D							

18. Violet/violet/violett

75A	75B	75C	75D	77A	77B	77C	77D	78A	78B
78C	78D	80A	80B	80C	80D	81A	81B	81C	81D
82A	82B	82C	82D	84A	84B	87A	87B	87C	87D
88D									

19. Light blue-violet/violet bleu clair/hellblauviolett

69C	69D	76A	76B	76C	76D	84C	84D	85A	85B
85C	85D								

20. Dark violet/violet foncé/dunkelviolett

79A	79B	79C	79D	83A	83B	86A

21. Blue-violet/violet bleu/blauviolett

83C	83D	86B	86C	86D	88A	88B	88C	89C	89D
90A	90B	90C	90D						

22. Violet-blue/bleu violet/violettblau

89A	89B	91A	92A	93A	93B	93C	94A	94B	94C
95A	95B	95C	96A	96B	96C	96D	97A		

23. Light violet-blue/bleu violet clair/hellviolettblau

91B	91C	91D	92B	92C	92D	93D	94D	95D	97B
97C	97D	100D							

24. Blue/bleu/blau

98A	98B	98C	98D	99C	99D	100A	100B	100C	101A
101B	101C	102B	102C	102D	103D	104A	104B	104C	105A
105B	105C	105D	106A	107A	107B	109A	109B	109C	110A
110B									

25. Dark blue/bleu foncé/dunkelblau

99A	99B	102A	103A	103B	103C

26. Light blue/bleu clair/hellblau

101D 104D 106B 106C 106D 107C 107D 108A 108B 108C
108D 109D 112A 112B

27. Light green-blue/bleu vert clair/hellgrünblau

110C 110D 111C 111D 112C 112D 113C 113D 117A 117B
117C 117D 118C 118D 119D 120D 121C 121D 122D

28. Green-blue/bleu vert/grünblau

111A 111B 113A 113B 114A 114B 114C 114D 115A 115B
116A 116B 116C 116D 118A 118B 119A 121A

29. Light blue-green/vert bleu clair/hellblaugrün

120A 120B 120C 121B 123A 123B 123C 123D 124C 124D

30. Grey-blue/bleu gris/graublau

115C 115D 119B 119C 122A 122B 122C

31. Blue-green/vert bleu/blaugrün

124B 125C 125D 126D 127D 128B 128C 128D 129B 129C
129D 130C 130D

32. Grey-green/vert gris/graungrün

126A 126B 126C 127A 133B 133C 133D

33. Green/vert/grün

124A 125A 125B 127B 127C 128A 129A 130A 130B 131D
132C 132D 134A 134B 134C 135C 140A 140B 142A

34. Light green/vert clair/hellgrün

134D 135D 136D 138C 138D 139D 140C 140D 141D 142B
142C 142D 143D 144B 144C 144D 145A 145B 145C 145D
149B 149C 149D

35. Brown-green/vert brun/braungrün

136C 137B 137C 137D 138A 138B 139B 139C 146A 146B
146C 146D 147B 147C 147D 148A 148B 148C 148D 189A
191A 191B 193A 193B 194A 194B 194C

36. Green-brown/brun vert/grünbraun

151A 151B 151C 151D 152A 152B 152C 152D 153A 153B
153C 153D

37. Dark green/vert foncé/dunkelgrün

131A 131B 131C 132A 132B 133A 135A 135B 136A 136B
137A 139A 141A 141B 141C 143A 143B 143C 144A 147A

38. Grey-brown/brun gris/graubraun

199A 199B 199C 199D

39. Yellow-brown/brun jaune/gelbbraun

163A 164A 164B 164C 165B 165C 167A 167B 167C 167D
168C 168D

40. Orange-brown/brun orange/orangebraun

31B 31C 32C 33C 34B 34C 34D 35A 168A 168B
169A 169B 169C 169D 170A 170B 170C 170D 171B 171C
171D 172C 172D 173B 179C

41. Light brown/brun clair/hellbraun

166C 166D 173C 173D 174B 174C 174D 176D 177C 177D

42. Brown/brun/braun

165A 166A 166B 171A 172A 172B 173A 174A 175A 175B
175C 175D 176A 176B 176C 177A 177B 200D

43. Brown-red/rouge brun/braunrot

178C 178D 179A 179B 180A 180B 180C 180D 181A 181B
181C 181D 182A 182B 182C 182D

44. Brown-purple/pourpre brun/braunpurpur

178A 178B 183A 183B 183C 183D 184A 184B 184C 184D
185B 185C 185D 186A 186B 187A

45. Dark brown/brun foncé/dunkelbraun

200A 200B 200C

46. Light yellow-brown/brun jaune clair/hellgelbbraun

158A 158B 158C 158D 159A 159B 159C 159D 160A 160B
160C 160D 161A 161B 161C 161D 162A 162B 162C 162D
163 B 163C 163D 164D 165D

47. Grey/gris/grau

156A 156B 156C 156D 157A 157B 157C 194D 195A 195B
195C 195D 196A 196B 196C 196D 197A 197B 197C 197D
198A 198B 198C 198D 201A 201B 201C 201D 202B 202C
202D

48. Green-grey/vert gris/grüngrau

188A 188B 188C 188D 189B 189C 189D 190A 190B 190C
190D 191C 191D 192A 192B 192C 192D 193C 193D

49. Black/noir/schwarz

202A

50. White/blanc/weiss

155A 155B 155C 155D 157D

11.(C) STANDARDIZATION OF PICTURES (Draft prepared by the Community Plant Variety Office (CPVO))

For applications of ornamental and fruit candidate varieties, the applicants are requested to send in photographs of the candidate variety together with the Technical Questionnaire. The photograph should contain the following:

1. an image of the whole plant and
2. an image of the most relevant part(s) of the plant, showing the specific characteristics of the variety e.g. the flower, (variegated) foliage or fruit

The photograph must be in color, of good quality and show a clear view of the variety. When relevant the photograph should show a comparison with the reference variety/ies. Photos from a catalogue as well as prints of digital images from a color printer would in general also be acceptable.

Text proposed by the CPVO for inclusion in the new General Introduction in paragraph 207 under Chapter 10.3.10 would be

> "207. Section 7 on Additional Information Which may Help to Distinguish the Variety asks for any additional information to be given which may help to distinguish the variety, mainly information on resistance to pest and diseases, on special conditions for the growing (e.g. time of sowing or planting, any special conditions for the examination of the variety). Technical Questionnaires for ornamental and fruit species also ask for a representative color photo of the candidate variety to provide helpful additional information and also to prove that the variety really existed at the time of application."
>
> -new text-: "Since the use of photographs has been deemed necessary for the conduct of the technical examination, applicants are requested to provide a photograph of the plant as a whole, and where pertinent a close-up photograph of the flower/fruit or any other relevant part of the plant. The photograph must be in colour, of good quality and show a clear view of the variety. When relevant the photograph should show a comparison with the reference variety/ies. Photos from a catalogue as well as prints of digital images from a colour printer would in general also be acceptable."–end of new text-

It should be particularly noted that for countries offering official government growing tests the applicant is not required to provide a full description at the time of application. A full official description eventually becomes available as the end product of the growing test.

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DRAFT FOR TGP/12
DATE:

UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
GENEVA

DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/12: NON-TRADITIONAL NON-MORPHOLOGICAL CHARACTERISTICS AND METHODS FOR VARIETY TESTING

12.(A) BIOCHEMICAL CHARACTERISTICS, ELECTROPHORESIS

12.(B) IMAGE AND IMAGE ANALYSIS

12.(C) IDENTIFICATION METHODS BASED ON MOLECULAR TECHNIQUES

12.(D) GENETIC DISEASE RESISTANCE CHARACTERISTICS

12.(E) DUS ASSESSMENT OF BULK SAMPLES

12.(F) COMBINING CHARACTERISTICS IN DUS ASSESSMENT

12.(A) BIOCHEMICAL CHARACTERISTICS, ELECTROPHORESIS

Document still to be prepared.

12.(B) IMAGE AND IMAGE ANALYSIS

**(Draft prepared by Mrs. M. H. Gandeline, France,
Mr. S. Grégoire, France and Mr. G. van der Heijden, Netherlands)**

Definitions

- An image is a representation of reality, from a quick drawing summarising the main aspects of an object, to a photograph, or a numerical capture for instance.

- A digital image is a spatial representation in a digital format of an object or of a two- or three-dimensional scene or of another image.

- Image analysis is a set of operations on an image in order to obtain parameters.

The parameters can describe the shape of an object, the length or width of an organ, quantify colour variegations of petals or leaves, etc. These operations can be performed by man on a regular photograph, or by computer software on digital image. Generally the term "image analysis" is used when digital images are analysed by computer.

Use of image and image analysis

- Image and digital images can be used in order to keep memory of the objects studied.

- Image analysis provide tools to derive information from digital images. The principle is "image in" -> processing -> "data out"

- This information can then be used by the expert to describe the material and/or for decision making.

In that respect image analysis is not fundamentally different from visual assessment or other measurements obtained in the field or in the laboratory.

In the first part of this document, we give examples in which images, or image analysis, can be useful; in the second part we briefly describe image analysis; in a third part we summarise things to be aware of.

1. EXAMPLES

Photographs

Photographs are used at different steps in variety testing, for instance.

- given by the breeder at the time of application. This gives the expert an idea of the type of material submitted. It can be kept as an element of description provided by the applicant, or can be used to prepare the studies by the examiner,

- Photographs (classical or digital) can be used to keep a record on the objects measured (field plots, plants, organs),

- Photographs have also been used in some gazettes or in other publications as information on protected varieties.

Digital Images

Digital images can be used in a similar way as normal photographs. However, one should be aware of the resolution used. Typically the resolution of a 35 mm film is about 4000 lines, which is more than twice the resolution of high resolution digital cameras in year 2000.

Digital images offer however some clear advantages above normal photographs:

1. easy to copy and exchange
2. easy to enhance and manipulate
3. easy to store in databases
4. allow automatic measurements
5. allow automatic comparison and image retrieval

In order to use digital images for measurement or comparison (image matching), it is necessary to record the images under standardised conditions. Different apparatus can be used to capture images; scanner, classical or digital cameras for instance.

Improving Efficiency

In combination with good logistic handling, image analysis can save a lot of time for measurements. It can also increase the precision of the measurement, especially compared with visual observations. Furthermore, it is possible to extract more information which could otherwise not be obtained, e.g. total shape analysis and shape similarity, quantification of variegation patterns, etc.

Images can be kept for long-term storage and further analysis, or only used for feature extraction. If the feature extraction is done “real time”, images might not be kept at all. It is also possible to do the analysis shortly after the image recording in batch or with interactive tools. The image capture can also be done quickly when the plants are at the right stage, and analysis performed later on, when the critical biological stage do not lock human resources.

Classical Measures with the Help of Images

Simple classical measures, such as length, width,… , can be obtained manually on photographs or automatically on digital images; instead of direct measure or visual assessment in the field or laboratory. Image analysis is used in this way for measuring size and shape of e.g. beans, carrots, onions, seeds,…Image analysis can help to perform classical examination, it is not reserved to "new" or "sophisticated" characteristics.

Analysis for Colour Characterisation

By image analysis it is possible to compute respective area of several colour zones in case of bicolour or variegated objects (leaves, petals). It is use to analyse colour in Rose, to analyse colour variegation patterns on Ficus benjamina, Dianthus,….

Electrophoretic Gels

Electrophoresis is sometimes used in relation with studies on varieties. In some cases the gels are digitised, and specific software is used to identify and register the spots to be used in order to describe the variety.

Comparing Varieties with the Help of Images

When images of different varieties have been collected in comparable conditions it is possible to compare them. Specific software can be used to retrieve the "similar varieties" from the database either from the content of one or more images, from the variety description, from molecular data or from any characteristic available. The database can be used to select the varieties with which the candidate should be cautiously compared. This is done either by a routine program, or by the expert who interactively manages the comparisons to be done according to the material or the objective of the study.

Identification, Post Control, etc.

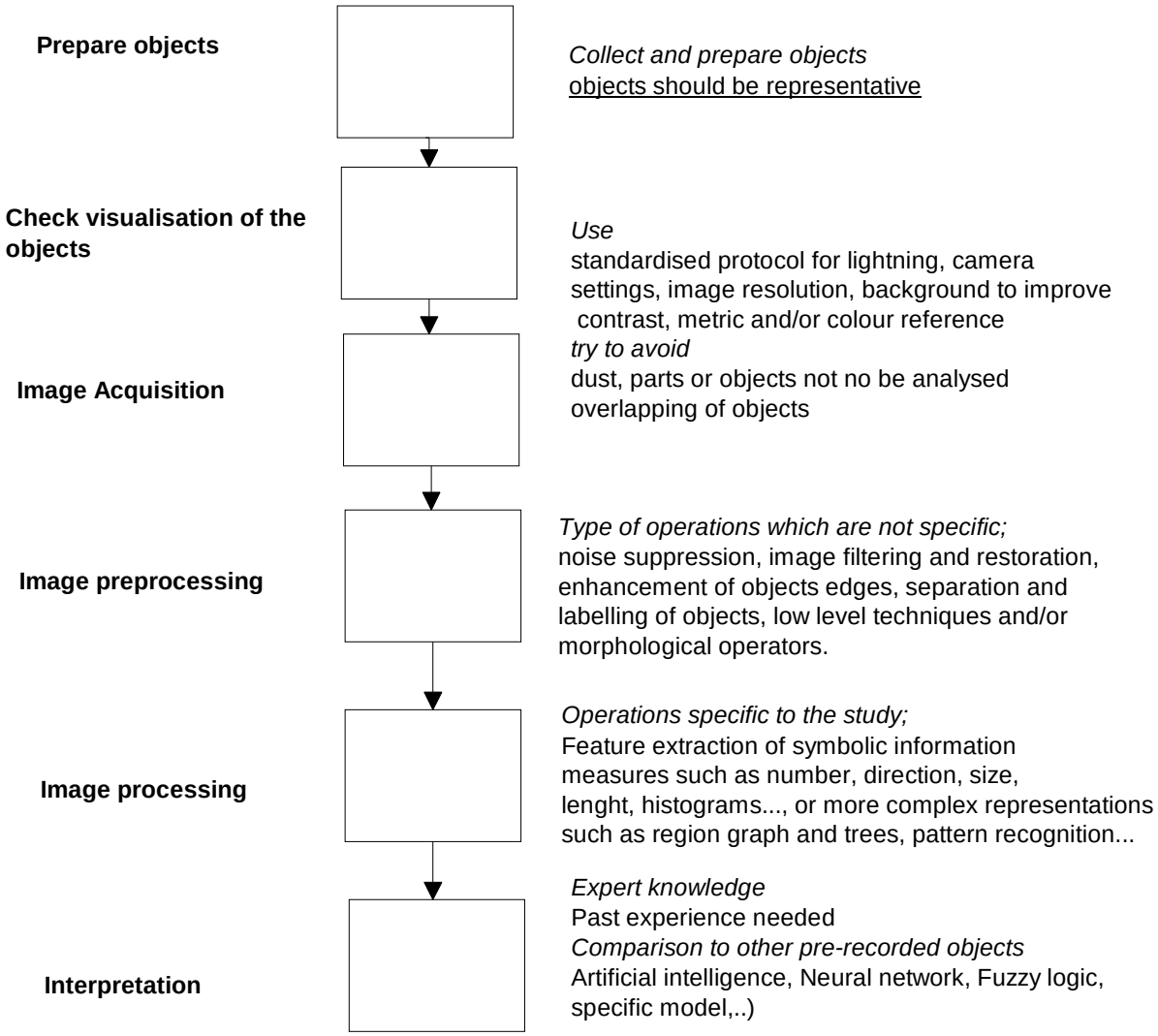
Various publications have shown that image analysis can be used with success to recognise species in mixtures, or a variety among others when compared to known references.

2. IMAGE PROCESSING, MAIN STEPS

Beforehand:

Experiment machine and software, train people, check reliability and reproducibility
Look at existing protocols and define protocols to use
Define type of material, time of examination,...
Check variability within and intra-varietal variability
Check effect of environment

Image analysis



Describe material and/or use in a decision process

Keep memory of results and on how the results were obtained

3. THINGS TO BE AWARE OF

Images offer only an instantaneous representation of reality. Experience and practice show that variability can occur according to growing conditions. This is also true for classical measurements made by visual assessment or direct measure, but should not be forgotten when images are used.

Sample Preparation

Like in DUS testing the samples to be used must be representative of the variety. Image analysis can be used in order to study the variability (on a plant, on different plants from the same variety at a given time, on date or state of development to use, …). Which parts to take and how many should be described and known by the users (persons who prepare plants, process images, experts using the results).

Image Acquisition

As far as possible the conditions of capture must be known and standardised .
For cameras the light conditions, the distance to the object, the size should be controlled (integration of a scale on the image itself). For photographs, the film used has a great influence on the colour but it is impossible to ask to the breeders to use the same kind of film. So, this problem must be take in count on the interpretation step. Whenever possible, a calibration procedure should be established and used.

Measures Itself

Sometimes the software is a black box, and the user can only choose the determination of the parameter without any possibility to change the way it is obtained. In other cases, a specific software computation has been developed in order to obtain reliable and comparable values.

Processing Images

Usually different treatments are applied to the raw image, (filters, opening, closing, edge detection,…) in order to improve the determination of the expected parameters.
Whenever possible this processing should be documented and kept along with the data and the parameters.

Image Storage

An initial reference image should be stored if it is possible. Then the choice of what to store (which steps of the process, in which format, how many by variety,…) is usually a compromise between many factors such as the capacity of storage, the technical needs to proceed to all treatments of the image, the further uses,… With a conveyor belt system, usually the data are extracted on the flight and no images are stored. For image databases, of course all images need to be stored. In that case, be cautious if you want to sacrifice image

quality (JPEG compression) to save disk space. It is usually more expensive to have to record an image of insufficient quality twice, than it is to buy an extra disk.

Storage of Parameters

The features obtained should be stored in files or databases. These data can be handled in a similar way as all other measured data in the field or the laboratory.

Colour Reproduction

Until now, the computer screens used to display the images are not able to give true colours: different screens will give visually different results for the same image. Also the cameras do not record colour in the same way. Therefore, do not rely on the colour seen on screen or print-out. Try to obtain the RGB-values as good as possible. Compare the RGB values, not the visual representation on the screen. Colour reference patterns (like colorchecker for instance) might be helpful here.

Good colour reproduction is still very difficult and there is not yet a standard procedure within UPOV. Also we should keep in mind that colour of plants is highly influenced by environment and we have to assess the colour precision that can be used in comparisons between pictures, not recorded with the same environmental conditions.

12.(C) IDENTIFICATION METHODS BASED ON MOLECULAR TECHNIQUES

Document BMT/3/2 gives information on several methods for the identification of molecular markers.

It has been prepared in 1995 and will be updated in the near future.

12.(D) GENETIC DISEASE RESISTANCE CHARACTERISTICS

(Draft prepared by Mr. R. Brand, France)

For many species, breeding for genetic disease resistances is one of the main topics of the selection of new varieties. The introduction of such resistances is required by the users of the varieties for agronomic traits. These resistant varieties provides to growers economic values and are now strongly considered to reduce the pollution effects of the agriculture and to improve the quality and security of the products for human alimentation.

Vegetable and fruit species in general, many agriculture crops - sunflower, wheat… - and some ornamentals - *Cupressus*, Carnation… - are concerned.

These disease resistance characteristics are also important for the description of varieties and therefore also for distinguishing one variety from another and for the examination of uniformity and stability. For the conduct of D.U.S. tests, only disease resistance characteristics that are capable of precise recognition and description, which lead to consistent and repeatable results must be considered. They also must enable a clear differentiation in the collection of varieties of the specie and fulfil, as possible, the usual uniformity requirements. They must be genetically determinate and heritable.

UPOV recommends, to fulfil such upper requirements, to use disease resistance characteristics for which a standardised method exists. The tests could be conducted in laboratory, growing room. They could be also conducted in glass house or open field in the case of controlled artificial inoculation, or reinforced natural contamination, assuming that the agro-environment will be uniform. The introduction of such characteristics in the table of characteristics needs an explanation in chapter VIII where the standardised method is described as following:

- maintenance of strains (medium, special conditions)
- execution of test:
- - growing stage of plants
  - temperature
  - light
  - growing method
  - method of inoculation
  - duration of test
    . from sowing to inoculation
    . from inoculation to reading
- number of plants tested
- remarks
- standard varieties
  . susceptible
  . resistant

with available literature (chapter x).

Disease resistance characteristics should be included at the end of the table. Recommended states of expression are “absent” (1) and “present” (9) and needs example varieties, commercial or disease resistance available example varieties (as plant introduction …) to be used during disease tests. This situation fit with dominant monogenic resistance.

As soon as recessive monogenic resistance, or polygenic resistance, are used different states of resistance can be observed. One solution is to transform the situation in an “absent” / “present” system, considering that the resistance is present if the variety get at least the level of a well known example variety (examples: polygenic resistance to *Fusarium oxysporum f. sp. melonis* strain 1-2 with Melon; *Phytophthora* infestans and Tomato yellow Leaf Curl Virus with Tomato ; *Phytophthora capsici* for Pepper; *Sclerotinia and Phomopsis* for Sunflower …).

A particular attention must be carried to the existing strains, if available, and their identification. It is recommended to follow the International rules edited by International Committee such as The International Committee for Taxonomy of viruses

UPOV documents give the list of pathogens and species for which countries are testing disease resistance characteristics in routine and offering co-operation.

12.(E) DUS ASSESSMENT OF BULK SAMPLES (Draft prepared by Mr. R. Brand, France)

For Distinction assessment, characteristics which describes qualitatively or quantitatively the technological qualities for special industrial requirement of particular economic value could be used.

Phenol components identification by gaze chromatography for aromatic oil species – lavendula, thymus, dry matter content for onion and root witloof chicory, protein content for alfalfa, érucique acid for swede rape, by example are concerned.

Regarding the Uniformity assessment, it is recommended to identify such characteristic plant by plant. But because of the cost of such analysis **and/or** the necessity to have enough product to realize the technological analyses, examination can conduct to mix the harvest of different plants to get a bulk sample. It can be a bulk of 10 plants for aromatic species or 5 bulbs in onion by example. In such an approach, the uniformity of the variety is not evaluated for this characteristic.

Only technological characteristics which are capable of precise recognition and description, which lead to consistent and repeatable results and clear differentiation in the collection of varieties of the species must be recommended.

The introduction of such characteristics in the table needs an explanation in Chapter VIII where the standardized method is described with available literature in Chapter X.

12.(F) COMBINING CHARACTERISTICS IN DUS ASSESSMENT

Document still to be prepared.

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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
GENEVA

DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/13: RELATIVE UNIFORMITY, COMPARABLE VARIETIES AND GUIDANCE FOR NEW TYPES

13.(A) RELATIVE UNIFORMITY, COMPARABLE VARIETIES AND GUIDANCE FOR NEW TYPES.

13.(B) DUS TESTING OF NEW SPECIES

13.(A) RELATIVE UNIFORMITY, COMPARABLE VARIETIES AND GUIDANCE FOR NEW TYPES
(Draft prepared by Mr. M. S. Camlin, United Kingdom)

1. INTRODUCTION

The level of uniformity is the most important consideration in the examination of new varieties for registration. No variety can be found distinct using a characteristic unless that characteristic is uniform in both the candidate and comparison variety. Thus the higher the degree of uniformity for a characteristic or variety the more scope there is for development of new, distinct varieties. However, if the uniformity standard is set too high it may become almost unattainable thereby preventing the development of new varieties. The examination system must therefore always strive to find the optimal balance and this document seeks to provide guidance on how this can be approached. For the assessment of the uniformity of a new candidate variety and checking its compliance with the UPOV uniformity criteria, the likely plant-to-plant variation within the variety arising due to its genetic make-up and the type of reproductive system employed for its breeding, maintenance and multiplication must be taken into account.

This is clearly recognized within the 1991 Act of the Convention of UPOV (The International Union for the Protection of New Varieties of Plants) which, at Article 8, with respect to the examination of uniformity, states the following:

> Article 8 - Uniformity
>
> *'The variety shall be deemed to be 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'*.

2. RELATIVE (SUFFICIENT) UNIFORMITY

In Article 8, the use of the phrases - *'sufficiently uniform'* and *'subject to the variation which may be expected from the particular features of its propagation'* - introduces the concept of an acceptable level of uniformity which is dependent upon the genetic make-up and system of propagation under consideration.

With vegetatively propagated, self-fertilized and single cross in-bred hybrid variety types, absolute plant-to-plant uniformity of both genotype and phenotype can, within reason, be expected for most characteristics with some additional allowances for the occurrence of inbreds in the hybrids. However, in the case of cross-fertilized varieties and multiple-cross hybrids the uniformity obtained for most characteristics can only be relative in comparison with other similar varieties. Examination systems must be devised and standards set with these differences in mind.

For the often discontinuously expressed, observed and non-measured characteristics normally used in vegetatively propagated, self-fertilized, or single cross in-bred hybrid varieties the assessment of uniformity is normally carried out by first defining the essential state of the variety either as a whole or across specific descriptor characteristics. A sample of plants from the variety is then the inspected to check compliance with this state. Normally,

within the 1-9 descriptor scale used by UPOV, it is accepted that a one-state difference is required for a constituent plant within a variety to be considered as an off-type, this level of difference being the same as that required for variety distinctness. Depending upon the population standard appropriate for the species under examination, the sample size used for the examination of uniformity is determined together with the maximum allowable number of off-types within the sample to allow the variety to meet the uniformity criterion.

However, for the continuously expressed and measured characteristics normally used in cross-fertilized varieties or, when relevant, multiple cross hybrid populations, there is a clear acceptance that a search for single off-type plants is inappropriate. Thus, it is a relative and not an absolute level of uniformity that is required of such types and the spread of the normal distribution for each of the measured characteristics, as represented statistically by the standard deviation (SD), is normally employed to determine compliance with the uniformity criterion. For the candidate variety, the distribution of the individual plant data for each characteristic is examined alongside similar data for known and comparable reference varieties of similar type and must fall within tolerances based upon predetermined statistical probability levels.

3. COMPARABLE VARIETIES

The level of relative uniformity required of a new candidate variety can most easily be based upon past experience of what is known to be attainable by the breeding method used and has been shown to have been successful in the maintenance and multiplication of varieties of a similar type. The target level of uniformity is set by comparison with these other varieties which, at specified levels of relative uniformity, have been shown to be able to maintain their identity through maintenance and repeated multiplication.

In most examinations, the genetic stability of a variety across different generations of multiplication is not assessed directly but is inferred from the uniformity examination over an appropriate period of testing. However, in the acceptance of the concept of relative uniformity there is a clear recognition that it can be accommodated within the protection system only if it does not affect variety stability or identity.

It is important that appropriate comparable varieties are chosen to set the standard for relative uniformity. Varieties of the same type as the new candidate variety must be selected and these varieties should also be ideally of similar agronomic type and general morphology.

The selection of comparable varieties is a critical step in the examination of the relative uniformity of a new candidate variety and, in the completion of the technical questionnaire, the breeder has the first important role to play. The technical questionnaire includes information on the origin, maintenance and reproduction of the variety and provides a preliminary description on the most important characteristics, often for use by the testing authority for grouping purposes in advance of field-testing. Information is also provided on the most similar varieties to the candidate variety. This information is very useful to confirm the descriptive information given for grouping purposes and can also be used to direct the testing authority towards the most appropriate comparable varieties.

Of course it is important to check that the information supplied by the breeder about the most similar (comparable) varieties is accurate. This will become clear once the initial grouping exercise has been completed and preliminary examinations undertaken on the submitted plant material, if applicable, or alternatively, when the first series of growing trials

has been completed. Once the essential descriptive characteristics of the new candidate variety have been determined it should then be possible to choose a representative set of comparable varieties from the reference collection of the appropriate type, to be grown together with the candidate variety. These can then be used to determine whether the level of relative uniformity of the new variety falls within acceptable limits.

4. GUIDANCE FOR NEW TYPES AND SPECIES

The main determinant of the plant breeding and multiplication systems utilized for variety production within any particular plant species is the natural mode of reproduction of that species and the ability of the plant breeder to control and modify this. At the early stages of development of the breeding history of most plant species the natural reproductive systems in place have therefore normally dictated what is considered to be sufficient uniformity.

As plant variety protection now extends across the whole plant kingdom, testing authorities, especially in the ornamental crops, are being faced with more and more new candidate varieties that represent the first application for protection within a plant species. Additionally, new intercrossing and multiplication methods are continually becoming available to breeders, often transposed from more advanced breeding or multiplication systems used in other species. As a result, novel variety types are increasingly being introduced, such as complex hybrid variety systems with varying levels of plant-to-plant uniformity, highly uniform micropropagated clonal varieties derived from within sexually reproduced and more variable populations or more variable seed propagated varieties produced in hitherto highly uniform vegetatively propagated species. We now have the situation in several crop species where it is possible to have several different variety types being produced at the one time, each requiring a different standard of uniformity.

For the testing authorities, the determination of the level of uniformity to be required of the first new candidate variety resulting from a new breeding method or representing the first application for protection within a plant species is very important as this variety will normally set the future uniformity standard for its type. However, there is a difficulty as in these circumstances there will be little or no past experience of the level of uniformity to be reasonably expected and no comparable varieties will be available for use for reference purposes.

While there is a general acceptance that the first variety of a new type must, to some degree, be allowed to set the standard for uniformity, it is important that this is set at an appropriate level. If the standard is set too high then an unreasonably high target might be set for the future which could hinder breeding development. Alternatively if too low a standard is accepted this could also prevent further breeding progress as the first variety would have encompassed too large a proportion of the possible variability available within the type or species.

It is therefore important that efforts are made to understand the natural genetics and reproductive methodology of the type and species to which the variety belongs to be able to have a realistic expectation of the level of uniformity that might reasonably be expected. It is also very important to study the breeding and maintenance methods outlined by the breeder to be sure that these will result in a true variety entity which will be able to be accurately described and either maintained or repeatedly produced true to its description over a period of years.

For the granting of the breeder's right, the method of propagation of any variety has implications for the technical examination of its compliance with all the DUS criteria, but in particular for the consideration of uniformity. It is therefore useful to briefly outline the four main types of variety systems which result from the different natural methods of reproduction adopted by plants, together with artificial hybridization systems, and to suggest the appropriate levels of uniformity which might reasonably be expected.

5. REPRODUCTIVE SYSTEMS AND VARIETY TYPES

Vegetatively Propagated Varieties – Clones

In vegetatively reproduced varieties the variety is produced by cloning a single plant. Once the initial cross of the parents has been completed and the desirable resulting recombined genotype favored by nature or selected by man this can be propagated vegetatively without further substantive genetic change. Vegetative reproduction has the advantage for the plant breeding industry that plants propagated in this way, without recourse to the sexual cycle, are normally very uniform and more genetically stable than those reproduced sexually. Variety maintenance and multiplication is normally straightforward except in certain species where deviations from description can easily result from natural somatic mutation. Indeed in some crops many new protected varieties continue to arise in this way from spontaneous mutation. In some micropropagation systems there have also been problems with unacceptable levels of somaclonal variation and regeneration protocols have had to be carefully developed to try to avoid this.

Vegetatively propagated varieties are derived from a single plants. Member plants should be genetically identical and varieties can be expected to exhibit very little plant-to-plant variability, showing high levels of uniformity and stability for all characteristics.

Self-fertilized Varieties - Lines

For the plant breeding industry the main advantage of self-fertilization is that it confers a much greater degree of genetic uniformity in varieties than does cross-fertilization. Varieties of self-fertilized species tend towards homozygosity, at least in their main descriptor characteristics, which are positively selected for uniformity by the plant breeder. They can, as a result, more easily be maintained true to their description across repeated cycles of sexual multiplication as the male and female gametes are of increasingly similar (if not identical) genotypic makeup. Variety multiplication is therefore relatively straightforward provided initial selection and maintenance have been correctly carried out.

Self-fertilized varieties tend towards homozygosity and member plants will be very similar genetically and, certainly, identical for their main descriptor characteristics. Varieties should show very little plant-to-plant variability and may be expected to be highly uniform and stable.

Cross-fertilized Varieties - Populations

From the point of view of the natural environment, the cross-fertilized plant species are those which most easily can employ the variability brought about by sexual reproduction to adapt to environmental or cultural requirements. However, this plasticity and readiness to respond to the

pressures of natural selection reflects a lack of uniformity and stability and means that multiplication and maintenance of cross-fertilized varieties true to their description is much more difficult. Because the male and female parents will have different genetic backgrounds in cross-fertilized varieties there are often problems for the plant breeding industry for variety maintenance and multiplication.

Varieties are made up of populations of heterozygous and genetically different plants and are kept within certain descriptive ranges either by continuous re-selection or, more usually, by production of what is termed a synthetic variety. In the case of a synthetic variety, for example in forage grasses, a number of similar and desirable plants are selected and placed in a totally intercrossing environment (polycross). The aim is to produce a population of plants in the F1, which will be in genetic equilibrium and will be able to maintain the essential identity of the variety across a limited number of further generations in an open-pollinated system with a degree of isolation for the seed crop.

Cross-fertilized varieties are derived from populations of selected plants. In all subsequent generations the member plants, all of which are heterozygous, will show a range of expression for most characteristics that will be determined by the make-up of the initial founder plants. Varieties will therefore inherently show plant-to-plant variability and the permitted limits of this variation for any variety must to be defined by statistical means in comparison with similar types or species. In maintenance and multiplication, such varieties are kept stable and true to description only with considerable care.

Hybrid Varieties

A hybrid variety results from the inducement of exclusive cross-fertilization between its component parental lines. This can be bought about by either manual (hand pollination, detasseling), chemical (gametocide) or genetic (self-incompatibility, male sterility) means. These may be used in various controlled crossing systems such as a two or three-way cross, inbred hybrid, top cross or a hybrid between two cross-fertilized varieties. The objective of the breeder is to utilize the heterosis or hybrid vigor which is expressed to most effect in the F1 generation to produce a favorable advantage in yield or some other desirable characteristic for the resultant progeny or hybrid variety. This heterosis is particularly well expressed in the case of crosses between inbred lines but can also be shown to advantage within other systems.

The hybrid variety produced from a single cross between two inbred lines is normally highly uniform because, in the F1 generation, all progeny are of the same predetermined, though heterozygous, genotype. The fact that heterozygosity is evident is of no consequence as there is normally no further multiplication beyond the F1 and the variety is maintained by repeatedly returning to a controlled cross of the parental lines. With heterozygous parents e.g. multiple cross hybrids or hybrids between cross-fertilized varieties, the situation with respect to uniformity is as for cross-fertilized varieties except that, once again, as no further multiplication of the hybrid itself is intended, there is no need to consider any influence of genetic equilibrium upon stability across future generations,.

Hybrid varieties are produced from a controlled cross between selected parents with the progeny representing the hybrid variety. While heterozygosity is present, phenotypic similarity and plant-to-plant uniformity is very high in the case of single-cross inbreds.

In other hybrids, the level of uniformity has to be considered according to the uniformity of the parents. The need to achieve a satisfactory level of uniformity for distinctness purposes must be given careful consideration where a range of hybrid systems exist within the one crop. Acceptance of a very low level of uniformity in complex hybrids could greatly inhibit the scope for distinctness between new candidate varieties. For this reason, characterization of parent lines has been used in some situations in determining the distinctness of hybrid varieties. Where this approach is not used it will be necessary to give careful consideration to preserving the scope for development of new varieties.

While uniformity remains a prerequisite of the variety entity it is not considered in respect of stability as multiplication is based upon maintenance of the parental lines and repeated enactment of the controlled crossing scheme to produce the hybrid.

In considering the standards to be required for uniformity of a new variety type in an already exploited crop or in a new plant species, it is important that full consideration is given to the influence of the inherent natural reproductive system of the crop species. This must be taken together with the modifying effects of the breeding and maintenance strategies employed by the breeder. Guidance can often be obtained from parallel breeding developments in other similar or related crop species. However, it is essential that the standard of uniformity set for the first candidate variety of a new type is given careful thought before its registration as important precedents will be involved affecting future breeding development and variety production.

For further information on the setting of uniformity standards in various crop types, reference should be made to Complementary Document TGP/10 and to individual crop Test Guidelines

13.(B) DUS TESTING OF NEW SPECIES
(Draft prepared by Mr. C. Barnaby, New Zealand)

INTRODUCTION

A testing authority may receive a request to test a variety of a species with which they have no experience. The first step would be to determine whether or not a UPOV test guideline exists. If not, search for other UPOV member states in TGP/5 that have testing experience with this crop. If this also has no result, it becomes necessary to establish a testing system and prepare your own test guideline. In the preparation of your own test guideline it could be helpful to discuss testing with neighboring countries.

Before testing begins it is helpful to learn as much about the new species as possible and to collect relevant information. Possible sources of information include botanical literature, trade and industry publications, trade catalogues, national research institutes, amateur plant collectors and the breeder. The breeder may be the most important information and plant material source of all and is advisable to develop a level of good working co-operation with the breeder.

It can be useful to examine the breeding origin of the variety to increase information about the species and the variety. The following are four scenarios:

- Clonal reproduction from a seedling in the wild population of a species not thought to be in cultivation. It is probable that there are no varieties of common knowledge. The authority should prepare a description and asses uniformity and stability according to the principles for testing first varieties in a species or genus.

- Clonal reproduction from an individual seedling in the general population. The species may be in commerce but possibly only exists as heterogeneous seedlings. It is less probable that there are varieties of common knowledge because the species exists, as heterogeneous seedlings and cannot be considered as varieties. The heterogeneous seedlings are not uniform. As a result these seedlings cannot be the subjects of DUS testing because plant to plant comparisons can only be made between varieties. If the seedlings have uniformity in at least the main characteristics then these seedlings possibly could be treated as varieties for DUS testing.

- Clonal selection for a desired attribute or form. Other clonal forms may have been selected in the species and exist in commerce as unnamed varieties. The candidate variety should be compared with the other unnamed varieties existing in commerce. The new variety should be distinct from the other unnamed varieties and uniform not only for the desired attribute but for all characteristics which are in the (national or UPOV) guideline.

- Seed propagated variety selected for a particular character from the general population. Other seed propagated varieties, whether named or unnamed, could exist in commerce. The new seed propagated variety selected for a particular character should be compared with other similar seed propagated varieties, whether named or unnamed. The new variety should be distinct from the other

seed propagated varieties and uniformity assessed according to the reproductive system of the variety and the applicable UPOV uniformity method.

Each of the above scenarios gives some information about the species and provides an indication as to whether or not varieties of common knowledge could exist.

Inter specific or inter generic hybrid varieties are a special type of new species. The parents may be well known but the resulting hybrid is new. Examples are plumcots (*Prunus salicina* x *P. armeniaca*) and pear hybrids (*Pyrus domestica* x *P. pyrifolia*). UPOV Test Guidelines exist for the parents; should one of these be used? The first step would be to have a close examination of the variety characteristics and determine if the variety is more like one parent than the other. If one parent has strongly influenced the variety characteristics then that parent's guideline might be used. If a few variety characteristics do not correspond to the guideline selected then the other parent's guideline is also available as a source of possibly more appropriate characteristics to enable a full variety description. It may become necessary to prepare a new national guideline for the hybrid, and a new UPOV guideline if the inter specific or inter generic hybrid varieties will be grown also in other UPOV member-states.

TESTING DISTINCTNESS

It is necessary to establish that the candidate variety is distinct from any other variety of common knowledge. For testing in new species there may or may not be other existing varieties. To ensure that the term variety is clearly understood, keep in mind the definition of a variety in the 1991 UPOV Convention. TGP/3 should be used to assist in understanding the term variety of common knowledge.

TESTING UNIFORMITY

The assessment of uniformity in new species is tested in accordance with standard UPOV principles. For vegetatively propagated and seed propagated truly self-pollinated, mainly self-pollinated, inbred line varieties, population standards are used.

For seed propagated cross-pollinated and synthetic varieties, the UPOV assessment of uniformity is based upon the level of variety variation compared with other existing varieties. How do you assess uniformity if there are no other varieties of common knowledge? If there are no other varieties then uniformity will need to be determined by another method. The following may assist:

- The uniformity in closely related species
- The uniformity in the family
- Consult with the breeder in order to understand the breeding method.
- Consider the possibility of further improving the variety's uniformity. Could the breeder easily remove off-types?
- Based on available knowledge, consider how uniform a cross-pollinated variety from the new species could be.

The variability determined in the first seed propagated cross-pollinated variety will probably affect the level of variability acceptable in the testing of future varieties in that species. Should the first variety tested be highly uniform, then this could have a greater effect

on the second variety tested than if the first variety was not so uniform. The second and later varieties would have to match the uniformity of the first and at the time of first testing it was unknown if that uniformity was representative for varieties in that species. A less uniform first variety has a reduced effect on subsequent varieties, as that uniformity may be more achievable for future varieties. An important point to remember is that an acceptable uniformity level can more easily be reduced than it can be increased with respect to existing varieties.

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DRAFT FOR TGP/14
DATE:

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GENEVA

DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/14: OTHER STATISTICAL METHODS

14.(a) Similarity, Clustering and Dendrograms

14.(b) Sequential Analysis

14.(A) SIMILARITY, CLUSTERING AND DENDROGRAMS

Document TWC/14/14 on Similarity, Clustering and Dendrograms discusses a variety of ways in which the differences or similarities between varieties may be quantified.

14.(B) SEQUENTIAL ANALYSIS

Document TC/32/6 on sequential analysis gives detailed information on that method.

A new document has still to be prepared.

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DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/15: SUPPORTING EVIDENCE

15. GENETIC LABELLING: A SUPPORT FOR DECISION-MAKING ABOUT DISTINCTION

15. Genetic Labelling: A Support for Decision-making About Distinction (Draft prepared by Mr. Joël Guiard, France)

The 1991 UPOV convention unambiguously established the definition of a variety according to phenotype by basing it on the expression of characters of a particular genotype or of a particular combination of genotypes (article 1, ii). The description of the expression of these characters is the basis for evaluating the criteria of distinctness, uniformity and stability, and especially for verifying that the variety for which breeders' rights are being requested is indeed clearly different from all known varieties (article 7).

Although the Convention has now explicitly established a phenotypic basis for description, the analysis of distinction has always involved examination of the expression of morphological and physiological characters, and thus the phenotype, of varieties. For the large majority of varieties, a decision concerning distinctiveness, whether positive or negative, can be reached from the phenotypic characters as a whole. However, it is not unusual for it to be difficult to conclude about distinctiveness from phenotype although other factors, particularly the origin of the variety or its agricultural performance in a particular environment, indicate that it is clearly distinctive. This situation most often results from the use of too few characters corresponding to the criteria laid down by UPOV. These criteria are that the character be a good indicator of variability within the species, only weakly affected by the environment, and easy and cheap to observe.

There have been studies aimed at identifying new phenotypic markers or new techniques to improve discrimination between varieties in various species. However, this has led to an increase in the experimental load, and the results are not always convincing.

In view of this situation, and the development of genetic labelling, the trend is rather to use characters which describe the structure of the genetic basis of the information, without there necessarily being expression of the corresponding genes (or without it being possible to confirm expression). Convinced that these developments will in the long run have a major impact on plant breeders' rights, UPOV has started to consider how to find solutions which will make best use of these new characters, while respecting both the phenotypic basis of the definition of a variety and the quality of the protection conferred by plant breeders' rights. Within UPOV, the idea arose of establishing a support for decision-making; the following principles could be used for its development.

A New Aproach

This approach is based on the following articles of the Convention:

- Article 1, vi: a definition clearly based on the expression of the genotype or a combination of genotypes, every variety being distinguished by at least one such character.

- Article 7: among the conditions for granting rights, the variety must be sufficiently distinctive from all known varieties.

This condition of sufficient distinctiveness does not define the basis on which it should be established. Therefore, it is reasonable to consider different means of ensuring sufficient distinctiveness for varieties as defined in article 1, vi.

Experience with DUS studies shows that it is not uncommon for a variety to be judged to be insufficiently distinct according to UPOV's major directing characters, but that, nevertheless, the variety can be declared sufficiently distinctive on the basis of other criteria or expert opinion. Examples include varieties differing substantially in their yield, a technologically relevant characteristic or their behaviour in a particular environment. A species expert will readily attest to a sufficient distinctiveness between varieties if it has been demonstrated by a precise and validated protocol, and the results are significant according to a defined minimal threshold. Another case is that where the expert has no difficulty in distinguishing between two varieties on the basis of direct comparison, but is unable to describe the distinction with only the characters recognised by UPOV.

In both these cases where the distinctiveness can be established, but cannot be described by UPOV characters, an instrument for helping decision-making is required.

Characters resulting from genetic labelling could serve to help decision-making if they allow identification of varieties, and if the following conditions apply:

- the characters must give a good description of the variability within the species, must not be substantially modified by the environment, and must be easy and cheap to analyse

- the characters must satisfy uniformity norms, considering the way of reproduction of the species and varietal structure

- protocols for the use of the characters must be precisely defined

- the analysis of distinctiveness report must include both: elements relevant to phenotype on which the experts based their conclusion of sufficient distinctiveness; and elements allowing the unambiguous identification of the two varieties.

In this type of case, any litigation initiated by the holder of rights for infringement will involve, not only the characters used as the basis for identification, but also the characters used by the experts to conclude that there was sufficient distinctiveness. Indeed, the way in which these decision support characters are used does not guarantee that the directly compared varieties can be distinguished from all other varieties on this basis alone. They are thus not in themselves sufficient for litigation.

Conclusion

The distinctiveness criterion is essential for the effective protection of plant breeders' rights. It is necessary for a just balance between the ability to identify a truly novel genetic construction and the detection of a minimal difference not corresponding to any substantial effort to create a new variety. The risk are large: first of not recognising novelty due to not using, or not having available, adapted tools; and second of failing to provide any meaningful protection.

There is much promise in an approach associating both phenotypic characterisation ensuring that varieties are considered in the UPOV sense, and genetic labelling which can clearly identify varieties. It may allow exploitation of the progress in varietal characterisation,

without the risk of losing what has already been established. This approach may, however, be only a step towards a system in which genetic labelling has a larger influence, and involving assessment of the genetic distances between varieties, and not differences observed character by character.

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DRAFT FOR TGP/16
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DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/16: MODEL SYSTEM FOR DETERMINING DISTINCTNESS

Document still to be prepared.

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TGP/17: TECHNICAL QUESTIONNAIRE TO BE COMPLETED IN CONNECTION WITH AN APPLICATION FOR PLANT BREEDERS' RIGHTS

17. Model Technical Questionnaire

17. MODEL TECHNICAL QUESTIONNAIRE (Draft for a Revised Text prepared by the Office of UPOV)

	Reference Number (not to be filled in by the applicant)

TECHNICAL QUESTIONNAIRE
to be completed in connection with an application for plant breeders' rights

1. Species *(Latin name)*

(COMMON NAME)

2. Applicant (Name and address)

3. Proposed denomination or breeder's reference

4. Information on origin, maintenance and reproduction of the variety

[Example:

4.1 Origin and breeding method

(a) Population [ ]

(b) Hybrid [ ]

(c) Synthetic Variety [ ]

(d) Other (please indicate)

..... [ ]

4.2 Other information]

5. Characteristics of the variety to be indicated (the number in brackets refers to the corresponding characteristic in the Test Guidelines; please mark the state of expression which best corresponds).

	Characteristics	Example Varieties	Note
	(To be copied from the Table of Characteristics and only a few other characteristics needed for the layout of the trial, only characteristics with an asterisk)		
	[EXAMPLE:		
5.1 (3)	**Leaf: length**		
	short		3[ ]
	medium		5[ ]
	long	Luxor, Markise	7[ ]
5.2 (5)	**Leaf: intensity of green color**		
	light		3[ ]
	medium	Katrien	5[ ]
	dark	Madona, Rubis	7[ ]
5.3 (13)	**Root: length**		
	short		3[ ]
	medium	Madona, Mariene	5[ ]
	long		7[ ]]

6. Similar varieties and differences between these varieties

Denomination of similar variety	Characteristic in which the similar variety is different o)	State of expression of similar variety	State of expression of candidate variety

o) In the case of identical states of expressions of both varieties, please indicate the size of the difference.

Proposal made by the TWO for an amended Chapter 6:

6. Similar varieties and differences between these varieties

Denomination(s) of variety(ies) similar to your variety	Characteristic(s) in which your variety differs from the similar variety(ies)	Describe the expression of the characteristic(s) for the similar variety(ies)	Describe the expression of the characteristic(s) for your variety
Example: name of variety	Plant: height	short	tall

Explanation:

The TWO considers the wording of the proposal more easily understood as, apart from the experts involved in the drafting and familiar with the UPOV terminology, few would understand the term “state of expression.” The TWO also proposed to delete the footnote as it would not be at all understood by the applicant and would apply only in very rare cases. Even in those cases the applicant would not know the exact states of expression of the Test Guidelines as he would not always have a copy of those Test Guidelines at hand and he would not really give the same expression in both columns.

7. Additional information which may help to distinguish the variety

7.1 Resistance to pests and diseases

7.2 Special conditions for the examination of the variety

7.3 Other information

For fruit and ornamental varieties the following sentence has to be added:

A representative color photo of the variety should be added to the Technical Questionnaire

8. Authorization for release

(a) Does the variety require prior authorization for release under legislation concerning the protection of the environment, human and animal health?

Yes [ ] No [ ]

(b) Has such authorization been obtained?

Yes [ ] No [ ]

If the answer to that question is yes, please attach a copy of such an authorization.

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DOCUMENTS COMPLEMENTING THE GENERAL INTRODUCTION TO THE ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY IN NEW VARIETIES OF PLANTS

TGP/18: DEFINITION OF TECHNICAL, BOTANICAL AND STATISTICAL TERMS USED IN UPOV DOCUMENTS

18.(A) GENERAL TECHNICAL TERMS

(i) Terms associated with basic principles

(ii) Terms and "unwritten rules" to be considered in the preparation of Test Guidelines

18.(B) BOTANICAL TERMS

18.(C) STATISTICAL TERMS

18.(A) GENERAL TECHNICAL TERMS

Remark:

These explanations have been prepared by Mrs. Lean, United Kingdom, before the completion of document TC/36/5 and thus without knowledge of the changes made compared to document TC/35/8. The contents would thus require alignment with document TC/36/5 as well as with the final wording of TC/36/6. It is included mainly to get an idea on how this part of TGP/18 could look like. The Office of UPOV has also slightly amended the numbering and headings and deleted part 18(b) (Botanical Terms) as that is almost identically included in document TC/36/5.

These explanations of terms and definitions refer to their use in the UPOV context. These may differ from the use of the same terms in a classical botanical sense. The list of terms and definitions is divided into the following subject areas:

18.(A) General Technical Terms

(i) Terms associated with basic principles

(ii) Terms and "unwritten rules" to be considered in the preparation of Test Guidelines

18.(B) Botanical Terms (e.g. terms used to describe plant habit to be copied from TC/36/5 once the wording has been agreed).

18.(C) Statistical Terms

Consistency

Within one document or within one group of documents there has to be consistency in the use of certain terms. The use of synonyms may lead to misunderstanding, e.g. "ramification" versus "branching" etc. (could be misunderstood to mean different things).

Motto: "The plant is always right"

Remark:

When we can agree on the use (including their definitions) we will be left only with the interaction between plant and examinar. To eliminate as much as possible of this subjective area, we use agreed example varieties.

18(a)(i) Terms associated with basic principles

Authorization for Release

The Technical Questionnaire requests the applicant to indicate whether the variety requires prior authorization for release under legislation concerning the protection of the environment, human and animal health and whether such authorization has been obtained. This is mainly to ensure that in the case of a "GMO" (Genetically Modified Organism) the testing authorities are warned in case they have to take certain precautions during the testing or obtain necessary authorizations but it covers also other possible environment or health problems. A "GMO" variety has, apart from those precautions, to be tested according to the same principles as any other variety

Characteristics

The word "characteristics" used in the UPOV Convention for the definition of the variety and in the articles on uniformity and on stability is the basis for distinctness. The three requirements of distinctness, uniformity and stability are therefore assessed in UPOV member states on the basis of characteristics.

Test Guidelines for each species are prepared by experts who select which characteristics of the species should be recorded to enable DUS to be assessed. These characteristics are chosen as being known to be least affected by the environment.

A "characteristic" is a feature of a whole plant or part of a plant. The sum total of characteristics of a plant provide a complete description .

Test Guidelines are made up of Tables of Characteristics chosen by experts. Where a Test Guideline is in place the characteristics listed are those which are considered to be important for the description of varieties and therefore also for the assessment of DUS.. Such characteristics may be morphological, physiological, biochemical or of another nature but they must meet the criteria set out below.

The Tables of Characteristics of the individual Test Guidelines are not exhaustive and may be enlarged by further characteristics if this proves to be useful and the characteristics meet the conditions set out below.

Where there are no UPOV Test Guidelines all characteristics used for the assessment of DUS must meet the conditions below. Characteristics are not selected on the basis of any commercial value for a variety

The basic requirements a characteristic has to fulfil before it can be included in the UPOV Test Guidelines or used for DUS testing are the following:

(a) it must be capable of precise definition;

(b) it must produce consistent and repeatable results for existing varieties;

(c) it must enable a clear differentiation in the collection of varieties of the species concerned;

(d) it must make it possible to fulfil uniformity requirements;

(e) it must be clearly defined in the observation and the evaluation of the results.

Although some degree of fluctuation in the expression of genetically controlled characteristics is expected under different environmental circumstances, priority is given to those inherited characteristics that are least susceptible to environmental influences. Precisely defined testing procedures are also of importance in minimising the influence of environmental conditions. In testing one has to be aware that expressions of characteristics can be affected by factors such as mineral deficiency or plant health. Rootstocks may also have an effect and certain expressions of vegetatively propagated varieties occurring during the youth phase of a tree may disappear with age.

Disease resistance characteristics as well as characteristics from chemical constituents may be included, provided that they can be precisely tested and that they are necessary for establishing distinctness. It is important that each of these characteristics should be well defined and that an accepted, standardized method is established for its evaluation and included in the Test Guidelines. In case they are the only distinguishing characteristic, a single bulk sample alone is not sufficient as uniformity has to be checked first to ensure that the characteristic can be used for distinction.

Categorisation of Characteristics

The UPOV categories of characteristics for use in DUS testing are:

(a) Grouping Characteristics
(b) Asterisked Guideline Characteristics
(c) Standard Guideline Characteristics
(d) Standard Non-UPOV Guideline Characteristics
(e) Supporting Evidence Characteristics

(a) Grouping (or Pre-Screening) Characteristics

Characteristics which can be generally used for prescreening varieties before any tests are undertaken. These characteristics are such that the written states will be sufficient for reliably establishing distinctness and must be sufficiently independent of environmental influences in all regions for this purpose. Such characteristics will always be asterisk characteristics (see below)

(b) Asterisked Guideline Characteristics:

Characteristics which UPOV considered important for the testing of DUS and for which UPOV agreed that they should be used on a routine basis for all varieties in every growing period over which the examinations are made and should always be included in the variety descriptions, except when the state of expression of a preceding characteristic or regional environmental conditions render this impossible (they are marked in the UPOV Test Guidelines by an asterisk (*)).

A characteristic should only receive an asterisk if it meets all the following criteria:

(a) it is important for description;

(b) it is needed as a minimum information for the exchange of information on the variety;

(c) if all experts agree to the asterisk (if one State objects to the indication of an asterisk to a given characteristic and states the reasons (e.g. no discriminating power under his country's conditions), no asterisk should be given);

(d) at least the range of example varieties remains the same in the different countries in case the expressions change from country to country.

(e) for a pest or disease resistance characteristic that it must have only the states "absent, present," (characteristics with degrees of resistance should not receive an asterisk).

(c) Standard Guideline Characteristics

Characteristics which UPOV regarded as useful for description, and appropriate for the testing of DUS but which were not considered necessary on a routine basis by all member States (they are included in the UPOV Test Guidelines without an asterisk).

(d) Standard Non Guideline Characteristics:

Characteristics appropriate for the testing of DUS but only of importance in one or a few States or only needed very rarely for distinction (they are not included in the UPOV Test Guidelines).

(e) Supporting Characteristics:

Characteristics which taken alone UPOV considered not sufficient to establish distinctness but which provide supporting evidence for other differences to then be used for distinctness.

Types of Characteristics

1. Truly Qualitative Characteristics
2. Nontrue-Qualitative Characteristics
3. Quantitative Characteristics

1. Qualitative Characteristics

True qualitative characteristics are characteristics classified as having discrete (clear cut) discontinuous states of expression, each state being self-explanatory and independantly meaningful. Each state is clearly different from the other and as a rule these characteristics are less susceptible to environmental influences. There are not many true qualitative

characteristics. Truly qualitative characteristics are classified by consecutive numbers according to the state commencing with Note 1 and often with no upper limit, for example: There are a few exceptions to that rule, for example, in order to avoid confusion in the case of ploidy, the number of chromosomes sets is accepted as Note (e.g. diploid (2), tetraploid (4)) octaploid (8).

2. Nontrue-Qualitative Characteristics

These are qualitative characteristics of which the states of expression, although having the possibility of continuous variation from one extreme to the other, do not form an extended linear range as in the case of true quantitative characteristics. Continous variation is disregarded for practical purposes. In cases where it is considered more reasonable to make further differentiation between the states of expression, intermediate states may be included, provided they are adequately worded and the states created are sufficiently different from one another.

3. Quantitative Characteristics

These are characteristics of which the different degrees of expression form an extended linear range with continuous variation possible from one extreme to the other. The range is divided into nine states which are normally equally spaced and measurable on a one-dimensional scale

In all cases of quantitative characteristics the full scale 1, 2, 3, 4, 5, 6, 7, 8, 9 is applicable. However, for practical purposes of presentation, only the Notes 3, 5, 7 or 1, 3, 5, 7, 9 are indicated in the Test Guidelines to state that the quantitative scale is applicable

Categories of Characteristics and Harmonization of States of Expression are handled in detail in document TGP/7.

Common Knowledge (See document TGP/3)

For UPOV, the main criterion for whether a variety forms part of common knowledge is the availability of living material. The material has to be living to enable the authorities to grow it and compare it with the candidate variety. The variety does not need a name. Unnamed clonal material or material sold under a species name forms part of common knowledge.

Example Variety

Wherever possible, example varieties are indicated describing different states of expression of the different characteristics. Actual measurements are only valid for a given testing place or even for a given year of testing at that place and are therefore unsuitable in UPOV Test Guidelines. This does not mean that they are not used or should not be used for the decision on DUS. Numerical values are therefore only seldom used in UPOV Test Guidelines. Example varieties from different regions should not be combined for a characteristic unless they have been tested at the same place
Example varieties should not change their order under different environmental conditions.

Species should not be listed as examples unless there is no doubt that the whole species shows the expression it represents and only if no example variety exists.

UPOV is aware of the fact that many example varieties indicated have only regional importance and some may also change slightly in their expression from place to place, but so far they are considered to fulfil the purpose of explaining the given expression much better than any measurement. Example varieties are used only as a help. The testing would become too difficult if an example variety had to be used for each characteristic and for each state. Example varieties are those varieties which were available to the expert who first drafted the document. It is also not possible to use the same example varieties on a worldwide level. Each State will have to prepare its own list of example varieties which are grown in its region or country. Thus the example varieties mainly represent or give an idea of the state of expression of a given characteristic at the testing place of the expert who prepared the draft for the Test Guidelines or the revision of existing Test Guidelines or at testing places with similar environment. The national authorities will choose out of the example varieties indicated in the Test Guidelines or from further varieties grown in their region the ones which they consider most appropriate.

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Notes

In the Table of Characteristics, a scale of possible states of expression (so-called "states") is indicated for each characteristic. The states are accompanied by "Notes" containing code numbers which permit the computerization of variety descriptions.

Off-type

Any 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 plant or part of the plant, used in the testing of distinctness, taking into consideration the particular species.

Population Standard

The population standard can be expressed as the percentage of off-types to be accepted if all the individuals of the variety could be examined.

Reference Collections: For more details see also document TGP/4.

Each country is expected to maintain, or to arrange for another country to maintain on its behalf, reference collections of viable seed or of vegetative plant material of the varieties to which it has granted protection. The reference collections should also contain seed or vegetative plant material of any other varieties likely to be useful as a reference.

State of Expression

In the Table of Characteristics, a scale of possible states of expression (so-called "states") is indicated for each characteristic. The states are accompanied by "Notes" containing code numbers which permit the computerization of variety descriptions. As far as possible, "Example Varieties" are also cited for each state. Some characteristics are marked with the sign (+), which indicates that the characteristic is illustrated by explanations and drawings or that testing methods are indicated in the Guideline chapter entitled "Explanations and Methods."

Technical Questionnaire

A standardized UPOV Technical Questionnaire on the species, has to be completed in connection with an application for plant breeders' rights. A standard Technical Questionnaire is reproduced in document TGP/15

Variety

Article 1 of the UPOV Convention gives a broad definition of a plant variety, including varieties not necessarily meeting the conditions for the grant of a breeder's right.

Article 1(vi) states:

"variety" means a plant grouping within a single botanical taxon of the lowest known rank, which grouping, irrespective of whether the conditions for the grant of a breeder's right are fully met, can be

- defined by the expression of the characteristics resulting from a given genotype or combination of genotypes,
- distinguished from any other plant grouping by the expression of at least one of the said characteristics and
- considered as a unit with regard to its suitability for being propagated unchanged;"

The technical criteria for a variety eligible for protection under the UPOV Convention have been developed to meet the requirements of Chapter III (Articles 5-9) of the UPOV Convention.

18(a)(ii) Terms and "unwritten rules" to be considered in the preparation of Test Guidelines
(to be aligned with wording in TC/36/5 once the wording has been agreed)

Abbreviation

In the Test Guidelines abbreviations should be avoided.

Absence/Presence

In characteristics with the states "absent, present" "absent" means total absence on all plants, e.g. of asymmetric leaves, "present" means some leaves on a plant are affected, the variation within one plant does not matter.

The correct Notes for alternative expressions "absent" and "present" would more correctly have been 1 and 2, but UPOV decided to stick to its original decision with the Notes absent (1) and present (9) to avoid confusion.

Anthocyanin

In the absence of any proof of the chemical nature of red coloration in any plant part, this term is used as a generic term for reddish coloration.

Apex

For UPOV purposes the apex is considered to be the whole (larger) apical (highest) part of an organ while the tip is only the small, most apical (extreme) part. The term "apex" should be used where the organ becomes about 20% narrower than the broadest part and the term "tip" only after it has become concave (to be checked).

Attitude

"Attitude" or "position" should be used instead of "pose" or "stance."

This characteristic may have different numbers of meaningful states in different species, e.g.:

"erect (1), semi-erect (2), horizontal (3) or
erect (1), erect to semi-erect (2), semi-erect (3), semi-erect to horizontal (4), horizontal (5)"

It depends on the variation within varieties and whether it is more reasonable in each particular species to divide the full range into 3 or 5 qualitatively expressed states or into the 9 quantitatively expressed states.

There is a need for agreement among TWP's to harmonize the terms used for this characteristic. "erect – prostrate" (for plant habit), or "vertical – horizontal"(for parts of plants) but not "erect – horizontal"!

Central

"Central" should be used for the center of a circle (it is pinpointed) while "middle" for the middle area (e.g. of a branch (a range).

Color

It is proposed to use only basic terms and not descriptive ones, e.g. "red" instead of "crimson," "yellow-green" instead of "lime," etc., unless they have been widely used for certain species and would otherwise lead to misunderstanding (e.g. "cream" for "yellowish white").

Combination of States

It is not possible to form a state of expression by combining two truly qualitative states, as by definition there is not transition between qualitative states. Therefore the following combinations are not possible: elliptic to ovoid, smaller to equal, flat to convex (e.g. "flat to convex" would include flat and all intensities of convex expression, and therefore would not be a state but a wide range of expression).

Foliage

The foliage includes branches and does not refer to leaves only.

Heading of a Characteristic

A characteristic normally starts by mentioning an organ of the plant, followed, after a colon, by the suborgan or the specialty to be observed (e.g.: "Leaf: shape of blade" or "Leaf blade: shape").

Height

For "Height" the terms "short --> tall" should be used.

Hyphen (-)

There should be no hyphen for the connection of the words (narrow acute, yellowish green, greenish yellow, etc.). The hyphen should only be used in cases where the first and the second word could be reversed without causing a grammatical error, e.g. with hyphens: ovate-elliptic, yellow-green, green-yellow. The hyphen could be replaced by "to" without change of meaning, that is both words have the same value. If the second word has the main meaning there should be no hyphen (e.g. yellow green means a green which has some yellow, while yellow-green means yellow to green). [In English yellow - green with a space before and after the hyphen would mean yellow to green while yellow-green without spaces has a different meaning (yellowish green). This differentiation cannot be made in other languages and thus should not be applied to avoid confusion for translations.]

Remark:

This is a linguistic question for English. So far I took it that in colors the *second word has always the main meaning, e.g. yellow green (whether or not written with hyphen) is a green color with yellow proportion. This would be the same in German and reverse in French and Spanish.*

An expression "ovate-elliptic" (whether or not written with hyphen) is unlikely; if ever it could only be "ovate or elliptic."

Intensity

For characteristics on color intensity, no example varieties should be indicated except if only one color (e.g. green) is mentioned. Example varieties could be given in the explanations for each color separately.

Length

"Length" and "width" are normally easier to observe, even if the observation is made by visual assessment rather than by measurement. However, "size" may be preferable for very small plant parts, e.g. stipules. Both "length" and "width" should normally not be included together with "size" for the same characteristic in one document. They may be included together with the length/width ratio. There may be special cases where it is preferred to also add "size" in addition to "length" and "width" but these should be kept to real exceptions.

Maximum

When measuring the diameter or width, the maximum dimension is always taken unless otherwise stated. It is therefore superfluous to include the word "maximum." Only in cases where a plant part has a larger and a smaller diameter, is it recommended to say "maximum diameter" and "minimum diameter."

Numbers

For numbers lower than 10, the actual numbers are often used, but spelled out. For higher numbers, "few (3), medium (5), many (7)" is used. If actual numbers are used, the states should be mutually exclusive, e.g. smaller than three (state 1), three to five (state 2), larger than five (state 3), unless the following situation occurs: only two (state 1), only three (state 2), two and three (state 3).

Order of Characteristics

In the Test Guidelines, the morphological characteristics are normally arranged in the botanical order of organs. Where applicable, distinctions are made between different stages in the life of a plant, such as dormant and growing periods, juvenile and mature stages or the

grains submitted by the applicant and the grains harvested from the plants in the growing trials. For the different organs the following order is used:

These may have to be revised)

grain (seed submitted)
seedling
plant (e.g.habit)
root
root system or other subterranean organs
stem
leaf [petiole, stipule, blade]
inflorescence
flower (calyx, sepal, corolla, petal, stamen, pistil)
fruit
grain (harvested)

Within the above order, the following subdivision of the characteristics of different organs of the plants has been adopted:

attitude
height
length
width
size
shape
color
other details (such as surface, etc., and characteristics of part of the organ such as base, margin, apex and tip.).

Order of States of Expression Inside a Characteristic

As far as it is possible, the smaller, lesser or lower expression should be assigned the lower Note. The order of the states should be as far as possible:

from weak to strong
from light to dark
from low to high
from narrow to broad

In case of colors the chronological appearance of the color may also be used.

In the case of shape characteristics the order should as a general rule be from the lesser expression to the higher or larger expression. Shapes of apex should start from pointed to rounded or from raised to depressed expression.

More details on the order of states of expression are contained in document TGP/7.

Remark:

In certain characteristics there appears to be a clash between two recommended orders: Ex. Shape of base: pointed (1), rounded (2), flattened (3), depressed (4). In this case the "narrow to broad" should overrule the "low to high."

Order of States of Expression

In the case of characteristics with two single alternative expressions and one combined expression, the combined expression is always placed at the end (e.g. only green (1), only red (2), green and red (3)), unless special reasons justify a different order (e.g. for Grapevine: to avoid an unnecessary deviation from a previous decision by another organization (0IV).

Presence

The Editorial Committee proposed a few years ago that the words “presence of' or “intensity of' should not be used in connection with a state “absent” for the reason that “presence” or “intensity” cannot be absent. Thus instead of “Presence of stipule: absent (1), present (9)” it should be stated: “Stipule: absent (1), present (9).”

Explanation: Several Technical Working Parties disagree with that proposal and have asked to be able to use the wording: “Intensity of anthocyanin coloration” with the first state: “absent or very weak (1)” instead of “Anthocyanin coloration: absent or very weak (1), weak (3), etc.” The same would apply to “Anther: amount of pollen: absent (1), sparse (2), abundant (3).” Although from a purely linguistic point of view it may be wrong, it is much more helpful for the understanding of the characteristic. It helps to separate the given characteristic from other characteristics of the same organ without having to look at the states of expression.

Pubescence

In general botanical use, this term has both a generic and specific definition. It is used as a generic term for any type of hair but is the specific term for fine, soft, short hair.

Comment: Working Parties will have to agree whether to use the term in the generic sense or only in the strict sense

In many instances in existing Test Guidelines the type of hair is short and soft and the term pubescence is valid in the strict sense. (eg: apple shoot and leaf characteristics). For instances where the hair is not soft and short, (as in Kiwifruit), a botanical term for the specific type of hair or the general term “type of hair” or “hairiness” should be used.

Repetitions Inside States of Expression

Instead of repeating a word in the states, it has to be used only once after the wording of the text of the characteristics, e.g. “Leaf blade: green color of upper side: light (3), medium (5), dark (7)” instead of “Leaf blade: color of upper side: light green (3), medium green (5), dark green (7).”

Resistance

Pest and disease resistance characteristics as well as characteristics on chemical constituents should only be included in the Test Guidelines if an agreed standardized method

is included as well.

Rigidity

"Rigidity (rigid)" should be used instead of "stiffness (stiff)"

Shape

If all states of expression of a shape characteristic have some basic shape (e.g. narrow elliptic, medium elliptic, broad elliptic), the characteristic should not be expressed as a shape (e.g. width: narrow, medium, broad).

"Shape in cross section" should be used and not "... of cross section."

Shape Characteristics

In shape characteristics in one state of expression, there can be two different expressions (e.g. Weeping Fig, characteristic 19: narrow elliptic (1), elliptic (2), broad elliptic -or broad ovate (3), ovate (4)), but also cases exist when there could be the whole range between two states of expression (e.g. Statice, characteristic *5:* elliptic (1), broad ovate to deltoid (2), narrow obovate (3), obovate (4)). The use of the word "to" was therefore also acceptable in shape characteristics.

Splitting of characteristics

Splitting into several characteristics should be done as early as possible (e.g. leaf color cut down to color and intensity of color), but may not always be useful (e.g. ornamentation of grain cut down to marbling (1/9), flecking (1/9), dotting (1/9)). It should thus not be obligatory but would depend on each case.

Underlining

I In the case that in two or more characteristics the only difference is e.g. in "upper" and "lower," both "upper" and "lower" should be underlined. The part that differs should be underlined.

Uniform

The term "uniform" is not admitted as a state of expression (e.g. do not use "uniform" for distribution of color, etc). This term is restricted for use with reference to uniformity in DUS and all varieties have to be uniform. The same applies to "distinct" for a color that is clear, etc. Instead 'even' or 'marked' could be used.

Weight

"Weight" should be used instead of "mass," otherwise it might get confused with "volume".

Whole scale

The whole scale 1, 2, 3, 4, 5, 6, 7, 8, 9 with example varieties should only be indicated if there is no risk of a change in order of the example varieties under different environmental conditions.

Wording of Characteristics

The wording of the characteristics should be made more precise and self-contained without the knowledge of the states. The states should also be made more easily understood without the full text of the characteristic irrespective of whether it would sound a little strange from a purely linguistic point of view, as long as the experts consider it helpful for the understanding of the characteristic. Therefore, the word “presence of' or “intensity of' could be added, even if the first state would read “absent” (if it was felt necessary to avoid confusion) or “absent or very weak” as long as without the addition it was not clear whether only the absence was of importance or other criteria as number, size, length, width, density, color, etc.

18.(B) BOTANICAL TERMS

(e.g. terms used to describe plant habit to be copied from TC/36/5 once the wording has been agreed).

18.(C) STATISTICAL TERMS

Document still to be prepared.

[End of document]