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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

TECHNICAL WORKING PARTY ON AUTOMATION AND COMPUTER PROGRAMS

Twentieth Session
Mexico City, June 17 to 20, 2002

REPORT

adopted by the Technical Working Party on Automation and Computer Programs

Opening of the Session

*1. The Technical Working Party on Automation and Computer Programs (hereinafter referred to as "the TWC") held its twentieth session in Texcoco, Mexico, from June 17 to 20, 2002. The list of participants is reproduced in the Annex to this report.

*2. The TWC was welcomed by the Deputy Secretary of Agriculture, Mr. Francisco Lopez Tostado, the Director General of the College of Postgraduates, Mr. Benjamin Figueroa Sandoval, and the Director of the National Service of Seed Inspection and Certification (SNICS), Mr. Eduardo Benítez Paulín.

*3. The session was opened by the Chairman, Mr. Wieslaw Pilarczyk (Poland) who welcomed the participants, and in particular new participants, to the TWC.

Adoption of the Agenda

*4. The TWC adopted the agenda as reproduced in document TWC/20/1 Rev., and agreed to follow the work plan proposed by the Chairman.

* The asterisked paragraphs in this draft report are reproduced from document TWC/20/6 (Report on the Conclusions).

Short Reports on Developments on Plant Variety Protection

5. Reports from members and observers: The TWC received oral reports from the participants on developments in plant variety protection in their respective countries. Experts from Germany reported on the development of a new software for data processing, which worked using the Linux operating system. Experts from the United Kingdom reported on preliminary results of incomplete block design applied to herbage DUS trials and on the use of image analysis techniques for DUS testing in peas. Experts from France reported on: a change to the testing locations for rose; the use of new devices to collect data in the field; the work researching mathematical methods to be applied in the analysis of biomolecular data and; the agreements with other countries for DUS testing. Experts from Mexico reported on the development of new national DUS testing guidelines for beans and maize. Experts from Colombia reported on the developments of DUS field trials for cotton, rice, soybean, sugarcane and tobacco. The expert from Kenya reported that, at that moment, around 600 applications for plant breeders' rights had been filed and that half of those were for ornamental crops. He added that the DUS trials for agricultural crops had generated a considerable amount of data to be examined. The expert from Denmark reported that the studies on trials in incomplete block designs would be continued. The expert also reported that a newly started research project "Characteristics of spring barley varieties for organic farming", would examine the need for special trials to test varieties developed for organic agriculture. (If there is a need for special trials, the research project will also examine how to do that.) The expert from Finland reported a remarkable decrease in the number of applications compared to the average in previous years. The expert from the Czech Republic reported on a new software for transferring the data taken in the field to the main system. The expert from Hungary reported on the development of a new DUS system that was in line with the new General Introduction recently adopted by the TC, on a new computer network and on the development of a new Website.

6. Special report on developments in *Opuntia Mill.* (cactus pear): Experts from Mexico presented a special report on developments in the DUS testing of *Opuntia Mill.* (cactus pear). An expert explained that *Opuntia Mill.* had been cultivated in Mexico for a long time but systematic collection of material had started only 10 years ago. He explained that there were 260 botanical varieties of *Opuntia Mill.* among which were 40 cultivars and the behavior of that material was highly influenced by the environment. For descriptive purposes, the 42 characteristics of the Food and Agriculture Organization of the United Nations (FAO) descriptor were used. He explained that the size and shape of the cladodes was very important in the description of the different materials but, unfortunately, the expression of that characteristic was greatly influenced by environmental conditions resulting in different descriptions for the same clone when cultivated in different locations. To overcome this problem, they used image analysis of the one-year-old cladode and some other physical measurements. He concluded that, by means of three out of the four components of the image analysis, it was possible to explain 60% of the total variability and it was also possible to cluster the examined materials into four groups. He added that the multivariate approach using image analysis proved to be more precise for differentiating varieties than the FAO descriptor. In reply to questions raised by TWC members, he further clarified that the cactus pear is a vegetatively propagated crop on which the *Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias* (INIFAP) was carrying out some breeding activities.

7. Reports on developments within UPOV: The TWC received an oral report from the Office of the Union on the latest developments on plant variety protection at the Technical Committee (TC) and at the Technical Working Parties (TWPs). It was reported that the Council, at its thirty-fifth session held on October 25, 2001, had elected Mr. Michael Camlin

(United Kingdom) and Mrs. Julia Borys (Poland) as Chairman and Vice-Chairperson, respectively, of the TC, in each case for a term of three years ending with the thirty-eighth ordinary session of the Council in 2004.

8. The TWC noted that the TC had proposed that, at its nineteenth extraordinary session on April 19, 2002, the Council adopt document TC/38/5, Annex I, as the General Introduction to the Examination of Distinctness, Uniformity and Stability and the Development of Harmonized Descriptions of New Varieties of Plants. It also noted that the TC proposed that the Council, in its session on October 24, 2002, elect the following as Chairpersons for the period 2003-2005:

TWA: Mr. Carlos Gómez-Etchebarne, Uruguay

TWC: Mr. Uwe Meyer, Germany

TWF: Mr. Erik Schulte, Germany

TWO: Mr. Chris Barnaby, New Zealand

TWV: Mr. Kees van Ettekoven, Netherlands

BMT: Mr. Gerhard Deneken, Denmark.

9. The TWC noted that the TC had agreed the timetable for the development of the TGP documents, as summarized in Annex II of document TC/38/7. The TWC reported that the TC had given highest priority to the development of TGP/7 "Development of Test Guidelines" and after this to TGP/4 "Management of Variety Collections", TGP/9 "Examining Distinctness" and TGP/10 "Examining Uniformity". The TWC noted, in particular, that the TC had agreed that the draft TG Template presented in Annex I of document TC/38/8 should form the basis for section 2 of document TGP/7 ("TG Template") and, accordingly, should be used as the basis for all future Test Guidelines.

10. The TWC reported that the TC had agreed with the proposal made by the Chairman of that Committee in document TC/38/9, that the composition of the Enlarged Editorial Committee (TC-EDC) should continue to include the Chairman and Vice-Chairman of the TC, the Chairmen of the TWPs and the Chairman of the Working Group on Biochemical and Molecular Techniques, and DNA-Profiling in Particular (BMT). In addition, a small number of additional members could be included in the TC-EDC, where and when necessary, to ensure that there was an appropriate range of expertise and experience.

11. The TWC noted that the TC had agreed, in accordance with the proposals in document TC/38/12, that the Office of the Union should seek to organize preparatory workshops for the TWP meetings to be held in 2002 and report the outcome to the TC at its thirty-ninth session in 2003. Invitations to the workshops would be included in the official invitations to the TWP meetings.

12. The TWC noted that the TC had discussed document TC/38/11: "Issues concerning protection of seed-propagated ornamental varieties", "Characteristics examined by patented methods", "Plant variety identification" and "Status of information provided in the Technical Questionnaire".

Molecular Techniques

13. Based on document TC/38/14 Add.-CAJ/45/5 Add., the TWC received an oral report from the Office of the Union on the latest developments at the BMT, the *Ad hoc* Crop Subgroups on Molecular Techniques (hereinafter referred to as "Crop Subgroups") and the *Ad hoc* Subgroup of Technical and Legal Experts on Biochemical and Molecular Techniques (hereinafter referred to as "the BMT Review Group").

14. The TWC noted that BMT had held its seventh session in Hanover, Germany, from November 21 to 23, 2001, under the Chairmanship of Mr. Michael Camlin (United Kingdom). It was reported that much of the meeting had focussed on the reports from the Crop Subgroups, which had been initiated at the previous BMT session and managed through the relevant TWPs. The future role of the BMT was also discussed. The TWC noted that the BMT had considered it important for the BMT Review Group to consider models for the use of biochemical and molecular techniques in DUS testing, and make recommendations on the acceptability of the following models, before further consideration of the technical aspects:

Option 1: Molecular characteristics as a predictor of traditional characteristics (Proposal 1):

(a) use of molecular characteristics which are directly linked to traditional characteristics (gene specific markers);

(b) use of a set of molecular characteristics which can be used reliably to estimate traditional characteristics; e.g. quantitative trait loci.

Option 2: Calibration of threshold levels for molecular characteristics against the minimum distance in traditional characteristics (Proposals 2 to 4).

Option 3: Development of a new system (Proposals 5 and 6).

15. It was reported to the TWC that the following recommendations were made by the BMT Review Group:

Option 1(a) (Proposal 1): For a gene specific marker of a phenotypic characteristic. This proposal was, on the basis of the assumptions in the proposal, acceptable within the terms of the UPOV Convention and would not undermine the effectiveness of protection offered under the UPOV system;

Option 2 (Proposals 2, 3 and 4): Calibration of threshold levels for molecular characteristics against the minimum distance in traditional characteristics for Maize, Oilseed Rape and Rose respectively, where used for the management of reference collections, were, on the basis of the assumptions in the proposals, acceptable within the terms of the UPOV Convention and would not undermine the effectiveness of protection offered under the UPOV system; and

Option 3 (Proposals 5 (Rose) and 6 (Wheat): It noted there was no consensus on the acceptability of these proposals within the terms of the UPOV Convention and no consensus on whether they would undermine the effectiveness of protection offered under the UPOV system. Concerns were raised that, in those proposals, using that approach, it

might be possible to use a limitless number of markers to find differences between varieties. The concern was also raised that differences would be found at the genetic level which were not reflected in morphological characteristics.

The TC agreed with the conclusions that proposals 1, 2, 3 and 4 could be pursued on the basis of the assumptions, whilst recognizing the need for further work to examine these assumptions and, in the case of option 2, to improve the relationship between morphological and molecular distances. The TC had noted the divergence of views expressed regarding proposals 5 and 6. The Administrative and Legal Committee (CAJ) agreed with the conclusions of the BMT Review Group and endorsed the opinion of the TC.

16. The TWC noted that the TC had reviewed the role of the BMT in response to recent developments in UPOV regarding biochemical and molecular techniques and it had agreed the future role of the BMT (see document TC/38/3, paragraph 24, Box 1).

17. The TWC noted that the following crop subgroups would meet during 2003: Mushroom, Oilseed Rape, Potato, Rose, Soybean, Sugarcane and Wheat.

UPOV Databases

18. The TWC received an oral report, based on document TC/38/6, from the Office of the Union, on the latest developments in the UPOV databases. It noted that, in order to construct a single database, it would be necessary to use a "unique identifier" which would be, at least for the time being, the code developed in document TC/35/16 "Revised Working Paper for a UPOV Taxon Code for Use in the UPOV-ROM Plant Variety Database." Some experts considered that the documents prepared for the development of the UPOV databases should be made available to the TWC experts.

Project to Consider the Publication of Variety Descriptions

19. The TWC considered document TC/38/10 Add. It was reported to the TWC that the Council, at its nineteenth extraordinary session on April 19, 2002, had considered the project for the publication of variety descriptions included in document TC/38/10 and had noted the particular technical aspects which would need to be developed for the model study on the publication of variety descriptions. The TWC noted that, according to the proposed project, the TC had decided to invite the TWPs to make proposals for species and to identify which members of the Union and other interested parties would wish to contribute to a model study on these species. The TC would then consider the proposals and, at its thirty-ninth session in spring 2003, select a short list on which to base any model study. It was reported that the TC had agreed to the proposal by the delegate of France that the TWPs should, for the species concerned, be invited to consider means of separating the varieties of common knowledge into agronomic groupings.

20. Conclusion: The TWC considered that an expert from the TWC should attend the Working Group on the Publication on Variety Descriptions. The matter would be left to the next Chairman.

TGP Documents

(a) TGP Documents to which the Technical Committee has given highest priority for discussion

TGP/9.3.2 Use of 'Phenotypic Distance' for Examining Distinctness

21. Mr. Sylvain Grégoire (France) introduced the document. He said that the program was being rewritten and that a pre/test version would be available for members by the end of 2002. He highlighted the notion of "Distinctness Plus" introduced in the document, which meant that, based on a computation of the differences between varieties and taking into account its size and the reliability of each characteristic, the threshold used to define a variety as distinct was larger than the minimum distance used by the expert to establish distinctness.

22. The expert from the Czech Republic asked about the method used to determine the adequate threshold level. The expert from France explained that, when the approach was first developed, around 10 years ago, the threshold level was closely related to the LSD, but this proved to be very narrow. Later on, as the system was developed, they moved from a LSD-based level to one based upon the experience of the crop experts. An expert from Germany asked whether, as a rule, qualitative characteristics were used in the first step and quantitative characteristics in the second step and asked for some clarification on the way the different weights that applied to each characteristic were determined. The expert from France explained that notes for the different states of expression were used for qualitative characteristics and that for quantitative characteristics, measurements were used. He also explained that a characteristic that was used in the first step would not be used in the second step and vice versa. In relation to the weight allocation of the different characteristics, he explained that the process had started with a characteristic by characteristic approach but later, based on experience, moved to the assessment of an overall difference. He emphasized that the reliability of the results was considered very important and that, for some characteristics, some parts of the scale could be more reliable than others. An expert from the United Kingdom considered that the results in reducing the number of the varieties which needed to be included in the field trial were impressive in the case of maize. Nevertheless he wondered whether it was necessary to sow the varieties to check the efficiency of the system from time to time and also wanted to know about the possibility to use the information provided by the applicant in the technical questionnaire for this analysis. The expert from France replied that, with the help of electrophoresis and after ten years of experience, the system had become very effective. He further clarified that each year there were meetings between the national authority, the breeders and the users to discuss the results provided by the GAÏA program. He concluded by recommending to those countries willing to implement the system that it was necessary to test the tool beforehand. An expert from Denmark considered the proposed method as a very promising tool for DUS testing. He considered that the program allowed the use of different thresholds for different characteristics and that it was the responsibility of the user to set up these thresholds. It was explained that the program was being rewritten to make it independent of any specific hardware. Another expert from the United Kingdom wondered whether consistent results could be envisaged using results from more than one country. The expert from France replied that UPOV sought harmonization on the assessment of the characteristics and that this tended to increase cooperation among members. He added that if different environmental conditions were used for the assessment of a given characteristic, then different threshold levels should be used.

23. Conclusions: The TWC noted that at that time the proposed program had been used by only one member and considered that it should be tested by more members before being

recommended by UPOV in document TGP/9.3.2. The TWC further agreed to keep the introduction as part of document TGP/9.3.2 and the GAÏA program to be presented as a TWC paper at the next TWC session.

TGP/9.4.1 Examining Distinctness in Different Types of Variety: General

24. Mrs. Beate Rücker (Germany) introduced the document. She wondered where the best place for this chapter of TGP/9 should be.

*25. Conclusions: The TWC agreed to have references to the features of propagation in this chapter and not in the chapters describing the statistical method for distinctness. The TWC also agreed the following modifications in the text of document TGP/9.4.1 (additional text underlined and deleted text strikethrough):

Paragraph 1 to read:

"1. The appropriate method for examining distinctness depends on the methods of recording the expression of a characteristic in a specific crop and the resulting set of data (see TGP/8). …."

Paragraphs 3 and 4 to read:

"3. Vegetatively propagated, truly self-pollinated and mainly self-pollinated varieties normally have very little variation within varieties. The same situation may occur in qualitative characteristics in cross-pollinated varieties (including synthetic varieties). A lack of significant variation within varieties allows examination of distinctness based on a single observation per variety, year and location. Guidance for the assessment of Distinctness in such cases is provided in (TGP/9. ~~In general, a minimum distance of one or more than one states is recommended to consider a variety to be distinct. In the case of a single observation for each variety, the application of a statistical analysis is not possible or necessary.~~"

"4. Within variety variation is normally greater for quantitative characteristics in cross-pollinated varieties, including synthetic varieties, due to genotypic variation. In this case, the expression of a variety should be recorded using ~~more than one~~ observations~~. Usually, records are taken from a~~ on number of individual plants. Distinctness can then be assessed by comparing the differences in variety means with a measure of random variation inherent in the variety means (see TGP/9.7 "Recommended Statistical Methods"). If a characteristic in a vegetatively propagated, truly self-pollinated or mainly self-pollinated variety is recorded by observation of individual plants, the same methods can be applied. This situation might occur where there is considerable plant to plant variation within varieties due to environmental effects is observed. However, in general, ~~a~~ one single observation per plot for each variety is sufficient in vegetatively propagated, truly self-pollinated and mainly self-pollinated varieties."

To add new paragraph at the end:

"The assessment of distinctness for hybrid varieties should follow the same rules independently of the degree of within variety variation of the level of the hybrid or of the parental lines. Specific guidance for the assessment of distinctness using the parental formula is provided in TGP/9."

TGP/9.6 Use of Multiple Locations in the Examination of Distinctness

26. Mr. Sylvain Grégoire (France) introduced the document. The TWC considered a comment from Australia that paragraph 7 of the document confused the consistent expression of a characteristic with whether that characteristic was expressed in successive generations. An expert from Denmark considered that consistency was related to the environment by genotype interaction whilst stability was related to successive generations. The TWC agreed to re-word the second sentence of paragraph 7 to make it clearer, or to remove the whole paragraph. The TWC considered the comment sent from Australia to paragraph 8 of the document, that the two locations must have different environments, should not be mandatory. The expert from France considered that UPOV could not ask for different environments to be mandatory on the one hand, if, on the other hand, overlapping cycles in the same place, or successive trials in greenhouses with a similar environment, were permitted. This would not prevent experts checking for environmental consistency by using different environments when they felt it was appropriate.

*27. Conclusions: The TWC agreed the following modifications in the text of document TGP/9.6 (additional text underlined and deleted text strikethrough):

Paragraph 4 to read as follows:

"4. For some crops, such as fruit trees, the same plants are examined over successive years. In this case, the condition of independence of growing cycles is not ~~also~~ satisfied. But, as it would be impossible in practice to plant successive trials, this is accepted."

To reword the second sentence of paragraph 7 or to remove the whole paragraph.

The last point of paragraph 8 to read as follows:

- "Some offices systematically grow varieties in more than one location (usually 2). They do this in order to provide a double check for consistency in crops for which they experience difficulties in proving distinctness and uniformity."

28. The TWC did not accept modification of the fifth point of paragraph 8 as proposed by Australia because it considered it necessary to check the consistency of the DUS test by sampling different environments.

TGP/9.7 Recommended Statistical Methods - COYD

29. Mrs. Sally Watson (United Kingdom) introduced the document. Some experts considered it useful to include an example of long-term COYD in the document. Other experts wondered why it was necessary to fix a limit of 20 degrees of freedom. An expert from Denmark explained that this limit was a compromise agreed in the past.

*30. Conclusion: The TWC agreed to add an example of long-term COYD and to put in the name of the Annex in paragraph 14. It also agreed to include other possibilities than "fitted constants" in paragraph 10 of Appendix A. The TWC also agreed to include the following modifications in the text of document TGP/9.7 (additional text underlined and deleted text strikethrough):

Paragraph 1, first sentence to read:

"1. To distinguish varieties on the basis of a ~~measured~~ quantitative 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 …"

Paragraph 12 to read as follows:

"12. 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 the characteristic is quantitative;

– 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~~."

Paragraph 16: to replace "present" by "common".

TGP/10.2 Assessing Uniformity According to the Features of Propagation

31. Mrs. Beate Rücker (Germany) introduced the document. Comments made at the TWC are reflected in paragraph 32 below.

*32. Conclusions: The TWC did not accept the proposal from Australia to modify paragraph 6, sentence 2, because it considered that the COYU is the only recommended method. The TWC also agreed to have references to the features of propagation in this chapter and not in the chapters describing the statistical method for uniformity, and to make the following modifications in the text of document TGP/10.2 (additional text underlined and deleted text strikethrough):

Paragraph 1 (b) to read as follows:

"(b) Variation within mainly self-pollinated varieties should also result, predominantly, from environmental influences but a low level of genotypical variation caused by some cross pollination is accepted. Therefore~~, the tolerance limit for uniformity may be higher~~ more variation may be tolerated than for vegetatively propagated and truly self-pollinated varieties."

Paragraph 2: to read as follows and to add a new one:

"2. As a result of the above, appropriate uniformity standards for the different types of varieties must be developed according to the features of propagation (specific population standards)."

"2.a The variation within varieties in a characteristic determines how that characteristic is used to determine uniformity in the crop (off-types in case of discontinuous variation or variances in case of continuous variation of characteristics). Thus, the uniformity of the

crop may be determined by off-types alone, by variances of the characteristics alone, or by off-types for some characteristics and by variances for other characteristics."

Paragraph 4 (b), last sentence to read as follows:

"(b) … An appropriate fixed population standard ~~should~~ may also be applied in the case of a very low number of comparable varieties."

Paragraph 6 to read as follows:

"6. If the detection of off-types is not possible because of considerable genotypic and/or environmental variation within varieties, uniformity should be assessed after taking this variation into account. The variability of a candidate variety should not exceed the variability of comparable varieties or types already known. The comparison between a candidate variety and comparable varieties is carried out on the basis of variances calculated from individual plant observations. The COYU procedure is the recommended statistical method for this comparison (see Section 10.3.1). This procedure calculates the tolerance limit on the basis of comparable varieties already known i.e. uniformity is assessed using a relative tolerance limit."

Paragraph 8 to read as follows:

"8. If the inheritance of a clear-cut segregating characteristic is not known, the ~~expression of the characteristic is treated in the same way as other characteristics in cross-pollinated varieties (including synthetic varieties). The~~ observed segregation ratio should be described. An assessment of uniformity is not possible for these characteristics. (The rules outlined for predictable segregation ratios in Chapter 10.3.3 should be used for testing stability.)"

TGP/10.3.1 Recommended Statistical Methods: COYU

33. Mr. Adrian Roberts (United Kingdom) introduced the document. Some experts highlighted that COYU was not applicable when there were less than nine reference varieties plus one candidate and therefore proposed a document presenting an alternative method to COYU to be prepared to cover that situation. Other comments made at the TWC meeting are reflected in paragraph 34 below.

*34. Conclusions: The TWC agreed to include a paragraph clarifying that the same number of plants, measurements and replications as in COYD were used. It also agreed that a paper should be prepared for the next TWC meeting proposing an alternative method to COYU when the requirements on degrees of freedom for COYU are not fulfilled. The TWC also agreed the following modifications in the text of document TGP/10.3.1 (additional text underlined and deleted text strikethrough):

Paragraph 1, first sentence to read:

"1. When the uniformity of plants of a variety is to be judged on the basis of ~~measurements~~ quantitative characteristics then the standard deviation (SD) can be used to summarize the spread of the observations."

Paragraph 11: to include an extra point "when the characteristic is quantitative"

Paragraph 14: to amend the second formula.

Paragraph 30: reference to "Table B 2" should be to "Table A 2"

To check the format of Table A 2.

TGP/10.3.2 Recommended Statistical Methods: Off-Types

35. Mr. Adrian Roberts (United Kingdom) introduced the document. The TWC noted the comment from Australia proposing the addition of a sentence indicating that it was not the only valid test for the assessment of number of off-types. Nevertheless, the TWC considered that it was the only method recommended by UPOV at the moment and decided that it was not necessary to modify the document in this aspect. An expert from Germany considered that the wording of paragraphs 46 and 47 proposed the use of the total number of off-types observed in two or three years, which was different from the two out of three year approach used previously. The experts from Denmark and France considered that the approach explained in paragraph 46 was a more powerful test, and the expert from the United Kingdom clarified that paragraph 47 left the possibility to use the two out of three year approach still open.

36. An expert from the United Kingdom considered that advice on relative tolerances in the number of off-types for the assessment of uniformity was missing in the TGP documents. Experts from Germany mentioned that they had some experience in that field. The TWC considered that a document on relative tolerances in number of off-types should be prepared. Some experts wondered about the possibility of moving the definitions included in paragraph 54 to TGP/14. The expert from France proposed to check whether there was a contradiction between the definition included in that paragraph and in TGP/14 and he noted that the removal of paragraph 54 of TGP/10.3.2 should be carefully considered because each TGP should be self-explanatory.

*37. Conclusions: The TWC considered that the tables and figures included in the document from pages 14 to 36 should be improved. It was agreed that Denmark would send the drafter the program to create new ones.

*38. The TWC also considered it necessary to include advice for the assessment of Uniformity by relative tolerances in the number of off-types in TGP/10. It was agreed that experts from Germany and the United Kingdom would prepare a document for the next session of the TWC.

*39. Several experts wondered whether the term "heterogeneous" included in the table of paragraph 11 was properly used or could be replaced by "non-uniform". It was also considered whether the chapter " Definition of Statistical Terms and Symbols" (paragraph 54) should be deleted and its content included in TGP/14. The TWC agreed to request the opinion of the other TWPs in relation to the use of the term "heterogeneous" and it also decided to keep paragraph 54.

*40. The TWC agreed the following modifications in the text of TGP/10.3.2 (additional text underlined and deleted text strikethrough):

> "2. ~~Uniformity of candidate varieties of self-pollinated and vegetatively propagated crops is normally assessed on the basis of the number of off-types recorded in tests~~. The maximum number of off-types that is acceptable should be chosen so that the probability of rejecting a candidate variety that should meet the crop standard is small. On the other hand, the

probability of accepting a candidate variety that has many more off-types than the standard of that crop should also be low."

"8. This method is recommended for use in assessing the uniformity by number of off-types ~~in self-pollinated and vegetatively propagated crops~~ with a fixed population standard."

(b) Other TGP documents

TGP/4.1 General Guidance for the Management of Variety Collections

*41. The Office of the Union introduced the document.

*42. Conclusions: Some experts considered that the wording of paragraph 14 was confusing, particularly the second part. The expert from Germany clarified that the aim of this part of paragraph 14 was to stress the need for, and the importance of, having a variety collection.

*43. The TWC agreed the following modifications in the text of paragraph 14 of document TGP/4.1 (additional text underlined and deleted text strikethrough):

Paragraph 14 to read:

"14. As a conclusion, it is important to underline that whatever the situation adopted to establish a variety collection, it is impossible and not necessary to have a full collection of varieties of common knowledge~~, but also to have a working variety collection with all varieties which would have to be included~~. Nevertheless, it is important that there should be an inclusive and relevant working variety collection."

TGP/14.3 Glossary of Statistical Terms

*44. The Office of UPOV introduced the document and recalled that this document had been considered by the TWC previously as document TWA/29/9.

*45. An expert from the United Kingdom considered that reference to textbooks on statistics should be included, and he had concerns about including some terms in the glossary. The expert from Denmark proposed to check the consistency between the definitions included in document TGP/14.3 and the ISO definitions. Following the proposal of the expert from France, the TWC agreed to keep the way it was written for future versions because it made the glossary easy to read for non-statisticians.

*46. Conclusions: The TWC agreed that the document should be modified following the discussions at the meeting and that an expert from the United Kingdom would prepare an updated version in consultation with other experts. It also requested the Office of the Union to seek the opinion of the initial drafter from Australia about this proposal.

TGP/8.6 Examining DUS in Bulk Samples

*47. Mr. Kristian Kristensen (Denmark) introduced document TGP/8.6. He explained that the document was based on document TWC/19/7, which had been discussed by the TWC the year before, and that the new version had been specially prepared in order to be understood by non-statisticians.

*48. Some experts considered that it would be necessary to include more examples to show the reaction to bulking in different characteristics. An expert from the United Kingdom proposed that the components of the formula in paragraph 3 should be considered as "sources of variation" instead of "variance caused by".

*49. Conclusion: The TWC also agreed the following modifications in the text of TGP/8.6 (additional text underlined and deleted text strikethrough):

Paragraph 4 to read:

"4. In cases where the data are not bulked the variance ~~on~~ of the difference between two variety means, σ^2_{diff}, becomes:"

Paragraph 10: the explanation to the formula to read:

$Var(Z_{vy}) = \sigma^2_{vy} + \sigma^2_f$

where

σ^2_{vy} is the total variance caused by the year in which the variety is measured

σ^2_f is the variance ~~caused~~ influenced by the number of degrees of freedom

σ^2_f is approximately $\frac{1}{2\nu}\left(\frac{\sigma}{\sigma+1}\right)^2$ when the recorded variable is normally distributed and the variances are not too variable. This last expression reduces to $0.5/\nu$ when $\sigma >> 1$. Here σ is the mean value of the s_{vy} values and ν is the number of degrees of freedom used in the estimation of s_{vy}.

TGP/8.1 Use of Statistical Procedures in DUS Testing: Introduction

*50. Mr. Paul Keizer (Netherlands) introduced document TGP/8.1. He explained that the document was an introduction, that it was not intended to be an exhaustive document and that reference to other TGP documents should be included.

*51. Several experts considered that the document included a too extensive part devoted to experimental design, a subject to be covered in document TGP/8.3 ("Experimental Design Practices"). Other experts supported its inclusion because they thought that this would raise awareness on the importance of having a good experimental design, and was also an attractive issue that would encourage crop experts to read it. Experts from the United Kingdom proposed that the document should be presented in a more structured way. The expert from Germany noted that the document referred to candidate varieties as "new varieties", which might cause confusion with the notion of novelty in the UPOV Convention. Furthermore, she considered that the use of the terms "internal factors" and "external factors" was confusing for crop experts. Finally she proposed to use the term "candidate variety" as for other TGP documents and to refer to "genetic effects" and "environmental effects" respectively. Other confusing terms identified were: "over the years" instead of "generations", "maternal effects", "sowing" instead of "growing cycle" and "replication" to designate each single vegetatively propagated plant.

*52. The TWC proposed to use a wording consistent with the other TGP documents to avoid confusing crop experts. It considered that testing a variety over more than one growing cycle did not check stability as mentioned in paragraph 9.

*53. The TWC considered that the inclusion of other methods for partitioning the error as proposed by Australia was in too much detail for an introduction to TGP/8. It also considered that data should be observed on plants in good growing conditions and that consistent results was an aim laid down in the General Introduction (see paragraph 5.3.3.1 of document TG/1/3).

*54. Conclusion: The TWC requested the drafter to reduce the reference to experimental design and to modify the document following the proposal raised during the discussion. The TWC also agreed the following modifications in the text of document TGP/8.1 (additional text underlined and deleted text strikethrough):

Paragraphs 10 and 11 to read:

"10. A fourth key element is the specific set of considerations that holds for a crop. There can be no general set of experiments and/or characteristics given, that will fulfill the UPOV requirements for DUS testing. It will depend on the crop and the considerations are diverse, but general information is provided in this document. For most crops, the characteristics and requirements are defined in the Test Guidelines. But sometimes other characteristics can be used as a complement for the 'agreed' characteristics. Observations can be made at all different stages of development of the crop, so it is imperative that all aspects of recording a characteristic are described properly and exhaustively to ensure that they can be compared in the long run but also understood by a novice."

"11. During or at the end of the study, the data, on the same set of characteristics ~~between~~ for all varieties, are used by the experts of the crop for DUS testing. The use of and the need for computations may differ considerably. In some cases the notes recorded and the knowledge of the expert are sufficient, while in other cases there is a need to compute a large set of data from more than one ~~sowing~~ growing cycle in order to obtain objective values on which to base the final expert decision."

TGP/8.2 Validation of Data Assumptions

*55. Mr. Kristian Kristensen from Denmark introduced document TGP/8.2 Rev.

*56. The expert from the United Kingdom proposed to include additivity of blocks and variety effects under item 8.2.3 Assumptions. It was also clarified that examples of ANOVA would be included in document TGP/8.5 "Statistical Methods for DUS Examination." The drafter requested the participants to provide examples when transformation of data had been used, to be included in future versions of document TGP/8.2

*57. Conclusion: The TWC agreed the following modifications in the text of TGP/8.2 (additional text underlined and deleted text strikethrough):

Paragraphs 6 and 7 to read:

"6. First of all, it is very important to design experiments in a proper way. The most important assumptions of analysis of variance methods are:

- independent observations
- variance homogeneity
- normally distributed observations (residuals)
- additivity of blocks and variety effects".

"7. In addition, one could state that there should be no ~~errors~~ mistakes in the data. However, most ~~errors~~ mistakes (at least the biggest) will usually also mean that the observations are not normally distributed and that they have different variances."

Paragraph 9 to read:

"9. This is a very important assumption. It means that no records may depend on other records in the same analysis (dependence between observations may be built into the model, but this is not so in the COYD and COYU or other UPOV recommended methods). Dependency may be caused e.g. by competitions between neighbouring plots, by lack of randomisation or by improper randomisation. More details ~~on independent~~ on ensuring independence of observations may be found in TGP/8.3 "Experimental Design Practices.""

Paragraph 10, second bullet point to read:

- "The variance ……. has a variance of 5, whereas varieties I and J each has a variance of 10. ~~Some results of comparing~~ The real probability of detecting differences between these varieties when they ~~are~~ in fact ~~identical~~ have the same mean are shown in Table 1. In Table 1, the variety comparisons are based on the pooled variance as is normal in traditional ANOVA. If they are compared using the 1% level of significance, the probability that the two varieties with a variance of 10 become significantly different from each other is almost 5 times larger (4.6%) than it should be. On the other hand, the probability of significant differences between two varieties with a variance of 5 decreases to 0.5%, when it should be 1%. This means that it becomes more difficult to detect differences between two varieties with small variances and easier between varieties with large variances."

Explanation of Table 1 to read:

"Table 1. Probability of significant difference between two identical varieties in the case where variance ~~heterogenity~~ homogeneity is assumed but not fulfilled (varieties A to H have a variance of 5 and varieties I and J have a variance of 10)."

Paragraph 11 to read:

"11. The data should be approximately ~~normal~~ normally distributed. The ideal normal distribution means that the distribution of the data is symmetric around the mean value and with the characteristic bell-shaped form (see Figure 2). If the data are not approximately normally distributed, the actual level of significance may deviate from the nominal level. The deviation may be in both directions depending on the way the actual distribution of the data deviates from the normal distribution. However, deviation from normality is usually not as serious as deviations from the previous two assumptions."

Paragraph 12 to replace "error" by "mistake".

Paragraph 12 to replace "outliners" by "outliers".

TGP/8.3 Experimental Design Practices

58. Mr. Jack Thissen (Netherlands) introduced the document. He explained that he considered that DUS testing had two main objectives: one to make comparisons between varieties and the other one the absolute assessment of characteristics. Finally, he particularly requested the TWC to comment on the structure of the document.

59. An expert from the United Kingdom considered it useful to cover the possibility of grouping varieties in the document. The expert from France clarified that side-by-side plots was not the design used in all trials. He said that by having pair-wise comparisons in special cases, crop experts learned and interpreted the testing in an integrated manner. He also proposed including more information on qualitative characteristics. The expert from the Czech Republic wondered about the correct use of the term "population" in paragraph 11. The expert from Germany considered that the document was not ready to be sent to other TWPs for comments yet. At the request of an expert from the United Kingdom, it was clarified that the recommendation laid down in paragraph 57, that narrow and long plots were preferred, came from the practical experience of DUS testing. An expert from the United Kingdom wondered whether paragraphs 1 to 34 were related to the main issue of the document. She also wondered whether it was really necessary to include the definitions in the document.

*60. Conclusion: The TWC agreed to delete the following paragraphs: 2; 4 to 10; 12 to 33; to reword paragraph 11 because the use of the term "plots of the population" was confusing and to include the use of grouping characteristics in the trial design. The TWC also agreed the following modifications in the text of document TGP/8.3 (additional text underlined and deleted text strikethrough):

Paragraph 44 to delete the comma in the first sentence and to replace "so" by a comma in the last sentence.

Paragraph 69 to read:

"69. The comparison between candidate and reference varieties is mostly based on observations from one to three years or cycles. Therefore, the number of replicates and the number of plants per plot in a single trial have an indirect effect on the variability which is used in the COYD and COYU analyses. Before performing these analyses, the means of the variety means and (log) standard deviations per year or cycle are calculated and then the analysis is performed on these means in the two-way variety by year or cycle layout. The residual variation in these analyses is the variety by year or cycle interaction. More refined techniques ~~based in~~ such as fitted constant and REML can be used, which allow for, e.g., between-trial heterogeneity in error variance."

TGP/8.4 Types of Characteristics and their Scale Levels

*61. Mr. Uwe Meyer from Germany introduced the document. He clarified that this document was an updated version of a previous document discussed at the TWC that included linguistic improvements, and recent developments in the TC had been taken into account.

*62. Conclusions: The TWC agreed to replace "level of view" by "level of process" throughout the whole document and also the following modifications in the text of TGP/8.4 (additional text underlined and deleted text strikethrough):

Page 4, second paragraph to read:

"The continuous quantitative data for the characteristic "Plant length" are measured on a continuous scale with defined units of assessment. It depends only on the costs and the necessity to get any value in cm or in mm. ~~Changing of measure~~ A change of unit of measurement e.g. from cm into mm is only a question of precision and not a change of type of scale."

Page 4, last paragraph to read:

"The definition of an absolute zero point makes it possible to define ~~additional constant~~ meaningful ratios. This is also a requirement for the construction of index numbers (e.g. the ratio of length to width). An index is the combination of at least two characteristics. In UPOV terms, this special case is defined as a combined characteristic."

Page 5, second paragraph to read:

"The interval scale is ~~higher classified than the ordinal scale but~~ lower classified than the ratio scale (Table 2). That means that it is possible to use more statistical procedures. Fewer statistical procedures can be used with interval scaled data than with ratio scaled data (Chapter 7). The interval scale is theoretically the minimum scale level to calculate arithmetic mean values."

Page 5, last paragraph to read:

"The ordinal scale is ~~higher classified than the nominal scale but~~ lower classified than the interval scale (Table 2). ~~It is possible to use more statistical procedures than for nominal scaled data but less than for interval scaled data~~ Less statistical procedures can be used for ordinal scale than for all of the higher classified scale data (Chapter 7)."

Page 6, third paragraph:

"Characteristics with only two categories (dichotomous ~~alternative~~ characteristic) are a special form of nominal scales."

Page 6, Table 2:

To replace "exact zero" by "absolute zero" in the column Description.

Page 7, the third paragraph and the remark to read:

"For quantitative characteristics, the scale level of data depends on the method of assessment. They can be recorded on a quantitative or ordinal scale. For example, "Length of plant" is usually recorded by measurements resulting in ratio scaled continuous quantitative data. Under specific circumstances, visual assessment on a 1 to 9 scale may be appropriate. In this case, the recorded data are qualitatively scaled (ordinal scale) because the ~~size~~ interval between the midpoint of categories is not exactly the same.

Remark: In some cases, visually assessed data on quantitative characteristics may be handled as ~~quantitative data~~ measurements. The possibility to apply statistical methods for quantitative data depends on the precision of the assessment and the robustness of the statistical procedures. In case of very precise visually assessed

quantitative characteristics, the usually ordinal data may reach the level of discrete interval scaled data or of discrete ratio scaled data."

Tables 4 and 5: to merge the columns Type/Procedure and Further Conditions and to delete "Recommended" from the titles of these tables. To replace "alternative" by "dichotomous" in table 5.

*63. The TWC furthermore agreed that a paper on chi square distribution should be prepared for the following session by experts from France and the United Kingdom.

TGP/8.5 Statistical Method for DUS Examination

*64. Mrs. Sally Watson (United Kingdom) introduced the document. She asked for information on other methods used for DUS testing to be included in the document.

65. The expert from Poland asked the drafter the reasons why she had structured the document from the most complex method to the simplest one. She replied that she wanted to avoid taking a typical statistical approach and that in the preparation of the document she had considered that the source of the data determined the type of analysis to be used. Another expert from the United Kingdom proposed adding bibliographical references. An expert from the Netherlands considered that, in the explanation of example C on page 6, it was necessary to clarify that the number of replicates was different for different treatments and proposed including a new example of variety-by-block design for the COYD example. In reply to those comments, the drafter proposed to add a new paragraph and to include references to other TGP documents. She suggested that another example of completely randomized analysis could be added but she was rather reluctant to delete the COYU example already included in the document. The expert from France considered that, with the inclusion of more cases, the document would become more complex, hence he highlighted the need to put them in a logical way and supported the proposal to make references to other TGP documents. Several experts considered it necessary to develop a document laying down the circumstances when incomplete block design could be used.

*66. Conclusions: The TWC agreed that the bibliography should be included in the document and the drafter would contact the national expert to get that information and to include another example of randomized block design, another example of completely randomized design and a section on paired t-test. As the document would become more voluminous with the inclusion of more methods, the TWC considered that special care should be taken in its structure. It was agreed that experts from Denmark and Poland would prepare a document on incomplete block design and experts from France and the United Kingdom would prepare a document on chi square for discussion at the next session of the TWC.

*67. Procedure for recommending statistical methods in TGP documents: The TWC received several comments suggesting that the statistical procedures and methods included in the TGP documents were not the only ones that could be used in DUS testing. Even though the TWC considered that it might be the case, it also considered that, to be recommended by UPOV in a TGP document, the TWC and the TC should examine any statistical method as follows:

(a) a working paper ("TWC document") should be presented to the consideration of the TWC, explaining the statistical principles applied including examples of its practical use in DUS testing;

(b) the TWC to examine the proposal and to decide whether it could be put to the TC as a recommended statistical method or whether further development is necessary;

(c) if considered suitable, the proposal to be put to the TC to be included as a TGP document.

*68. TGP documents to be redrafted before further consideration by other TWPs: The TWC considered that the following TGP documents should be redrafted and reconsidered by the TWC before being sent to other TWPs for further consideration:

TGP/8.1 Introduction

TGP/8.2 Validation of Data and Assumptions

TGP/8.3 Experimental Design Practices

TGP/8.5 Statistical Methods for DUS Examination

TGP/14.3 Statistical Terms

Statistical Methods for Data Produced by Biochemical and Molecular Methods

*69. Mr. Sylvain Grégoire (France) introduced document TWC/20/2. Some experts proposed that the information related to databases should be included in a separate document. One expert considered that the measurement of distances in morphological characteristics could not be as easy as from molecular markers and therefore correlation between these two variables could present some difficulties. Some amendments in the wording were proposed.

70. An expert from the Netherlands considered that the document was very well drafted and comprehensive. Nevertheless, he explained that, in relation to paragraph 7, the band scoring is mainly done manually. In paragraph 12, he proposed checking the formulas n_{10} and n_{01} and to consider the issue of Essentially Derived Varieties (EDV) in future and to review the example referred to in paragraph 28. The expert from France replied that he considered there to be no difference in assessing uniformity in traditional characteristics and in molecular markers. Finally, in reply to a question from an expert from the United Kingdom, the expert from France added that he considered that, in his personal opinion, the TWC could provide assistance on particular problems in the use of molecular data for variety testing. He considered that a paper with general answers in this subject could be produced, that the TWC could also have a good input for the development of option 2 (see paragraph 14 of this document) and even in the development of option 3. Nevertheless, he stressed the need of real data to be able to go further in this task.

*71. Conclusion: The TWC agreed that the above-mentioned comments be incorporated in future versions of this document.

Uniformity Standards for COYU

72. The TWC noted document TWC/20/3, which included the information on the standards used for COYU sent in reply to Circular U 3216. An expert from the Netherlands proposed that

information on the LSD value should be included in the table. An expert from Germany informed the TWC that some work had been done at the Technical Working Party for Agricultural Crops (TWA) in relation to the harmonization of plant variety descriptions and further development of these investigation could include the analysis of the LSD used in different countries and its impact on the descriptions obtained. Experts from France and Germany suggested presenting the data in a more harmonized way.

*73. Conclusion: The TWC agreed that further information was necessary to be able to propose a recommendation. It decided to repeat the survey and to have a new edition of the document for the following session and to improve the layout of the table as follows:

Probability levels							
		COYU			COYD		
		+2	(3)	+3	+2	(3)	+3
Species	Country 1						
	Country 2						
	Country 3						

+2 : Acceptance after 2 years

(3) : Go to 3rd year test

+3 : Acceptance after 3 years

Efficiency of Incomplete Block Design in DUS Herbage Trials

74. Mrs. Sally Watson (United Kingdom) introduced document TWC/20/4, Preliminary Report on the Efficiency of Incomplete Block Designs in DUS Herbage Trials. Several experts highlighted that although there was a need to have a document with recommendations on the use of incomplete block design, there was still lack of experience in the use of this design in DUS testing.

*75. Conclusion: The TWC agreed that a new paper should be presented at the next session showing the efficiency of incomplete block design in a new set of data.

Telecommunications, Exchangeable Software and Contacts

*76. The TWC welcomed document TWC/20/5, which was an update of the previous version (see document TWC/19/9).

*77. Conclusion: The TWC requested the Office of the Union to include the e-mail list in the restricted area of the UPOV Website.

Presentation on the Image Database Flores

78. Mr. L.C. Paul Keizer (Netherlands) made a presentation of the image database for ornamentals, Flores ™. He considered that this could be a useful tool for the management of variety collections. The expert from France considered that it was a very interesting

presentation and asked whether there had been any problem with the normalization of the method. The expert from the Netherlands explained that they did not see too many problems in this aspect. He clarified that they were not looking at the images on a pixel-wise basis, but were rather looking for different scales and distances and they also calculated variances.

Workshop Report

79. Mr. Kristian Kristensen, coordinator of the Workshop on Data Handling which took place from June 12 to 14, 2002, in Texcoco (Mexico), gave a brief report on that activity. He thanked the lecturers for their participation and the organizers for the excellent arrangements and facilities provided for the activity. He noted that 27 participants from seven different countries and one participant from an international observer organization had attended the Workshop. The main objective had been to introduce the main statistical principles used in DUS testing and to provide guidance on the use of the COY program. He concluded that the comments received from the participants would be taken into account when organizing future workshops and recommended repeating the activity in the future.

80. The TWC thanked Mr. Kristensen and the other experts involved in the organization of the Workshop and agreed to repeat the activity if possible.

Future Program, Date and Place of the Next Session

*81. At the invitation of the expert from Denmark, the TWC agreed to hold its twenty-first session in Tjele, Denmark, from June 10 to 13, 2003. During the twenty-first session, the TWC planned to discuss or re-discuss the following items:

1. Short reports on developments in plant variety protection

    (a) Reports from members and observers (oral reports by the participants)

    (b) Reports on developments within UPOV (oral report by the Office of the Union)

2. Molecular Techniques

    (a) Report on developments

    (b) *Ad hoc* Crop Subgroups

    (c) Statistical data for method produced by biochemical and molecular methods

3. Project to consider the Publication of Variety Descriptions

4. UPOV Databases

5. Chi square distribution (a document to be prepared by experts from France and the United Kingdom)

6. Alternative method to COYU when the requirements on degrees of freedom for COYU are not fulfilled

7. Relative tolerances in the number of off-types (document to be prepared by experts from Germany and the United Kingdom)

8. Incomplete block design (document to be prepared by experts from Poland and Denmark)

9. Glossary on Statistical Terms (a new document to be prepared by experts from the United Kingdom in consultation with other experts)

10. Efficiency of Incomplete Block Design in DUS Herbage Trials (a new document to be prepared by experts from the United Kingdom)

11. Calculation of phenotypic distances (a new document to be prepared by experts from France)

12. TGP documents

13. List of statistical documents prepared by the TWC

14. Telecommunications, exchangeable software and contacts

15. Date and place of the next session

16. Future program

17. Report on the conclusions of the session.

Technical Visit

82. On June 19, the TWC visited the *Centro Internacional de Mejoramiento del Maíz y del Trigo* (CIMMYT). Prof. Timothy G. Reeves, Director General of CIMMYT, made a presentation on the policies of CIMMYT in intellectual property. A visit to the "Wellhausen-Anderson" Plant Genetic Resources Center followed, where a presentation on the objectives and management of the germplasm bank was given.

Closing of the Meeting

83. Mr. Sylvain Grégoire and Mr. Kristian Kristensen, were each awarded a UPOV bronze medal in recognition of their chairmanship of the TWC for the periods 1994 to 1996 and 1991 to 1993, respectively.

84. This report has been adopted by correspondence.

[Annex follows]

ANNEX

LIST OF PARTICIPANTS

I. MEMBER STATES

COLOMBIA

Lilia Amparo BONILLA, Instituto Colombiano Agropecuario (ICA), Calle 37 # 8-43, Bogotá (tel. +57 1 232 8643, fax +57 1 232 8643 e-mail: obtentores.semillas@ica.gov.co)

Jaime LUGO, Instituto Colombiano Agropecuario (ICA), Predios Universidad del Tolima, Iloague, Tolima, Colombia. (tel. +578 264 3066, fax +578 288 9826, e-mail: semillas@ica.gov.co)

CZECH REPUBLIC

Lydie ČECHOVÁ (Mrs.), Central Institute for Supervising and Testing in Agriculture, 56901 Hradec Nad Svitavou (tel.: +420-461 535 003, fax: +420-461 22 748, e-mail: cechova@ooz.zeus.cz, lydie.cechova@zeus.cz)

DENMARK

Kristian KRISTENSEN, Biometry Research Unit, Department of Agricultural Systems, Danish Institute of Agricultural Sciences, Postbox 50, 8830 Tjele (tel.: +45 8999-1201, fax: +45 8999-1200, e-mail: kristian.kristensen@agrsci.dk)

FINLAND

Kaarina PAAVILAINEN (Ms.), Ministry of Agriculture, Plant Production Inspection Centre (KTTK), Seed Testing Department, P.O. Box 111, 32201 Loimaa (tel.: +358 2 760 56 247, fax: +358 2 760 56 222, e-mail: kaarina.paavilainen@kttk.fi)

FRANCE

Vincent GENSOLLEN, Groupe d'étude et de contrôle des variétés et des semences (GEVES), 711, Rue JF Breton F34090 Montpellier (tel.: +33-4 67 04 35 85, fax: +33-4 67 63 37 58, e-mail: vincent.gensollen@geves.fr)

Sylvain GRÉGOIRE, Groupe d'étude et de contrôle des variétés et des semences (GEVES), La Minière, F-78995 Guyancourt Cedex (tel.: +33-1 30 83 36 00, fax: +33-1 30 57 01 47, e-mail: sylvain.gregoire@geves.fr)

GERMANY

Uwe MEYER, Bundessortenamt, Osterfelddamm 80, 30627 Hannover, (tel.: +49 511 956-6639, fax: +49-511-56 3362, e-mail: uwe.meyer@bundessortenamt.de)

Beate RÜCKER (Mrs.), Bundessortenamt, Osterfelddamm 80, 30627 Hannover, (tel.: +49-511-956 66 39, fax: +49-511-56 33 62, e-mail: beate.ruecker@bundessortenamt.de)

HUNGARY

Zoltán VERESS, National Institute for Agricultural Qualification (NIAQC), H-1024 Budapest, Keleti Károly u-24 (tel.: +36 1 212 3127, fax: +36 1 212 5800, e-mail: veressz@ommi.hu)

KENYA

Evans O. SIKINYI, Registrar, Plant Breeders' Rights Office, Kenya Plant Health Inspectorate Service, Headquarters - Waiyaki Way, P.O. Box 49592, Nairobi (tel.: +254 2 44 00 87 fax: +254 2 44 89 40 e-mail: kephis@nbnet.co.ke)

MEXICO

Rodrigo AVELDAÑO SALAZAR, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), Serapio Rendón No. 83, San Rafael, 06470 México, D.F., (tel.: +52 55 5140-1651, fax: +52 55 5546-9020).

Miguel ÁVILA PERCHES, Centro de Investigación Regional del Centro (CIRCE), Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP). Km. 4.5 Carretera Toluca-Morelia, Paseo Presidente Adolfo López Mateos s/n, 00350 Zinacantepec, Estado de México (tel.: +52 722 232-4555, fax: +52 722 232-4555).

Aquiles CARBALLO CARBALLO, Professor–Investigator, Colegio de Postgraduados (CP), Km. 35.5 Carretera México–Texcoco, 56230 Montecillo, Estado de México (tel.: +52 55 5804 5900, fax +52 55 5804-5962, e-mail: carballo@colpos.colpos.mx).

Fernando CASTILLO GONZÁLEZ, Professor–Investigator, Colegio de Postgraduados (CP), Km. 35.5 Carretera México–Texcoco, 56230 Montecillo, Estado de México (tel.: +52 595 952-0257, fax +52 55 5804-5962, e-mail: fcastillo@colpos.colpos.mx).

Enriqueta MOLINA MACÍAS (Ms.), Servicio Nacional de Inspección y Certificación de Semillas (SNICS), Av. Presidente Juárez Núm. 13 Col. El Cortijo, 54000 Tlalnepantla, Estado de México (tel.: +52 55 5384 2213, fax: +52 55 5390 1441, e-mail: enriqueta.molina@webtelmex.net.mx).

Porfirio RAMÍREZ VALLEJO, Professor–Investigator, Colegio de Postgraduados (CP), Km. 35.5 Carretera México–Texcoco, 56230 Montecillo, Estado de México (tel.: +52 595 952-0257, fax +52 55 5804-5962, e-mail: ramirez@colpos.colpos.mx).

Juan VIRGEN VARGAS, Campo Experimental Valle de México (CEVAMEX), Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), Apartado Postal 10, 56230 Chapingo, Estado de México (tel.: +52 595 954-2877 ext. 137, fax: +52 954-6528, e-mail: jvirgen_vargas@hotmail.com).

Áureo ZAGAL, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), Serapio Rendón No. 83, San Rafael, 06470 México, D.F., (tel.: +52 55 5140-1651, fax: +52 55 5546-9020).

NETHERLANDS

Paul KEIZER, Prof. Onopark 162, 6716, EB EDE (tel.: +318 630347, e-mail: l.c.p.keizer@plant.wag-ur.nl)

Jac THISSEN, Veldheimweg 40, 6871 CD Renhum (tel.: +317 476936, e-mail: j.t.n.m.thissen@plant.wag-ur.nl)

POLAND

Wieslaw PILARCZYK, COBORU, Research Center for Cultivar Testing, 63-022 Slupia Wielka (tel.: +48 61 28 52 341, fax +48 61 53 558, e-mail: wpilar@owl.au.poznan.pl).

UNITED KINGDOM

Adrian ROBERTS, Biomathematics & Statistics Scotland (BioSS), The University of Edinburgh, The King's Buildings (JCMB) Edinburgh EH9 3JZ (tel.: +44 131 650 4893, fax: +44 131 650 4901, adrian@bioss.sari.ac.uk)

Sally WATSON (Mrs.), School of Agriculture and Food Science, The Queen's University of Belfast, Newforge Lane, Belfast BT9 5PX (tel.: +44-2890-255 292, fax: +44-02890-255 008, e-mail: sally.watson@dardni.gov.uk)

II. OFFICER

Wieslaw PILARCZYK, Chairman

III. OFFICE OF UPOV

Raimundo LAVIGNOLLE, Senior Counsellor, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland (tel. +41-22-338 9565, fax +41-22-733 0336, e-mail: raimundo.lavignolle@.upov.int)

[End of Annex and of document]