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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

FIRST PREPARATORY MEETING FOR THE REVISION OF THE UPOV CONVENTION

Geneva, April 23 to 26, 1990

NOTION OF VARIETY

Document prepared by the Office of the Union

Introduction

1. At its twenty-fifth session, the Administrative and Legal Committee asked the Office of the Union to prepare a document on the notion of variety for presentation to its following session (see paragraph 50 of document CAJ/XXV/2 Prov.). Since the Council decided at its twenty-third ordinary session to entrust the preparatory work for the Diplomatic Conference to preparatory meetings for the revision of the Convention, the afore-mentioned document is submitted to the present meeting.

2. It should be noted that it has been proposed that a definition of the notion of variety should be included in the revised text of the Convention. The text considered by the fourth Meeting with International Organizations and the twenty-fifth session of the Administrative and Legal Committee was worded as follows:

> "For the purposes of this Convention:
>
> ...
>
> ii) variety shall mean any plant or part of plant, or any grouping of plants or parts of plants, which, by reason of its characteristics, is regarded as an independent unit for the purposes of cultivation or any other form of use."

3. The discussions resulting from this text are recorded in paragraphs 49 to 65 of document IOM/IV/10 (which are concerned with the whole set of proposed definitions) and in paragraphs 30 to 50 of document CAJ/XXV/2 Prov. These reports supply useful information both on the course of the discussions on the notion of variety itself and on its implications and effects.

Basic Principles of Taxonomy

4. Before dealing with the notion of variety it is helpful to set out certain basic principles of taxonomy, that is to say of "the science concerned with the rules for the classification of life forms" (Petit Robert).

5. Anyone who wishes to apprehend the natural world in all its diversity begins with identifying and classifying its various components and then placing them into categories. In the field of biology, the species is the basic unit of classification and nomenclature. According to von Wettstein, a species is a group of individuals whose descendants resemble them as much as they resemble each other, in all the characteristics which appear to be important to the observer. According to another definition a species is a group of individuals which actually or potentially interbreed and who are isolated sexually from other similar groups.

6. There is no need to discuss here the above definitions or those that have been proposed by others. One should note simply the fundamental role of the observer (expert): he decides which characteristics are important and which degree of similarity is required to classify two individuals in the same species; he also decides or judges that two individuals or populations are, for example, on the same side of a dividing line. One should note equally the importance of individual decisions, particularly in the plant kingdom where vegetative propagation, the phenomenon of sexual incompatibility within a species, the relative ease of making interspecific crosses and the great tolerance to chromosomal variations complicate to a great extent the task of the taxomonist. It is for this reason that, for example, plants with different ploidy levels--which cannot be crossed or can only be crossed with difficulty--are often classified within the same species. As will be seen, these comments are equally applicable, in broad outline, to the notion of variety.

7. Species which have many characteristics in common and which, in principle, are descended from a common ancestor are grouped within the same genus. In scientific nomenclature, the names of the species are formed by combining the name of the genus (grammatically a noun) followed by an adjective (or an adjectival form) that is particular to the species. Wheat for example is called Triticum aestivum. The genus and the species are thus the two cornerstones of botanical (and zoological) nomenclature. In their turn, the various genera are grouped into classes of ever increasing breadth, of which the most important are the family, the order, the class and the division.

8. Subdivisions can also be established within the species in order to distinguish types which have more and more characteristics in common as the unit which is distinguished becomes progressively more narrow. These units are the following, with examples set in brackets from the cabbage (the species Brassica oleracea):

(i) Subspecies (indicated by the abbreviation ssp.--usually no distinctions are made at this level within the cabbage);

(ii) Convariety (for example B. oleracea convar. capitata--the garden cabbages);

(iii) Variety* (B. oleracea convar. capitata var. sabauda--Savoy cabbage, with crinkled leaves--or var. capitata--garden cabbage, with smooth leaves);

(iv) Subvariety (indicated by the abbreviation subvar.);

(v) Form (B. oleracea convar. capitata var. capitata f. alba--white cabbage--or f. rubra--red cabbage);

(iv) Subform and special form, these two subdivisions being most particularly used when differing natural forms are used as ornamental plants after simple selection (alpine plants for example).

The Every-day Concept of Variety (From the Standpoint of the Exploitation of Plant Resources)

9. Inevitably, from the stage of the gatherers onwards and, above all after man passed from this stage to a more deliberate exploitation of natural plant resources, he has drawn progressively finer distinctions within the exploited material. It is these which are in effect varieties. Distinctions of a similar kind are regarded as breeds in the animal kingdom. It is important to emphasize that these two concepts are not part of the system of scientific classification but are economic concepts, in the broad sense of that term. In the case of varieties this difference is further emphasized by the existence of an International Code of Botanical Nomenclature and of a, separate, International Code of Nomenclature for Cultivated Plants.

10. A very general definition from the economic standpoint could be as follows:

> "A variety is a subdivision of the species which is distinguished for the purposes of the exploitation of the plant resources of the species."

Few conditions attach to distinctions made in this way: they must simply be expedient (useful); that assumes the following:

(i) the distinctions must be able to be made within the species either by reference to their characteristics, or by reference to external elements such as their geographical origin (which continues to play an important role in the case of forest trees) or their denomination;

(ii) it should not be possible to make further useful distinctions within the identified unit (there needs to be a certain level of homogeneity);

(iii) the identified unit must have a certain permanence (there needs to be a degree of stability).

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* Botanical variety, to be distinguished from a cultivated variety. In order to avoid confusion, botanists have created the word "cultivar" as a contraction of "cultivated variety." This, however, has only added to the confusion. Originally proposed to identify varieties of an horticultural origin, it has been used more and more frequently to identify varieties which resulted from breeding work as opposed to varieties which appeared spontaneously. It is for that reason that it was translated into German as "Zuchtsorte" in the 1961 text of the Convention.

One encounters these conditions whether one considers the subject from a technical, economic or scientific standpoint. They are encountered yet again, with qualifications which underline their variable nature, within legal texts.

The Scientific Concept of Variety (From the Standpoint of Genetics and Plant Breeding)

11. Whilst most dictionaries and encyclopeadias have shortcomings as far as the definition of the concept of variety is concerned, works on plant breeding either limit themselves to very general statements or dispense altogether with any definition. A typical textbook sets out the genetic principles of plant breeding and then describes the various methods of plant breeding, either systematically or by classifying them according to the reproductive or vegetative propagating systems of the relevant plants. The concept of variety, that is to say, what constitutes a variety in each instance and what conditions must be satisfied for a given material to be regarded as constituting a variety, derives from the scientific and technical explanations given.

12. That there is no gulf separating the every-day concept and the scientific concept of variety is demonstrated by the following examples of definitions drawn from works on plant breeding:

(i) For Y. Demarly ("Génétique et amélioration des plantes", Masson, 1977), "cultivar" is a general term designating any cultivated genetic structure.

(ii) For R.W. Allard ("Principles of Plant Breeding", John Wiley & Sons, Inc., 1960), a variety is "a subdivision of a species. A group of individuals within a species which are distinct in form or function from other similar arrays of individuals."

(iii) For A. Gallais ("Théorie de la sélection en amélioration des plantes", Masson, 1990) a tentative definition--one notes the "might be considered"--could be the following:

> "From the plant breeding point of view, a variety might be considered as an artificial population with a narrow genetic base, with rather well defined agronomic characteristics which is reproducible with more or less precision following a pre-determined method of production."

This definition is immediately followed by a discussion of five main types of variety:

- population varieties
- synthetic varieties
- hybrid varieties
- pure-line varieties
- clonal varieties and their equivalents.

13. What is often considered to be a definition in the International Code of Nomenclature for Cultivated Plants is built upon this same principle since the first paragraph of Article 10 derives much of its meaning from the examples which are given in Article 11. These Articles are reproduced in full in the Annex. It should be noted that the requirement of homogeneity does not derive from Article 10, but from Article 11.

14. This same principle will be adopted below since it is the most helpful. The distinctions will however be adapted to our particular objective, namely to clarify the concept of variety for the purposes of breeders' rights and for the purposes of other forms of protection.

15. Vegetative Propagation.- In the case of vegetative propagation, the whole genetic makeup is passed on without modification--subject to the possibility of mutations--from the parent plant to a progeny plant by means of the part of the parent plant with gives rise to the progeny plant. In this case the varietal type is that of a clone, that is to say, in accordance with Article 11 of the International Code of Nomenclature for Cultivated Plants, a "genetically uni- form assemblage of individuals ... derived originally from a single individual by asexual propagation." This mode of inheritance results in very great homo- geneity and very great stability; both would be complete in the absence of mutations.

16. This definition--as well as some of the subsequent definitions in the Code--calls for two remarks:

(i) The concept of variety corresponds to the concept of a group, but nothing prevents a clonal variety from being represented by a single individual. Originally, a clone is limited to a single individual, or to a part of an individual in the case of a bud mutation ("a sport"). Equally, in the phase of its decline, a variety can finish up by being represented by one single individual. Nothing would prevent an individual which remains as the sole specimen from being considered as a variety if the condition of distinctness is fulfilled (if the specimen cannot be distinguished from specimens of another variety, it will be part of that variety). Plant breeders incidentally use the terms "plant," "variety," "hybrid" or "cross" within breeding programs for vegetatively propagated plants without drawing any distinction between them.

(ii) A clone can in the same way be represented by a single part of a plant provided, if one considers only the traditional field of agricultural exploitation, that the part permits a complete plant to be reproduced. In this context, the smallest part that can represent a clone is a single cell with its cell wall intact or without its cell wall (a protoplast). This fact is contrary to the view that a variety only exists in the form of complete plants which complete a full growth cycle.

17. The International Code of Nomenclature for Cultivated Plants refers in its Article 11(e) to a special kind of clone which can be distinguished from the normal types by their habit of growth which is maintained by appropriate methods of propagation. It is a known fact that the choice of a cutting determines to some degree the final form of a tree (this is particularly true with conifers and taxads); that there exist juvenile forms (in vitro propagation frequently produces these) and that viruses, viral particles and bacteria can induce important variations. For the purposes of plant variety protection, different forms induced by such factors, which are not genetically determined, are not and cannot be recognized as varieties.*

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* This is one of the reasons why UPOV ought not to rely on the International Code of Nomenclature for Cultivated Plants for its definition of variety. Another reason is that the present text of the Code seems to admit any distinction, while the 1961 text required any distinction to be based upon a characteristic that was important from an agricultural point of view.

18. Sexual Reproduction.- In the case of sexual reproduction--which involves the seed in the case of higher plants--each progeny inherits one half of the nuclear genetic constitution from the female plant with the other half coming from the male plant. Each generation accordingly sees the coming together ("recombination") of two complementary halves. Three different reproductive regimes can be distinguished: self-pollination; cross-pollination; controlled or semi-controlled crossings.

19. In the case of self-pollination, the two halves of the genetic makeup come from the same plant. Successive self-pollinations of plant material originally derived from a cross have the effect of reducing by one half with each generation the level of heterozygosity (heterozygosity is the condition where one individual possesses two different forms of genetic information, or alleles, for a single gene). Complete homozygosity results in one plant transferring the totality of its genetic makeup to its progeny. A variety based upon such homozygosity is a pure line.

20. In view of the foregoing, it is clear that a single plant or a single seed represents and will perpetuate a pure line. Such varieties have a very high level of homogeneity and stability.

21. Certain plants are not ready self-pollinators and, for example, are either self-incompatible (the pollen of a plant is unable to fertilize flowers on this same plant), or such that an increase in homozygosity causes a loss of vigor (inbreeding depression). In these cases varieties take the form of populations. A population variety is made up of different plants which have characteristics in common enabling the population to be distinguished from other populations. Homogeneity is relative in this case.

22. In its most simple form, a population variety results from the bulk multiplication, with or without selection, of a natural population (an ecotype) or of an artificial population. Such a variety can only be represented by a group of plants or seeds sufficiently broadly based to ensure the transmission of all the characteristics of the population whilst preserving the proportion of these characteristics within it.

23. Population varieties do not permit the maximization of performance because of their intrinsic heterogeneity and are difficult to maintain. Systems of controlled crossing have accordingly been invented in order to minimize these disadvantages. In the case of maize, the production of hybrid varieties is based upon the following principles:

(i) the breeding of lines (called "inbreds" since these result from forced self-pollination or from the pollination of closely related plants) and the acceptance of the resulting inbreeding depression;

(ii) the crossing on a large scale of two such lines chosen for their combining ability and the sale of the seed thus produced to farmers (single-cross hybrids), or

(iii) the crossing of this single-cross hybrid with another line or another single-cross hybrid to produce commercial seed of a three-way hybrid or of a double-cross hybrid.

24. A single-cross hybrid derived from two homozygous lines is perfectly homogeneous because it is comprised of plants which have the same genotype; three-way hybrids and double-cross hybrids are heterogeneous within the limits set by the genetic makeup of their parental lines, with the structure of the heterogeneity being regulated by the laws of genetics.

25. If one sows the harvest product derived from commercial hybrid seed, one will generally experience a reduction in yield which could be as high as 20% in the case of grain-maize. The farmer must thus seek a fresh supply of seeds each season which will have been produced by the repetition of the cycle described above. It is this repetition which ensures the stability of the variety (see the reference to a cycle in Article 6(1)(d) of the present text of the Convention).

26. The increase in yield which is generally experienced and which results from heterosis or hybrid vigor (the heterozygote is superior in performance to the homozygous parents) is not the only advantage conferred by a hybrid scheme. Such schemes are used with a number of cross-pollinating species and increasingly with self-pollinators. Processes, some of which are quite sophisticated, have been developed to set to work the two complementary reproductive systems, that is to say inbreeding for the creation and maintenance of parental lines and outbreeding to effect the crosses. The schemes also deploy variations at the level of the parents (use of populations, of more or less fixed lines or of clones as parents), at the level of the control of the crossings (with the production of semi-hybrid varieties) or at the level of the complexity of the crossings (in the case of wheat, consideration has been given to commercializing the generation which results from the multiplication of the single-cross, which would, in effect, be a simplified form of synthetic variety).

27. A synthetic variety results theoretically from crossing a certain number of constituents (in principle five at least) which might be individual plants, lines, or clones and exploiting the product of the crossing, either at the level of this same generation (called Syn 1) or at the level of a subsequent generation. Since the genetic structure changes from one generation to the next, the generation which is commercialized must be defined. The design of synthetic varieties and of varieties of similar type--for here also numerous variations are possible--tends to be limited to cross-pollinating plants which are reluctant self-pollinators or which are difficult to manage economically as self-pollinators, particularly to forage plants.

28. Hybrid and synthetic types of varieties cannot be maintained or exploited in a lasting manner unless one possesses their components and the formula by which they are associated.

The Technical Concept of Variety (From the Standpoint of Seed and Nursery Plant Production)

29. In practical reality, one can frequently encounter more or less significant departures from the theoretical models for a number of reasons which are illustrated below in the case of clones and pure lines.

30. The multiplication of clones always carries with it a risk of multiplying mutations. Clonal varieties may thus take the form of collections of similar clones (that case is mentioned in Article 11(a) of the International Code of Nomenclature for Cultivated Plants).

31. Pure-line varieties are rarely entirely homozygous, either because the foundation material carried with it some residual heterozygosity (which amounts statistically to 1.5% at the F_7, or seventh generation after the cross) or because the foundation material was itself made up of a bulk of very similar pure lines. Finally, seed production is exposed to the risk of mutations, of accidental fertilization by alien pollen and unintended seed mixture. Tolerances are accordingly essential, particularly in relation to homogeneity.

32. Accordingly, even in those cases where the theoretical concept of variety is very precise, the practical concept is eminently variable at two levels:

(i) at the level of the recognition of a plant entity as a variety;

(ii) at the level of the acceptance of certain material as a part of a given variety.

The variability arises in relation to the three criteria mentioned at paragraph 10 above (distinctness, homogeneity and stability) and, as conditions for protection, in Article 6 of the Convention.

The Concept of Variety and the Convention

33. Article 6 in the present text of the Convention defines the conditions of protection in general terms which require implementing rules capable of accomodating all the variable elements described above. Those implementing rules are set out in the General Introduction to the Guidelines for the Conduct of Tests for Distinctness, Homogeneity and Stability of New Varieties of Plants (document TG/1/2), a text which can be readily revised. UPOV is thus able to adapt rapidly to any new situation.

34. Given the general evolution of the varieties and seeds industry and of the concurring views of the parties involved, the conditions established by UPOV have shown remarkable durability; they correspond very closely to the conditions required in order that an entity may be recognized by the vast majority of interested parties as a variety. This does not prevent, however, differing views from emerging at some point of the economic chain as indicated above.

35. From time to time it is therefore necessary to make reference to a concept of variety which is broader than the concept of a "protectable variety." For instance, the distinctness criterion requires a comparison with "any other variety." Within this latter expression it is essential to include entities which are not necessarily protectable. In the same way, in relation to infringements, commercialized material which is different, without being clearly distinguishable, from the material of a protected variety must still be considered to be part of the variety.

36. To the extent that there is a need to define the field of application of the Convention, it will be necessary to retain a flexible definition in order to take account of all the factors mentioned above, including the diverse forms in which the various types of varieties can be represented.

[Annex follows]

ANNEX

INTERNATIONAL CODE OF NOMENCLATURE FOR CULTIVATED PLANTS

Article 10

The international term *cultivar* denotes an assemblage of cultivated plants which is clearly distinguished by any characters (morphological, physiological, cytological, chemical, or others), and which, when reproduced (sexually or asexually), retains its distinguishing characters.

The cultivar is the lowest category under which names are recognized in this Code. This term is derived from *cultivated variety*, or their etymological equivalents in other languages.

Note 1. Mode of origin is irrelevant when considering whether two populations belong to the same or to different cultivars.

Examples: Carnation 'William Sim' produces colour mutants which by further mutation and back mutation give rise to indistinguishable colour variants of diverse origin. All indistinguishable colour variants, irrespective of their origin, are treated as one cultivar. The tobaccos described as 'MacNair 30' and 'NC 2326' constitute only one cultivar since, though they derived their resistance to *Phytophthora parasitica* var. *nicotianae* from different wild species, they cannot be distinguished by their present characters.

Note 2. The concept of cultivar is essentially different from the concept of botanical variety, *varietas*. The latter is a category below that of species. Names of botanical varieties are always in Latin form and are governed by the Botanical Code. Rules for the formation of cultivar names are set out in the present Code (see Arts. 27–32).

Note 3. The term cultivar is equivalent to *variety* in English, *variété* in French, *variedad* in Spanish, *variedade* in Portuguese, *varietà* or *razza* in Italian, *varieteit* or *ras* in Dutch, *Sorte* in German, *sort* in Scandinavian languages and Russian, *pinzhong (p'in-chung)* in Chinese, and *hinshu* in Japanese, whenever these words are used to denote a cultivated variety.

Note 4. The terms cultivar and variety (in the sense of cultivated variety) are exact equivalents. In translations or adaptations of the Code for special purposes either *cultivar* or *variety* (or its equivalent in other languages) may be used in the text.

Note 5. Usually a cultivar will comprise a part only of the species, botanical variety or other botanical category under which it is classified. A cultivar may however be co-extensive with any of these.

Note 6. When a forestry provenance is clearly distinguished by one or more characters and, when reproduced, retains its distinguishing characters, it may be treated as a cultivar.

Article 11

Cultivars differ in their modes of reproduction. The following are examples of categories that can be distinguished:

a. A cultivar consisting of one clone or several closely similar clones. A clone is a genetically uniform assemblage of individuals (which may be chimaeral in nature), derived originally from a single individual by asexual propagation, for example by cuttings, divisions, grafts, or obligate apomixis. Individuals propagated from a distinguishable bud-mutation form a cultivar distinct from the parent plant.

Examples: *Fraxinus excelsior* 'Westhof's Glorie'; potato 'Bintje'; *Cynodon dactylon* 'Coastal'; *Syringa vulgaris* 'Decaisne'; *Rubus nitidoides* 'Merton Early'.

b. A cultivar consisting of one or more similar lines of normally self-fertilizing individuals or inbred lines of normally cross-fertilizing individuals.

Examples: *Triticum aestivum* 'Marquis'; *Zea mays* 'Wisconsin 153A'.

Note. A multiline composite variety may be treated as a single cultivar or as a mixture of different cultivars.

c. A cultivar consisting of cross-fertilized individuals which may show genetical differences but having one or more characters by which it can be differentiated from other cultivars.

Examples: *Lolium perenne* 'Scotia'; *Phlox drummondii* 'Sternenzauber', a mixture of different colour forms, all characterized by the same star-like shape of the corolla; *Medicago sativa* 'Ranger', the breeder seed of which is derived from intercrossing five seed-propagated lines, each maintained under isolation.

d. A cultivar consisting of an assemblage of individuals reconstituted on each occasion by crossing. This includes single-crosses, double-crosses, three-way crosses, top-crosses, and intervarietal (intercultivar) hybrids.

Examples: Sorghum 'Texas 610', a single cross; maize 'US 13', a double-cross involving four inbred lines; maize 'H-611', an intervarietal hybrid of 'Kenya Flat White' and 'Ecuador 573'.

e. A cultivar consisting of one clone or several closely similar clones which have a habit of growth which is clearly distinguishable from the normal habit and which is retained by appropriate methods of propagation.

Examples: *Chamaecyparis pisifera* 'Squarrosa Intermedia', a juvenile form; *Sequoia sempervirens* 'Prostrata', a prostrate form; *Picea abies* 'Pygmaea', a witches' broom.

[End of Annex and of Document]