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UPOV

TC/XIII/10
ORIGINAL: English
DATE: May 9, 1979

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

TECHNICAL COMMITTEE

Thirteenth Session
Geneva, March 26 to 28, 1979

SECOND WORKING PAPER FOR A REVISED GENERAL INTRODUCTION TO THE GUIDELINES FOR THE CONDUCT OF TESTS FOR DISTINCTNESS, HOMOGENEITY AND STABILITY OF NEW VARIETIES OF PLANTS

prepared by the Office of the Union on the basis of the decisions taken by the Technical Committee

1. During its thirteenth session the Technical Committee discussed a working paper for a revised general introduction to the Guidelines for the Conduct of Tests for Distinctness, Homogeneity and Stability of New Varieties of Plants (hereinafter referred to as "General Introduction to the Test Guidelines") as reproduced in document TC/XIII/5.

2. The results of these discussions are reproduced in the Annex to this document. The paragraphs which differ from the corresponding paragraphs in the Annex to document TC/XIII/5--shown in parentheses--are as follows: 2(2), 12(11), 16(15), 18(17), 19(-), 31(29), 33(31), 36(34), 37(35), 48(46), 49(47), 51(49), 53(51), 55(53), 57(55), -(56), 59(59).

[Annex follows]

ANNEX

SECOND WORKING PAPER FOR A REVISED GENERAL INTRODUCTION TO THE GUIDELINES FOR THE CONDUCT OF TESTS FOR DISTINCTNESS, HOMOGENEITY AND STABILITY OF NEW VARIETIES OF PLANTS

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A. INTRODUCTION

1. The International Convention for the Protection of New Varieties of Plants provides that protection shall only be granted after examination of the variety. The prescribed examination should be adapted to the special requirements of each genus or species, and must of necessity take account of any special requirements for growing the plants.

2. To give guidance on this adaptation UPOV has published Guidelines for the Conduct of Tests for Distinctness, Homogeneity and Stability of New Varieties of Plants. With these "Test Guidelines" as they are called in their short title member States have a common basis for the testing of varieties and the establishing of variety descriptions in a standardized form which facilitates international cooperation in examination between their authorities. The Test Guidelines are also helpful to applicants for the grant of rights by giving them information on the characteristics to be studied and on the questions which they will be asked about their varieties.

3. The Test Guidelines should not be considered an absolutely rigid system. There may be cases or situations which are not covered within the present framework, and these should be dealt with in a manner which is in keeping with the principles contained in the Test Guidelines. The Test Guidelines will be amended in the light of experience.

4. The main part of the Test Guidelines is the "Table of Characteristics" indicating the characteristics for the examination and for the preparation of the examination report. In addition to the table and the reference to the present document, special guidance for each respective species is provided in the "Technical Notes." Where necessary, explanations or drawings and methods are given for certain characteristics in the "Explanations and Methods." An Annex containing the "Technical Questionnaire" to be completed in connection with an application for plant breeders' rights completes the Test Guidelines. The layout of the Test Guidelines is explained in detail in the chapter entitled "Layout and Presentation of Test Guidelines" (see paragraph 44 et seq.).

5. Normally, for each species separate Test Guidelines are prepared or will be prepared. If, however, in a group of species only a few characteristics differ between the species, these species are grouped together in one document. On the other hand, if within one species there are big differences with respect to certain characteristics and if it is found desirable to make use of the whole scale of a given characteristic for each group separately, separate characteristics are foreseen or will be foreseen for each group inside a species, either in one single document or, if there are too many of them, in different documents. This separation, however, is or will be possible only if the borderline between the groups can be clearly defined.

B. GENERAL CONSIDERATIONS ON EXAMINATION

6. According to Article 6 of the Convention, the criteria for the grant of plant breeders' rights include:

(i) distinctness,
(ii) homogeneity, and
(iii) stability.

I. TESTING OF DISTINCTNESS

(a) General

7. According to Article 6(1)(a) of the Convention, 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. The characteristics which permit the variety to be defined and distinguished must be capable of precise recognition and description.

8. The varieties with which a new variety has to be compared are the varieties whose existence is a matter of common knowledge. The first basis for comparison is normally those varieties maintained in the reference collections of the examining State.

9. An important characteristic is not necessarily a quality which is connected with the idea of a certain value which the variety may possess. The characteristics listed in the Test Guidelines are important for distinguishing varieties from one another, but these lists are not exhaustive and other characteristics may be added when they have been found useful.

10. To enable varieties to be tested and a variety description to be established, characteristics are subdivided in the Test Guidelines into their different states of expression, called in short "states," and the wording of each state is followed by a "Note." For a better definition of the states of a characteristic in the Test Guidelines, example varieties are indicated whenever possible.

(b) Qualitative and Quantitative Characteristics in General

11. The characteristics used to distinguish varieties may be either qualitative or quantitative.

12. "Qualitative characteristics" should be those which show discrete discontinuous states with no upper limit on the number of states. Some characteristics which do not fit this definition may be handled as qualitative when the states encountered in practice are sufficiently different from one another, i.e. not all the states of a continuous variation exist in the varieties currently available.

13. "Quantitative characteristics" are those which are measurable on a one dimensional scale showing continuous variation from one extreme to the other. They are arbitrarily divided into a number of states for the purpose of description. In practice, they may not always be measured but are recorded by visual observation.

14. Both qualitative and quantitative characteristics may be to a greater or lesser extent subject to environmental influence which may modify the expression of genetically controlled differences. The characteristics least influenced by environment are preferred. The use of the findings must be limited and in certain cases abandoned when it is evident that phenotypic expression has been more strongly influenced or altered by environmental factors than is usual.

(c) Qualitative Characteristics

15. In the case of qualitative characteristics, two varieties have to be considered distinct if they show expressions which fall into two different states of the respective characteristics.

(d) Quantitative Characteristics

16. In the case of quantitative characteristics, two varieties have to be considered distinct if they are distinct at one testing place at least, provided that the difference between them is clear and consistent (differences with the same sign). In order to obtain comparable results in the various member States, the extent of the test (e.g. size of plots, sample size, number of replications, duration of test etc.) has to be fixed. It is desirable to make a direct comparison between two such varieties. A difference occuring in two consecutive, or in two out of three, growing seasons with one percent significance, based for instance on the application of the Least Significant Difference, is considered a clear difference.

(e) Characteristics Observed Visually

17. Visual characteristics are characteristics that are or can be made visible. Differences in taste, smell, feeling, etc., can be dealt with in the same way as visual characteristics.

18. A quantitative characteristic which is normally observed visually but is capable of being measured should be measured, in case of doubt, if it is the only distinguishing characteristic in relation to another variety. When interpreting visual assessments, two varieties are to be considered distinct if they are distinct at one testing place at least, provided that the difference between them is clear and consistent. In order to obtain comparable results in the various member States, the extent of the test has to be fixed. It is desirable to make a direct comparison between two such varieties. When statistical methods are used, the properties of the scale are taken into account and the same confidence levels are borne in mind as for true quantitative characteristics.

19. When examining visually observed quantitative characteristics it is not always necessary to use statistical methods to distinguish two varieties. Consistent differences noted in visual observations on eight to ten occasions represent the same reliability as a one percent significance of measured characteristics, based for instance on the application of the Least Significant Difference.

20. Quantitative characteristics recorded by visual assessment could be measured given time and adequate facilities. In many cases (e.g., hairiness, glaucosity, curvature, etc.), this would involve quite sophisticated techniques but, in theory, it is possible.

21. Instead of counting the exact number of hairs or measuring the thickness of the wax layer, the varieties are classified on the basis of eye observations. A trained observer can make rapid and reliable classifications. It is indispensable to define the characteristic in question (e.g., either density of hairs or length of hairs).

22. When a fixed scale is used throughout the trials and years, the environmental influence on the varieties is reflected in the figures. Statistical operations on these figures must be preceded by a test on the properties of the scale; e.g., do the observations show normal (Gaussian) distributions and, if not, why not?

23. Visual characteristics are often recorded on a scale that does not satisfy the assumptions of the usual parametric statistics. Even the simple operation of calculating a mean value is not allowed if the notes are taken on a ranking scale not having equal intervals throughout the scale. In this situation, generally only non-parametric statistical procedures are applicable. In such cases, it is advisable to use a scale established on the basis of example varieties representative of the different levels of the characteristics. One and the same variety should then always receive the same Note and thus facilitate the interpretation of data.

24. Whatever the scale, direct pairwise comparisons are recommended because these have the least bias. In each comparison, it is acceptable to note a difference between two varieties as soon as this difference can be seen with the eye and the observer is convinced that it could be measured if the facilities were available. The simplest criterion for establishing distinctness is of course to require consistent differences (differences with the same sign) in pairwise comparisons, provided that they can be expected to recur in following trials.

(f) Combination of Characteristics

25. When having to decide whether two varieties are distinct from each other, cases may arise where two varieties differ in two or more separately assessed characteristics, each below the agreed level of significance.

26. In these cases, the combination of characteristics might be a way to establish distinctness. In practice, this possibility has already been used when examining the relation between two characteristics as a new characteristic (e.g., length/width ratio).

27. It is often seen that the relation between two characteristics is stable and may show significance when the separate characteristics do not. There are, however, some statistical pitfalls with ratios. A check has to be made to ensure that the assumptions of the statistical method used are really satisfied.

28. If two characteristics are combined to form one new characteristic and the difference reaches at least the agreed level of significance (1% in at least two years), it is acceptable to use this finding as a basis for establishing distinctness.

29. Another possibility might be to establish distinctness on the basis of a multivariate analysis, e.g., by combining the data of two or more characteristics by Hotellings T^2 or a discriminant function analysis. Care should be taken to

avoid the introduction of an artificial combination resulting from the analysis of a limited set of data without having enough experience of its repeatability.

30. For the time being, no solution can be proposed for the case where two or several characteristics cannot be combined. But the question might be considered whether in such cases a sufficient number of characteristics might reveal a difference which has to be taken into consideration.

II. TESTING OF HOMOGENEITY

(a) General

31. According to Article 6(1)(c) of the Convention, a variety must be sufficiently homogeneous, having regard to the particular features of its sexual reproduction or vegetative propagation. To be considered homogeneous, the variation shown by a variety must be as limited as possible, depending on the reproductive system of the variety. Possible off-types due to occasional mixture, mutation or other causes, that is plants which differ in their description from that of the variety, require a certain tolerance. Unless stated otherwise in the relevant Test Guidelines, these tolerances should not exceed those set down below.

32. Residual variation within a variety must be as low as possible to permit accurate description. The amount of residual variation will differ according to the reproductive system of the species--vegetatively propagated, self-fertilized, or cross-fertilized--and it is necessary to allow different tolerances.

(b) Vegetatively Propagated Varieties and Truly Self-Pollinated Varieties

33. For vegetatively propagated varieties and truly self-pollinated varieties, the following table indicates the maximum acceptable number of off-types in samples of various sizes.

Maximum Acceptable Number of Off-Types in Samples of Various Sizes

Sample Sizes	Maximum Number of Off-Types
≤ 5	0
6 - 35	1
36 - 82	2
83 - 137	3

(c) Mainly Self-Pollinated Varieties

34. Mainly self-pollinated varieties are varieties which are not fully self-pollinated but which are treated as such for testing. For these, a higher tolerance is required and the maximum number of off-types allowed in the table for vegetatively propagated varieties and for truly self-pollinated varieties are doubled.*

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* The Technical Committee decided that the Technical Working Parties should be requested to list, within their competence, those crops where the higher tolerance should be applied.

(d) Cross-Pollinated Varieties including Synthetic Varieties

35. Cross-pollinated varieties normally exhibit wider variations within the variety than vegetatively propagated or self-pollinated varieties and it is sometimes difficult to distinguish off-types. Therefore no fixed tolerance can be determined but relative tolerance limits are used through comparison with comparable varieties already known.

36. For measured characteristics, the standard deviation or variance should be used as the criterion for comparison. A variety is considered not to be homogeneous in the measured characteristic concerned if its variance exceeds 1.6 times the average of the variance of the varieties used for comparison.

37. Visually assessed characteristics have to be handled in the same way as those which are measured, namely, by comparing them with comparable varieties already known. The number of plants visually different from those of the variety should not significantly (95% confidence level) exceed the number found in comparable varieties already known.

(e) Hybrid Varieties

38. Single cross varieties have to be treated as mainly self-pollinated varieties, but a tolerance has also to be allowed for inbred plants (sibs). It is not possible to fix a percentage as the decisions differ according to the species and the breeding method. However, the percentage of sibs should not be so high as to interfere with the trials. The Technical Working Parties will fix the maximum percentage tolerated in the Test Guidelines concerned.

39. For double cross or three-way cross varieties, a segregation of certain characteristics is acceptable if it is in agreement with the formula of the variety. If the heredity of a characteristic is known, clear-cut segregating characteristics have to be treated as qualitative characteristics. If the described characteristic is not a clear-cut characteristic, it has to be handled as in the case of normal cross-pollinated varieties; that is to say, the homogeneity has to be compared with that of comparable varieties already known. For the tolerance of sibs, the same considerations apply as in the case of a single cross variety.

III. TESTING OF STABILITY

40. According to Article 6(1)(d) of the Convention, the variety must be stable in its essential characteristics, that is to say, it must remain true to its description after repeated reproduction or propagation or, where the breeder has defined a particular cycle of reproduction or multiplication, at the end of each cycle.

41. It is not generally possible during a period of 2 to 3 years to perform tests on stability which lead to the same certainty as the testing of distinctness and homogeneity.

42. Generally, when a submitted sample has been shown to be homogeneous, the material can also be considered stable. Nevertheless, during the testing for distinctness and homogeneity careful attention has to be paid to stability. In cases of doubt, stability has to be tested by growing a further generation or new seed stock to verify that it has been maintained true to the appropriate description. If no facts are discovered which might indicate that the variety is unstable, it can be assumed that the variety is stable.

IV. REFERENCE COLLECTIONS

43. As far as is feasible in relation to the crops concerned, each country is expected to maintain, or to arrange for another country to maintain on its behalf, reference collections of viable seed or vegetative plant material of the varieties to which it has granted protection. Preferably, the reference collections should contain seed or vegetative plant material of any other varieties which are likely to be useful as a reference. Normally, seed or vegetative plant material should be obtained from the breeder, and, when it is necessary to renew the seed or plant material in stock, the new lot should be checked in a growing test before use.

C. LAYOUT AND PRESENTATION OF TEST GUIDELINES

I. ORIGINAL LANGUAGE

44. The Test Guidelines are originally drafted in one of the three working languages of UPOV (English, French and German) and adopted in that version. In the case of any discrepancy between the original text and the translations into the two other languages, the original text prevails. For this purpose, each set of Test Guidelines contains an indication of the original language in which it was drafted.

II. TECHNICAL NOTES

45. The individual Test Guidelines for a given species start with a reference to the present document, followed immediately by the so-called "Technical Notes." While the present document gives merely general recommendations and guidance applicable to all Test Guidelines--or most of them--the Technical Notes give technical recommendations and special guidance with respect to the species dealt with by the respective Test Guidelines. These recommendations refer, for example, to the quantity and quality of plant material to be sent in, its health requirements, the conditions under which the tests have to be undertaken, including the size of plots and numbers of replications, the duration of the tests, the grouping of varieties in the tests, as well as some other very detailed indications as to the part of the plant on which a given characteristic has to be observed, at what time and in what manner.

III. TABLE OF CHARACTERISTICS

(a) General

46. The Table of Characteristics indicates all characteristics of a given species which should be examined and included in the description of the varieties. It also contains additional characteristics which some of the member States consider helpful in taking the final decision on the variety. In this Table of Characteristics, a scale of possible states of expressions (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. Certain characteristics in the Table of Characteristics are marked with an asterisk (*), which indicates that these characteristics should be used every growing period for the examination of all varieties and should always be included in the description of the variety, except when the state of expression of a preceding characteristic renders this impossible. 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 chapter entitled "Explanations and Methods."

(b) Order of Characteristics

47. In the Test Guidelines, the sequence of morphological characteristics is normally arranged in the chronological order of recording, starting from the time of planting or sowing (in some cases even before) until harvest (or even after). Within this 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, base and top).

48. 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 and the grains harvested from the plants obtained from the submitted material. For the different organs the following order is used:

grain (seed)
seedling
plant (e.g. attitude)
root
root system or other subterranean organs
stem (bulb, stolon)
sprout
leaf
inflorescence
flower
fruit
grain

(c) Qualitative Characteristics

49. Qualitative characteristics as well as those of the quantitative characteristics which are handled in the same way as true qualitative characteristics are classified by consecutive numbers according to the state commencing with Note 1 and with no upper limit. Here the principle to be applied is that of assigning the lower Notes to smaller, lesser or lower qualities, in so far as this is possible. For instance:

Poplar: sex of plant

dioecious female	(1)
dioecious male	(2)
monoecious unisexual	(3)
monoecious hermaphrodite	(4)

(d) Quantitative Characteristics

50. As a general rule, the state of a quantitative characteristic is expressed by a word-pair containing two opposite concepts, for instance:

weak/strong
short/long
small/large
fine/coarse
pointed/blunt
low/high
narrow/broad
lax/dense
soft/firm
early/late
flat/deep

51. The further separation of the different states of a given quantitative characteristic can be seen from the following table, which indicates an example for different states of quantitative characteristics.

Example for Different States of Quantitative Characteristics

State	Note
absent or very weak	1
very weak to weak	2
weak	3
weak to medium	4
medium	5
medium to strong	6
strong	7
strong to very strong	8
very strong	9

52. As can be seen from the preceding table, the different states are given Notes numbered from 1 to 9. Notes 1 to 3 denote weak states, and Notes 7 to 8 prominent or strong states. The basic elements of each word-pair listed above are given Notes 3 and 7.

53. On the basis of the above-mentioned system, the following cases can be described:

(i) Extreme states of characteristics are indicated by the addition of the word "very" and are given Notes 1 or 9 (for instance "very weak" (1), "very strong" (9)).

(ii) Medium states of characteristics are generally indicated by the use of the word "medium" and are given Note 5.

(iii) Intermediate states are given Notes 2, 4, 6 or 8. The corresponding words are arranged according to the system shown in the table above whereby the state below and the state above the intermediate state are combined by the word "to" (for instance, in a characteristic with the words "weak/strong," the expression for the state with Note 2 is formed by a combination of the words for the state with Note 1 reading "very weak" and the word for the state with Note 3 reading "weak" by means of the word "to" to read "very weak to weak").

54. For the application of the Test Guidelines for quantitative characteristics the full scale (1 to 9) is used. However, to make work easier for the drafter of the Test Guidelines, those Test Guidelines would normally only indicate states 1, 3, 5, 7, and 9 or even only states 3, 5, and 7.

55. For characteristics which can also be absent, such as hairs and anthocyanin coloration, Note 1 means "absent or very weak." In alternative observations, the state "absent" is coded by Note 1 and the state "present" by Note 9. If in a characteristic it is necessary to make a distinction between complete absence and different degrees of presence, the characteristic is split in one alternative characteristic with the states "absent (1)" and "present (9)" and in another quantitative characteristic with the Notes from 1 to 9. The Note 0 has not been used in the Test Guidelines.

(e) Example Varieties

56. In the Table of Characteristics of the Test Guidelines, wherever possible example varieties are indicated or photographs or drawings prepared fixing or describing different states of expression of the different characteristics. Figures--if used at all--are used only for the first stage, to be abandoned as soon as possible. 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. Out of the example varieties indicated in the Test Guidelines the national authorities will choose the ones which they consider most appropriate for the solution of a given problem.

(f) Characteristics Which Should Always be Included in the Description of a Variety

57. It may not always be necessary to use all the characteristics listed in the individual Test Guidelines to identify and describe a variety. To harmonize descriptions issued by the member States under the terms of the Convention, certain characteristics have been marked with an asterisk (*), as already mentioned above, to show that they should be used every growing period for the examination of all varieties and should always be included in the description of the variety, except when the states of expression of a preceding characteristic render this impossible. Characteristics which are not so marked have to be recorded if they are necessary to distinguish the variety under examination from another variety. The list of characteristics is not exhaustive, however, and further characteristics may be used by the examining authority if they are considered useful or necessary.

III. EXPLANATIONS AND METHODS

58. The Table of Characteristics of the Test Guidelines is normally followed by a chapter entitled "Explanations and Methods." It contains explanations, drawings or an indication of the methods which are necessary for the understanding of the different characteristics presented in the Table of Characteristics.

IV. TECHNICAL QUESTIONNAIRE

59. The Test Guidelines contain in an Annex a "Technical Questionnaire to be completed in connection with an application for plant breeders' rights." In the Technical Questionnaire, certain indications have to be given on the origin, maintenance and reproduction of the variety to help the examining authority to understand certain results obtained during the testing. Furthermore, those characteristics from the Table of Characteristics of the Test Guidelines are indicated on which information is considered necessary to enable the testing authorities to group the varieties with other varieties in such a way that the test can be conducted in a reasonable manner. While in the Table of Characteristics only those characteristics can be included, which can be tested by the competent authorities, here in particular cases also indications are used which are not characteristics in the true sense if they give valuable information on the variety. For the same purpose, the applicant is asked in another part to give an indication of the characteristic(s) by which he considers his variety to be different from the other varieties most closely resembling it. In the final part of the Technical Questionnaire, the applicant for plant breeders' rights is free to add any additional information which he may consider helpful in establishing that the variety is distinct as well as any particulars he may think useful for the testing of the variety.

[End of Annex and of document]