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UPOV

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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

TECHNICAL WORKING PARTY FOR AGRICULTURAL CROPS

Twenty-fourth Session

Hanover, Germany, June 20 to 22, 1995

REPORT

adopted by the Technical Working Party for Agricultural Crops

Opening of the Session

1. The twenty-fourth session of the Technical Working Party for Agricultural Crops (hereinafter referred to as "the Working Party") was held in Hanover, Germany, from June 20 to 22, 1995. The list of participants is reproduced as Annex I to this report.

2. Mr. R. Elsner, President of the Federal Plant Varieties Office, welcomed the participants to his office in Hanover. The session was opened by the Chairman, Mr. H. Ghijsen (Netherlands).

Adoption of the Agenda

3. The Working Party adopted the agenda of its twenty-fourth session as reproduced in document TWA/24/1 after having agreed to discuss under item 6 also some questions of electrophoresis in wheat.

Short Reports on Special Developments in Plant Variety Protection in Agricultural Crops

4. The Working Party received from some of its experts short reports on recent developments in their countries. The expert from Germany reported on the testing of some new species such as camelina, saflor, poppy and hemp. The expert from France reported on an application of a GMO variety of maize and emphasized that it was important that the applicant stated the fact that his variety was a GMO and that he had satisfied the requirements defined at national level concerning the risks connected with the dissemination of that type of varieties.

Important Decisions Taken During the Last Sessions of the Technical Working Party and the Technical Committee

5. The Working Party referred to the report on its last session as reproduced in document TWA/23/16.

6. Mr. Thiele-Wittig gave a brief report on the main items discussed during the previous session of the Technical Committee and referred participants, needing further details, to the full report reproduced in document TC/31/6.

7. UPOV Documents in Electronic Form: The Working Party noted that the Technical Committee had requested that a survey should be made in order to inquire who would be interested in documents in electronic form and for which purpose they would be needed, before asking the Office of UPOV to keep the electronic version of documents in full agreement with the printed versions. It also noted the proposal of the TWC to the Technical Committee that UPOV should make available Test Guidelines in electronic form via e-mail and supported that suggestion.

8. List of species admitted for certification but for which no UPOV Test Guidelines as yet exist: The Working Party recalled that the Organisation for Economic Cooperation and Development (OECD) had discussed the question of new agricultural species on the list of species admitted for certification but for which no UPOV Test Guidelines as yet existed. It also noted that, while the list was a rather long one, the number of species on it for which ten or more varieties were mentioned amounted to 24 only. The Working Party further noted that the Technical Committee had requested it to consider whether it would be useful to establish UPOV Test Guidelines for certain of those species. It finally agreed that because of its tight agenda for the further session it could only plan to establish Test Guidelines for *Bromus* and for *Lotus*.

9. Definition of Off-Type: The Working Party noted that the Technical Committee had agreed to the conclusion of the TWO that each plant which showed a mutation in parts of its organs was considered to be an off-type. It also noted that the TWO had reported to the Technical Committee that it would make no difference between admixtures and other off-types but disagreed with that decision as far as the crops of its group were concerned. Genetically unrelated plants or plants very clearly not belonging to the variety would not be counted as off-types.

10. Working Procedure for Establishing Test Guidelines: The Working Party noted that the Technical Committee had recommended that, in the preparation of new or revised Test Guidelines, there should be at least two responsible experts/countries and not just one as at present, especially in small crops where large subgroups were not justified, so as to ensure that work would continue even if a responsible expert was prevented from attending a given session of a Working Party. It also had agreed that in future new drafts would be presented to the Editorial Committee at the

same time as they were sent to the professional organizations for comments and that the Editorial Committee would not limit itself to highlighting linguistic discrepancies but would also ensure that UPOV concepts were maintained in the documents, would highlight where this was not the case, and would propose as far as possible solutions to any such shortcomings.

11. List of Species in Which Practical Technical Knowledge has been Acquired: The Working Party noted that the Technical Committee had requested that the present document TWO/27/13 comprising a list of species of ornamental plants tested in the UPOV member States should be extended to cover all species in which practical knowledge has been acquired in the member States. It further noted that a new Circular had been issued to collect that information. Some experts considered that information of special importance for new species.

12. Use of Disease Resistance Characteristics in Distinctness Testing: The Working Party noted that the Technical Committee had agreed that disease resistance and tolerance characteristics were acceptable for the establishing of distinctness if they fulfilled the same requirements for acceptance as any other characteristic. It had also agreed to the following definitions:

Resistance: The ability of a variety or of a mono-specific population to limit the activities of a given pest or pathogen throughout the whole or a part of a growing cycle. Several resistance levels may generally be defined.

Susceptibility: Susceptibility corresponds to a zero-resistance level of a variety or population with respect to a given pest or pathogen.

Tolerance: Ability of a variety or population to tolerate the development of a pest or pathogen whilst displaying disorders that are without serious consequences for their growth, appearance or yield.

UPOV Central Computerized Data Base

13. The Working Party noted the latest stage of preparation of the UPOV central computerized data base on CD-ROM as set forth in Circular U 2229 dated February 24, 1995. The Office of UPOV had invited all its member States to submit data for the envisaged UPOV-ROM Demonstration Disk by April 15, 1995. It had received data from 15 States (Argentina, Austria, Canada, Denmark, France, Germany, Hungary, Israel, Japan, New Zealand, Netherlands, Spain, Sweden, United Kingdom, United States of America (PVPO and PTO). The Office of UPOV, with the help of experts from WIPO, had checked the data received and requested, where necessary and possible, corrections from some countries. Thereafter, all data were submitted to JOUVE for the preparation of the above-mentioned UPOV-ROM Demonstration Disk. The Working Party also noted the existence of Circular U 2277 containing a list of open questions on the UPOV-ROM Demonstration Disk. All experts were invited to check that list and send their comments or proposed answers to the Office of UPOV.

14. The experts from the breeders asked that UPOV should make available the UPOV-ROM Demonstration Disk also to breeders.

Survey on the Use of Electrophoresis

15. Electrophoretic Characteristics in General: The Working Party noted that the majority of the Technical Committee had been of the view that it was not possible to establish distinctness solely on the basis of a difference found in a characteristic derived by using electrophoresis and that such characteristics should therefore only be used as a complement to other differences in morphological or physiological characteristics. It noted that the Technical Committee had decided to take these characteristics out of the main text of the Test Guidelines and to place them in an Annex, thereby creating a special category of characteristic and that the Test Guidelines should state that these characteristics were considered useful but that they might not be sufficient on their own to establish distinctness and thus should not be used as a routine characteristic but only at the request or with the agreement of the applicant for the candidate variety.

16. Potato: The Working Party recalled document TWA/23/9 containing a survey prepared by experts from Germany on the use of electrophoresis in potatoes and some additional information on that document given by the electrophoresis expert from Germany. It also noted that a subgroup meeting on potato had been planned in Hanover, Germany, on November 22 and 23, 1994. Due to a lack of sufficient interest and few announced participants, the meeting had finally been canceled. The majority of the Working Party took the view that the existing 50 characteristics in the Test Guidelines are sufficient to distinguish all varieties up to now. The Working Party noted that only Germany used characteristics derived by electrophoresis for distinctness purposes although so far no variety had been granted protection on the basis of electrophoretic characteristics alone. Some other countries used electrophoresis only for identification purposes. While the experts from Germany reported that they had obtained agreement from the German breeders to their procedure the breeder present during the session opposed the use of electrophoresis for distinctness, especially for routine use. It should only be used as the last resort.

17. The question arose on the meaning of last resort. Was it meant as opposed to routine characteristics or was it meant to be additional information which on its own would not be sufficient for distinctness purposes? Several experts recalled the decision of the Technical Committee on the special status of electrophoretic characteristics in which the majority had considered them not able to distinguish a variety on their own. The expert from France referred to their weighting of characteristics in maize which would not enable the distinguishing of varieties on electrophoretic characteristics alone.

18. *Poa pratensis*: The Working Party noted explanations given by experts from the Netherlands on the use of electrophoresis in *Poa pratensis*, on the basis of a publication, the summary of which is reproduced in Annex IV to this report. *Poa pratensis* being an apomictic species, although propagated as seed, could be compared with vegetatively propagated species. The report concluded that for *Poa pratensis an* electroferogram (i) could be regarded as a unique combination of characteristics and (ii) could be used as an identification label for selecting similar reference varieties. Morphological characteristics had a better distinguishing ability and thus electrophoresis was not necessary for distinctness purposes. The combination of morphological characteristics with electrophoretograms gave a strong evidence of the variety identity.

19. In the Netherlands, an inventory for the existing varieties with respect to their electroferograms had been made to facilitate the selection of the correct reference varieties and to reduce their number and thus the costs of the test. Electrophoresis would thus facilitate the organization of the trials.

20. The expert from Germany referred to the fact that electrophoresis characteristics were broadly used in commerce for several species. It was his opinion that the tools used to identify a variety after the granting of protection should be the same as the tool used for the testing and granting of the right. Several experts considered the question not to be a technical one but only a legal one. The use of tools for post control and certification of a variety should not be the concern of UPOV. The variety was defined by the description established at the time of granting the right and by the plant material. If, after the grant, additional characteristics were used as routine, the variety description would have to be extended for those characteristics. The description would thus change all the time at any introduction of a new characteristic. What was protected was the variety represented by the plant material and not the description.

21. The Working Party finally concluded that for *Poa pratensis* electrophoresis was at present not needed for the distinguishing of varieties. The use of electrophoresis for identification purposes, for the layout of the trials in the field or for the elimination of certain reference varieties to cut down the cost of testing would require further studying, especially with respect to what data would be used, how and what distance inside a given characteristic was applied.

22. The expert from France will prepare a paper on the use of electrophoresis in the layout of tests and in the testing of maize, the expert from the Netherlands on the use of electrophoresis in the layout of tests and in the handling of the testing of *Poa pratensis* and of potato, including the procedures, the limitations and the precautions taken.

23. Ryegrass: The Working Party noted document TWA/24/5 on Possible Application of Electrophoresis to the Registration of Ryegrass Varieties prepared by experts from the United Kingdom and document TWA/24/7 on SGE Method for Analysis of Isoenzymes from *Lolium perenne* and *Lolium multiflorum* prepared by experts from France. While document TWA/24/7 described the SGE method mentioned, document TWA/24/5 discussed the possibilities with respect to ryegrass, examining some of the important principles particularly with respect to uniformity, setting out the advantages and disadvantages of the application of electrophoretic examinations to the crop and finally considering systems and methods which might be acceptable to UPOV for variety registration purposes. Unlike wheat and barley (self-fertilized) or maize (F1 hybrid), for which UPOV had already accepted electrophoretic methods, varieties of ryegrass, a cross-fertilized crop, were, in effect, populations of plants kept within limits true to description by careful initial selection and delineation of their founder populations within specific ranges of variation for a number of characteristics. Careful isolation and limitation of the number of generations during multiplication were then also necessary to maintain genetic stability and varietal identity. The concept of uniformity as applied to clonal and self-fertilized crops, to F1 hybrids and even to apomictic crops was therefore not appropriate. The document made a comparison of the uniformity concept applied to various broad groupings of crop types according to crop type, nature of varieties and uniformity/disuniformity: (i) Vegetatively propagated crops with clones and identical plants or off-types; (ii) Apomictically propagated crops with clones and identical plants or off-types; (iii) F1 hybrids with F1 generation and identical plants or off-types; (iv) Self-fertilized crops with inbred lines and identical plants or off-types; (v) Cross-fertilized crops with populations and limits to variability.

24. While for Poa pratensis (an apomictic crop) the conventional uniformity standards and principles already defined for clonal self-fertilized and F1 hybrid crops could probably be applied without difficulty, for ryegrass the consideration of the use of electrophoresis for the registration of varieties involved a decision of principle. The concept of uniformity within ryegrass had so far

been applied only to discontinuous morphological or physiological characteristics. The only presence/absence characteristics used for ryegrass were those applied for classification or grouping purposes only and could not be used for distinctness purposes as no varieties were considered to be totally uniform.

25. The examination of uniformity was, at least partly, made to ensure that any variety which showed a distinctive characteristic for registration would maintain that distinctive feature during multiplication and commercialization. Thus, in this respect it could be claimed that it was stability or genetic equilibrium of the characteristics rather than their absolute uniformity which was essential. Most, if not all, problems would arise for ryegrass with electrophoresis if the need for absolute plant-by-plant uniformity was rigidly required. If the principle was accepted that no cross-fertilized variety was absolutely uniform either electrophoretically or morphologically, the recognition that repeatability of the differences between varieties was more important than plant-by-plant uniformity could lead to the acceptance that distinctness could be established between varieties with different but stable proportions of different genotypes. If this proposal were accepted then there would be opportunities for the use of certain electrophoretic methods in variety registration in cross-fertilized crops such as ryegrass, possibly in a similar "last resort" situation as had been accepted for certain other crops.

26. One additional aspect which particularly applied to crops such as ryegrass was the possible danger of reducing the minimum (genetic) distance between varieties and leaving open the possibility of plagiaristic selection by breeders of electrophoretic variants out of existing varieties. The views of breeders organizations would therefore be of particular importance in arriving at a conclusion on the application of electrophoretic methods to these crops.

27. The main advantages for the acceptance of electrophoresis for ryegrasses were: (i) More distinctness problems resolved even if only used as "last resort"; (ii) Potentially more rapid and less expensive testing system; (iii) Permanent descriptions provided - independent of environment; (iv) "Bred-in" distinctness possible. The main disadvantages were: (i) Possible erosion of genetic distance and breeders' protection; (ii) Replacement of existing systems not possible - morphological uniformity required; (iii) Extra uniformity requirements through to maintenance in some cases. The methods used could be classified into two main types: (i) General protein examinations (storage proteins); (ii) Specific protein loci examinations (isozymes).

28. Mr. Camlin concluded by recommending the use of PGI/2 genotype frequencies as a means, in a last resort situation of distinguishing between varieties for registration purposes, subject to the satisfactory resolution of the minimum distance, essential derivation and plagiarism concerns. At the same time consultation with ASSINSEL should begin to determine their views on these issues.

29. The breeder present during the session reported that the question of plagiarism had been discussed during the last ASSINSEL Congress in Argentina. A pilot study had been made for tomato, and another one may be made for ryegrass.

30. The expert from France made a certain reservation to the reasons for judging uniformity (see paragraph 25). Uniformity was not essentially checked to ensure stability. In his opinion the judgment of uniformity in these species consisted in an evaluation of relative intravarietal uniformity which, compared to the intraspecific variability, allowed to judge the pertinence of the characteristic concerned for the distinguishing of the variety. The Working Party finally concluded that the use of electrophoresis for cross-fertilized species should follow exactly the same rules as agreed for wheat, barley and maize. The characteristics obtained by the use of electrophoresis

would be placed in an annex to the respective Test Guidelines. They would be additional characteristics of a special category with certain restrictions (e.g. they would only be used to confirm a difference seen by the crop expert and they would alone not be sufficient to establish distinctness and would not be used as a routine characteristic).

31. The expert from the United Kingdom would prepare by the end of February 1996, on the basis of document TWA/24/7 and in cooperation with the expert from France, a draft for an annex to be added to the Test Guidelines for Ryegrass. The draft should then follow the same procedure as draft Test Guidelines normally follow.

32. The French expert considered whether the chi-squared test or alternatives should be studied as a tool to organize the DUS work in the field and on the influence of frequencies on the distance of varieties. He proposed to prepare a document in cooperation with his national statistician and the chairman of the TWC.

33. Timothy: The Working Party noted a report from experts from France on the use of electrophoresis in timothy. In studying the possible use of the esterase method, it appeared that timothy was a rather difficult species. It was a cross-fertilized species and only bulk samples could be used. So far the method could only be used as a control. Forty-one bands would be available and not only the absence or presence but also the band intensity could be used. So far in France 50 to 60 varieties of timothy existed which could all be separated by that method. If the number were to increase (e.g. to 200) difficulties might arise.

34. The Working Party noted that there were three possible uses of electrophoresis: (i) As a help in the organization of the trials; (ii) As a means of preselection to limit the number of reference varieties in the trial and (iii) For DUS purposes.

35. With respect to use for DUS purposes, several experts repeated the decision taken by the Technical Committee. Some experts considered whether several problems preventing use on its own for distinctness were rather questions or problems related to the principle of whether monogenetic characteristics should or should not be acceptable as single characteristics to establish distinctness. The problem, however, was that also many morphological characteristics were monogenetic but for many of them genetic knowledge was still missing. That should not, however, be a reason not to discuss that possibility. Otherwise the whole system of plant variety protection might be in danger of being destroyed. The expert from France agreed to prepare a new paper for the next session.

36. Wheat: The Working Party noted that new alleles had appeared in new varieties and it was thus necessary to amend or complete some of the electrophoretic characteristics in the recently published Test Guidelines for Wheat. The Working Party reconfirmed the procedure envisaged in the past by the Cereal Subgroup for such cases. The existence of any new allele had to be confirmed through ring tests on the same plant material by at least three laboratories. Thereafter, a draft Addendum to the adopted Test Guidelines for the species concerned would have to be prepared containing: (i) a standard sample; (ii) a photo of the new allele and (iii) a description of the bands concerned. That draft addendum should then follow the normal procedure for drafts for revised or new Test Guidelines. The expert from Germany would prepare by the end of the year a first draft of new alleles of wheat for discussion during the next session. The expert from the United Kingdom will prepare a similar draft with new alleles of barley and the expert from France with new alleles of maize.

Statistical Methods

37. Ear rows/drilled plots: The Working Party noted that the experts from the Netherlands would not be able to prepare a paper on that subject until the next session of the Working Party.

38. Combination of documents TC/30/4 and TWC/11/16: The Working Party noted that as a result of the discussions on the documents TC/30/4 and TWC/11/16 the TWC had realized that the quality of statistical papers in general was essential for the good understanding and acceptance of a method. It was thus necessary to improve documents in general. It will therefore rewrite the COYD and COYU method and document TWC/11/16. In the document on the COYD method the comparisons with other methods would be removed, the figures improved and explanations to the figures added. Document TWC/11/16 would be reworded to stand on its own; it will be extended to cover more than one test; the drawings would be presented with actual points, not in continuing curves; concrete cases would be added, especially for very low sample sizes (e.g. four or six plants in case of vegetatively propagated species). All documents would comprise a definition of the statistical terms used in the document; if possible, the definitions would be copied from existing references to be indicated.

39. The TWC will in addition prepare several papers on the population standard in order to facilitate finding the right standard for a given species.

40. Application of COYD to self-fertilized crops: The Working Party had a lengthy discussion on whether the COYD and COYU analysis developed for cross-fertilized species could also be applied to self-fertilized species. Some experts saw no difficulty in applying the COYD method to self-fertilized species but not the COYU method. As both methods had to be applied in parallel it foresaw problems. The statistical expert from Germany explained that the situation between cross-fertilized and self-fertilized species was different. In cross-fertilized species a higher number of plants was observed with replications and there was a genetic variation from plant to plant and a variation caused by environment. In self-fertilized species there were rather uniform plants, only environmental variation, only one replication and only few plants, in general less than 20. It was not possible to calculate a valid LSD with one replication only.

41. The reply to that proposal was that the present way of handling agricultural self-fertilized species would not allow the application of statistical methods. Moreover, it was difficult to apply statistics if the trial plots were not randomized. In agricultural self-fertilized crops the decision was taken on the basis of the knowledge of the crop expert by side-by-side comparisons and clear differences seen by the eye and not by statistical data. In practice, no country represented in the session really applied statistical methods in self-fertilized crops. Some of the member States not represented may, however, apply statistics to varieties of those species. The Working Party thus finally concluded that for self-fertilized crops statistical methods were not needed.

42. Sequential analysis: The Working Party noted that the TWC had prepared a document (TWC/13/17) on sequential analysis at the request of the Technical Committee and that in preparing this document it had been intended to avoid formulas, to stick to the principle of one page and one example with more information in independent parts and at different levels. The goal was to check samples of varieties for off-types whereby it had to be avoided to reject good varieties or to accept bad ones. Pages three and four of the document contained the document requested by the Technical Committee with information on the principle of the sequential analysis method and giving an illustration of that analysis with an example. The document then discussed in detail general considerations on UPOV work which reminded the basic practice of the work

carried out in UPOV and which it was important to keep in mind when discussing the methodology. It thereafter made a comparison of different approaches with examples illustrating the sequential analysis and other common practices such as "study during one year with a fixed sample size." It finally contained additions corresponding to the different approaches with information for those who wished to know how the figures for the different examples had been obtained. The TWC had requested several of its experts to inform their national colleagues in the TWA to check the document and to inform them or the Chairman of their impressions and of the usefulness of the different parts for discussions on the subject in the Technical Committee. On the basis of those comments the Chairman would prepare a revised draft document for distribution to the Technical Committee. Some experts were of the opinion that the examples chosen, however, did not reflect the problem cases of the small samples.

43. Image Analysis: The Working Party noted that the Technical Committee had requested that a survey should be made of what had already been done in the field of image analysis and what problems had been encountered with that tool in variety testing. Some delegates had warned that it may be difficult, especially for the system of breeders' testing, to make any characteristic mandatory which could only be observed with that tool. This should also apply to any other methods which breeders themselves may find difficult to apply not only before applying for breeders' rights but also in the maintenance of the variety after the granting of protection. The results of the survey were included in Circular U 2220 and are reproduced in Annex V to this report. The Working Party also noted that the TWO will discuss the subject on September 4, 1995, and a proposal for a European Union project had been prepared as well. The Working Party agreed that it was important to standardize the taking of measurements, the storage of data and their interpretation.

44. Visual Observations: Mr. F. Laidig, Germany, reported that during its last session the TWC had discussed possibilities to help in the selection of useful visually-observed characteristics at the time of revising existing Test Guidelines, in ensuring the appropriate states of expressions in detecting correlations between characteristics and the discriminatory power of individual characteristics. So far, past data from wheat and French bean had been used. It had been proposed to select one agricultural species for which the Test Guidelines were planned to be revised to demonstrate the usefulness of the method. The Working Party agreed to use the revision of the Test Guidelines for Sunflower and to accept the help of the TWC in the right selection of characteristics and their states of expression. The experts from France and Spain will approach their national experts in the TWC and supply them with the necessary data of the past testing of sunflower varieties, discuss the results with the statistical expert and report to the Working Party during its next session.

Cooperation with breeders in the testing of varieties

45. The Working Party referred to document TWA/23/7, containing a summary of the survey on the involvement of the applicant or breeder in the examination of a variety based on trials carried out by or on behalf of the breeder, according to the conditions laid down in Annex II to document CAJ/32/10-TC/29/9, approved by the Council in 1993. It also noted that the Technical Committee had asked that the survey on the involvement of breeders or applicants in the testing of varieties be repeated so as to cover non-agricultural species also in order to have full details of the testing systems of the individual member States. It furthermore noted that under Circular U 2268 a new questionnaire, including the replies received so far, had been distributed, asking for information on

all types of crops. The end of June has been fixed as a deadline for answers. The Working Party invited all its members to reply to that Circular.

46. A breeder present in the session raised personal doubts as to whether applicants would be able to handle the whole test with the numerous example varieties. In his personal view it was not possible for an applicant to handle the whole reference collection of agricultural crops.

Final Discussion on Draft Test Guidelines for Flax, Linseed (Revision)

47. The Working Party noted the draft Test Guidelines for Flax, Linseed, as reproduced in document TG/57/4(proj.) and documents TWA/25/4 and TWA/24/9 containing comments received in writing from the United Kingdom and France. The Working Party finally made the following main changes in document TG/57/4(proj.):

(i) Table of Characteristics:

Characteristics

4 To be kept unchanged

5 To have the additional example "Hella (0) (3) "Viola (F) (5)"

6 To have "Reina" replaced by "Belinka (F)"

8 To have the bracketed remark replaced by the following "immediately after opening of flower"

9 To have the following states: "yellowish (1), salmon pink (2), greyish (3), bluish (4)" and the example variety "Reina" replaced by "Regina"

10 To keep the asterisk

12 To have the example variety "Reina" deleted

13 To have the example variety "Opaline (F)" corrected

(ii) Technical Questionnaire: To have paragraph 7.3 placed under paragraph 5.5 in the Technical Questionnaire.

(iii) Possible Additional Characteristics: The Working Party will discuss the usefulness of the following characteristics: Seed shape, petal shape, foliage color, early growth habit. That discussion should, however, not delay the adoption of the Test Guidelines.

Discussion on Working Papers on Test Guidelines

Test Guidelines for Rape Seed (Revision)

48. The Working Party noted documents TG/36/3, TWA/23/5, the report of the Subgroup TWA/24/2 and document TWA/24/3, containing a new working paper on Test Guidelines for Rape Seed.

49. The expert from Germany introduced document TWA/24/2 explaining the different subjects treated by the Subgroup on Rape Seed and reported that it had agreed to leave open which system of testing (plant rows or individual plants) should be used as it had not been possible to agree on a single variety model for rape seed.

50. The Working Party discussed at length what was more important for the definition of a variety and its testing, the genetically fixed way of reproduction of the species or the method used by the breeder to develop the variety. In rape seed, four different variety models were possible: (i) hybrids; (ii) inbred lines; (iii) self-fertilized varieties; (iv) narrow populations. The testing would depend on the model of the variety. The different variety models and the different ways of testing were partly a question of different historical development. It was expected that with the development of hybrid varieties the differences would be reduced.

51. The Working Party finally made the following main changes in document TWA/24/3:

(i) Methods and Observations: Paragraph 1 to read: "Unless otherwise indicated, in the case of plant-by-plant assessment of distinctness and stability all observations should be made on 60 plants or parts of 60 plants." At the end of paragraph 3 a sentence to be added reading: "For other types of varieties the general rules for the testing of uniformity as stated in the General Introduction to the Test Guidelines should apply."

(ii) Table of Characteristics: Characteristic 11 to have the following example varieties: Poloj (1); Sponsor; Zeus (3); Arista; Falcon (5); Orly; Emerald (7); Astor; Sparta (9)."

52. The Working Party also discussed how to handle a varietal association where a male sterile hybrid for the production of the final crop was mixed with another pollinator. While several experts were of the opinion that the varietal association was no variety but a mixture of two varieties or a plant breeding kit, some experts asked for more time to reflect on the question before taking a final decision. The whole matter was, in addition, more a legal than a technical question.

53. The expert from Germany repeated his proposal to consider, in the case of a varietal association, the variety itself, the sterile hybrid, its lines and the pollinator. The DUS of the variety could be substituted by the DUS test of the sterile hybrid. It should be aimed at having, for variety protection, the same definition of variety as for national listing.

Test Guidelines for Soya Bean (Revision)

54. The Working Party noted documents TG/80/3, TWA/22/6, TWA/23/2 Rev. and TWA/24/8. It noted the explanations given on the electrophoretic method contained in document TWA/24/8 and agreed to include the electrophoretic characteristics in an annex to the revised Test Guidelines

for Soya Bean in the same way as for wheat, barley and maize. In the absence of experts from the United States of America, the Working Party asked the experts from France to prepare for the next session of the Working Party before the end of February 1996 a new draft for revised Test Guidelines for Soya Bean on the basis of document TWA/23/2 Rev. in the normal manner as for any other UPOV Test Guidelines.

Test Guidelines for Subterranean Clover

55. The Working Party noted documents TWA/22/8 and TWA/23/6 and the fact that in the absence of an expert from Australia no new draft had been prepared. It recalled the decision of the Technical Committee that, if possible, two countries should always be involved in the preparation of revised or new Test Guidelines. It thus agreed that the expert from New Zealand would contact his colleague in Australia and that they would together prepare a new paper for the next session of the Working Party. The experts from Germany, Spain and the United Kingdom would send their comments on the present draft to the expert from New Zealand before the end of the year and the new draft would be prepared before the end of February 1996 for distribution to the members of the Working Party.

Test Guidelines for Rice (Revision)

56. The Working Party noted documents TG/16/4, TWA/23/12 Rev. and TWA/24/12, distributed during the session, and made the following main changes to document TWA/24/12:

(i) Subject of these Guidelines: To cover also hybrid varieties

(ii) Material Required: To have in paragraph 1 a sentence on hybrids added, requiring 1 kg of seed from each of the components.

(iii) Table of Characteristics:

Characteristics

5, 10, 12(a), 14, 15, 16, 19, 20, 20(a), 27 To receive an additional asterisk.

15 To have the first proposal of states deleted

27 To have the second proposal of states deleted

30 To have the states "non-glutinous, intermediate, glutinous"

30(a) To have a method for the observation added

(iv) Example Varieties: The expert from Spain to prepare by the end of the year a new draft with further example varieties for the next session.

Test Guidelines for Cotton (Revision)

57. The Working Party noted documents TG/88/3, TWA/23/14 Rev. and document TWA/24/11, distributed during the session, and made the following main changes to document TWA/24/11:

(i) Methods and Observations: To have a new paragraph inserted after paragraph 3 to read: "All leaf characteristics should be observed on the fully expanded leaf, with the exception of the leaf color which should be observed at the flowering stage."
(ii) Table of Characteristics:

Characteristics

4 To be deleted

6(e) To be kept if the expert from Israel could supply example varieties

11 To have the asterisk deleted

17(d) To receive an asterisk

24 To have the words "degree of" inserted

To have a new characteristic "Stem: color" inserted with the states "light green (1), dark green (2), red green (3)"

(iii) Example Varieties: The expert from Spain will include more example varieties and prepare a new draft for the next session by the end of the year.

Test Guidelines for Bromus

58. The Working Party noted documents TWA/23/13 and TWA/24/6 prepared by experts from France and reporting on DUS trials of *Bromus* varieties in France. Although *Bromus* was self-fertilized, France proposed that it should be treated as a cross-fertilized crop with the testing of spaced plants and with the application of the COYD and COYU analysis as (i) *Bromus* was not totally self-fertilized and (ii) breeders were the same as for perennial fodder crops (mainly synthetic varieties of cross-fertilized species) and treated *Bromus* varieties in the same way. Thus it was not possible to require complete uniformity but only relative compared with already known existing varieties. The document compared several examples of *Bromus* and *Dactylis*. It concluded that the COYD and COYU criteria as well as other statistical tests could be appropriate to check distinctness and uniformity of *Bromus* varieties even though they suppose an extra workload due to the plant-by-plant assessment of characteristics. The examples presented in the document showed that it was a good method to take into account the relative uniformity of the varieties and to facilitate the decision on distinctness.

59. The expert from France explained the reasons for the use of the COY analysis as laid down in document TWA/24/6. When testing *Bromus* varieties one had not only to take into account the reproduction method of the species in question but also the fact that the varieties were not more uniform than other cross-fertilized grass varieties as breeders would handle them in a similar way.

The way of breeding had thus to find its reflection in the testing. Breeders would introduce sister lines or group lines that were not fully identical. Some experts proposed that electrophoresis be applied to single grains to find out whether they were real mixtures. Others questioned whether the reduced uniformity resulted from the type of propagation or only from the mixing which may not form part of the type of propagation. Others raised the question whether the COYU analysis was applicable as those varieties were not in equilibrium but mixtures which the breeder had not selected stringently enough. Breeders should be asked to produce more uniform varieties.

60. The expert from France will prepare an updated draft for Test Guidelines for *Bromus* for the next session by the end of the year. That draft will also include *Bromus auleticus,* a real cross-fertilized species. The expert from Uruguay will supply the French expert with information on the species and a proposal for a list of characteristics to be tested.

Status of Test Guidelines

61. The Working Party agreed that the draft Test Guidelines for Flax, Linseed (Revision) should be sent to the Technical Committee for final adoption and that the draft Test Guidelines for Rape Seed (Revision) should be sent to the professional organizations for comments. It also agreed to rediscuss the Test Guidelines for the other species mentioned on the agenda at its next session.

Future Program, Date and Place of Next Session

62. At the invitation of the expert from Greece, the Working Party agreed to hold its twenty-fifth session in Thessaloniki, Greece, from June 11 to 14, 1996. During the session, the Working Party planned to discuss the following items:

(a) Short reports on special developments in plant variety protection in agricultural crops (oral reports)

(b) Important decisions taken during the last sessions of the Technical Working Party and the Technical Committee

(c) UPOV Central Computerized Data Base (oral report)

(d) Use of electrophoresis:

- *Poa pratensis* and potato (NL to prepare a document)
- Ryegrass (GB to prepare a document)
- Timothy (FR to prepare a document)

(e) New alleles for certain species:

- Wheat (DE to prepare a document)
- Barley (GB to prepare a document)
- Maize (FR to prepare a document)

(f) Statistical methods

- Ear rows/drilled plots (NL to prepare a document for the TWA and TWC)
- Combination of documents TC/30/4 and TWC/11/16 (results from the discussion in the TWC)
- Application of COYD to self-fertilized crops (advice requested from the TWC)
- Chi-squared test or other test for organizing field tests (FR to prepare a document)
- Visually-assessed characteristics (FR/ES to report on the results of the application of statistical methods to sunflower).
- Sequential analysis (document prepared by the TWC for the Technical Committee)
- Image analysis (results from the TWC and TWO)

(g) Cooperation with breeders in the testing of varieties (TWA/22/12 and UPOV to prepare a new document)

(h) Final discussion on draft Test Guidelines for Rape Seed (Revision) (TG/36/4(proj.))

(i) Discussion on working papers on Test Guidelines for:

- Rice (Revision) (TG/16/4, TWA/24/12, ES/UY to prepare a new document)
- Cotton (Revision) (TG/88/3, TWA/24/11, ES to prepare a new document)
- *Bromus* (TWA/23/13, TWA/24/6, FR/UY to prepare a document).
- Soya Bean (Revision) (TG/80/3, TWA/23/2 Rev., TWA/24/8, FR to prepare a new document)
- Subterranean Clover (TWA/22/8, TWA/23/6, NZ/AU to prepare a new document)
- Sunflower (Revision) (TG/81/3, FR/ES to prepare a new document)
- Tobacco (FR/GR to prepare a document)
- Lotus (GB/UY to prepare a document)

63. The Working Party already noted an invitation to hold its session in 1997 in Uruguay and in 1998 in Sweden.

Visits

64. In the afternoon of June 20, the Working Party visited the seed store and the saflor trial fields at the headquarters of the Bundessortenamt. On June 21, 1995, the Working Group visited the testing station and the trial fields at Rethmar.

65. *The present report has been adopted by correspondence.*

[Five Annexes follow]

ANNEX I

LIST OF PARTICIPANTS AT THE TWENTY-FOURTH SESSION OF THE TECHNICAL WORKING PARTY FOR AGRICULTURAL CROPS HANOVER, GERMANY, JUNE 20 TO 22, 1995

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[Annex II follows]

Annex II

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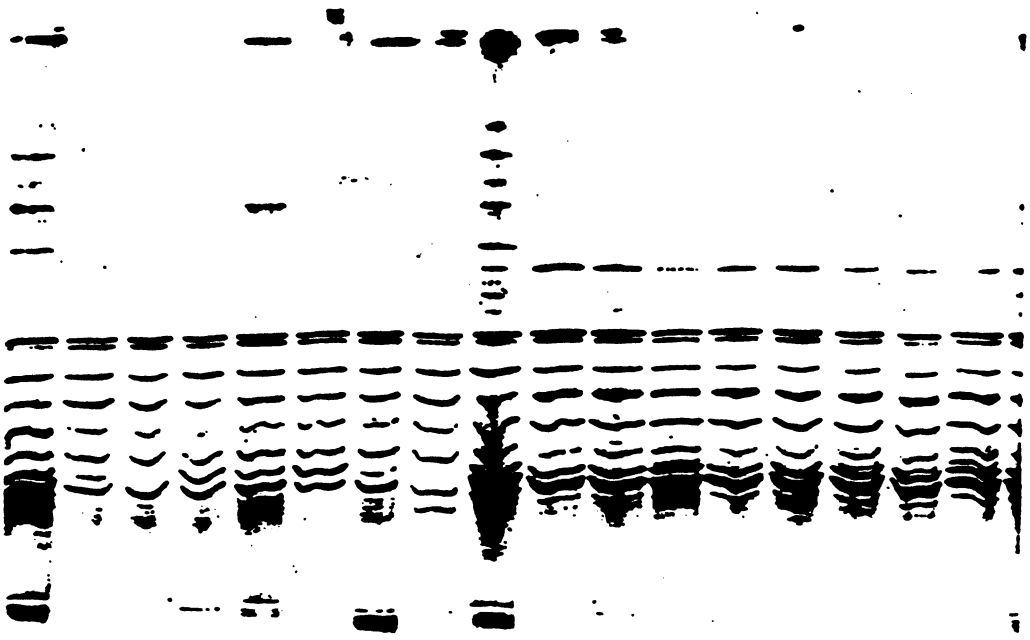
[Annex III follows]

ANNEX III

ELECTROFORESIS AS AN EXTRA TOOL

Quick technique



Similar and identical varieties with an identical electroferogram (Bulk: seed mixtures of standard varieties)

Pedigree seed of ten plants from a candidate. Plant 2 and 5 were suspected off-types, caused by a disease attack

In an apomictic crop like Kentucky bluegrass electroforesis has shown its potential for a quick and reliable identification method of genotypes. This is useful to facilitate and affirm the D.U.S. (Distinctness, Uniformity and Stability) testing for registration and Plant Breeders' Rights. Moreover, it can be used in seed certification and control of seed mixtures.

H.C.H. Ghijsen, D. Kleingeltink, G.v.d. Wardt

Kentucky bluegrass or smooth stalked meadowgrass (*Poa pratensis*), is widely used in the USA and western Europe as a turf grass for home lawns and sport fields. The long rhizomes of the species make it very attractive for sod growers. There are great variety differences in disease and wear resistance; general appearance and colour. The apomictic reproduction system acts like a vegetative propagation by the seed, which yields very uniform varieties in turf and seed production fields.

Problems of varietal uniformity however, occur regularly as sometimes the percentage of the occurring sexual reproductions is too high, leading to many off-types in seed production fields. Varieties bred by crossing mostly suffer from heterogeneity as, unavoidably, the more sexual types in the enforced crossings yield hybrid seed. Another source of breeding material is collecting plants in old turf areas like golf courses and parks. This collection work has led to the first successful, leafspot-resistant varieties like Merion and Baron in the early seventies.

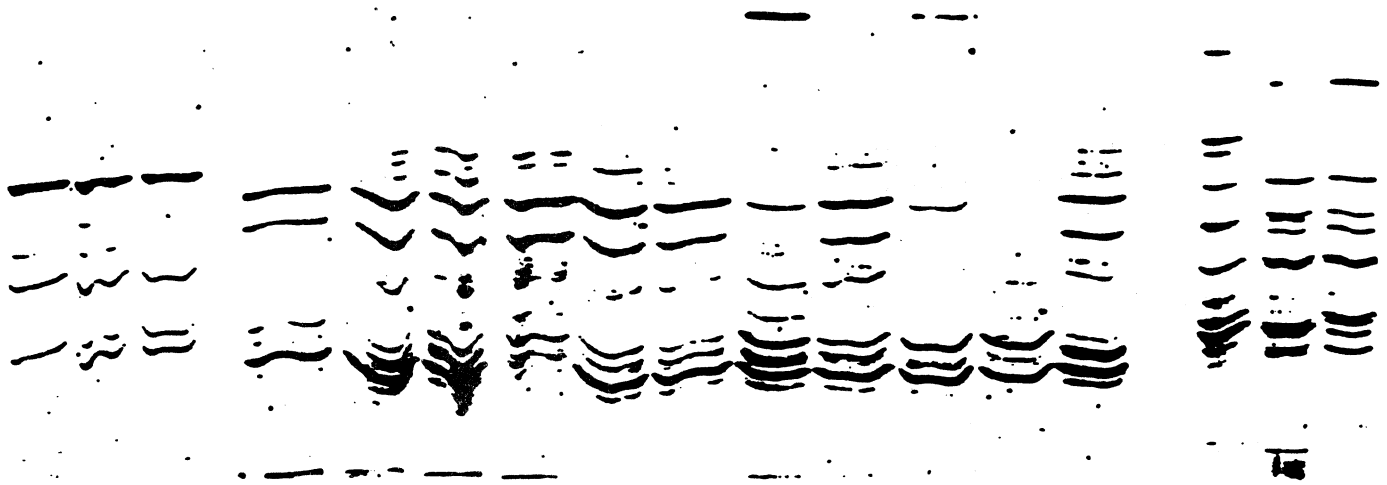
The variation in nature however seems to be limited. In the late seventies the Institute for Variety Research (RIVRO) at Wageningen, the Netherlands, received several applications for registration which were identical to well known varieties like Merion, Baron, Parade and Fylking. The origin of these duplicates was, as has been proved, different from the origin of the 'mother' varieties. This similarity has been shown in the D.U.S. and VCU trials carried out by the RIVRO. The D.U.S. is determined by twenty morphological and physiological characters of which six are established in the seedling stage.

Although no significant VCU differences have been shown between varieties that were identified as too similar in the

Table 1. Closely distinct varieties with an identical electroferogram

variety	distinct for
Nugget - Ryss	date of inflorescence emergence
Baron - Fortuna	date of inflorescence emergence
Baron - Victa	plant height
	leaf width
	growth habit
Impellia - Enoble	leaf sheath anthocyanin colour
	date of inflorescence emergence
	flagleaf length
	plant height

.entities similar varieties



Seed harvested from ten plants of a standard sample of an existing variety. Plants 7, 9 and 10 were off-types. S: original bulk standard sample

Control of the parentage of a hybrid. A and B are the parents of A x B

D.U.S. test, some pressure was felt to look for other discriminative characters. Electroforesis was a probable solution for some of the problem cases. The first results of the IEF electroforesis method, described in 1990 by F. van Dreven in Plant Varieties and Seeds, however, emphasized the D.U.S. test results. Moreover, the discriminative power of electroforesis seems to be less than that of the traditional characteristics. Nevertheless, at the Centre for Plant Breeding and Reproduction Research, the successor of the RIVRO, almost all existing bluegrass varieties (266) have been put on gel in order to look at the possibility of using the electroforesis technique as a pre-screening method in D.U.S. testing by identifying similar genotypes in an early stage. These can be grown side by side in the field trial in order to detect possible differences easier and quicker.

The experience up till now has shown that in some cases varieties that have identical electroforesis patterns can be differentiated by one or more morphological or physiological characters. There is no evidence that varieties with a different electroferogram are identical in the field, in D.U.S. as well as in VCU tests. Further experience must show whether this gives a good basis to only test the candidates in comparison with the reference varieties identified by electroforesis.

A second useful application of the electroforesis technique is the verification of off-types in the uniformity test. Sometimes, plants of one variety look different as a consequence of irregularities in the field or a disease attack. In some cases a test with electroforesis showed that these aberrant plants belonged to the same variety.

By applying electroforesis to nearly all existing varieties, it has been confirmed that several groups of identical varieties exist. This implicates that several variety names are to be regarded as synonyms.□

Table 2. Identical varieties according to electroferograms and field characters

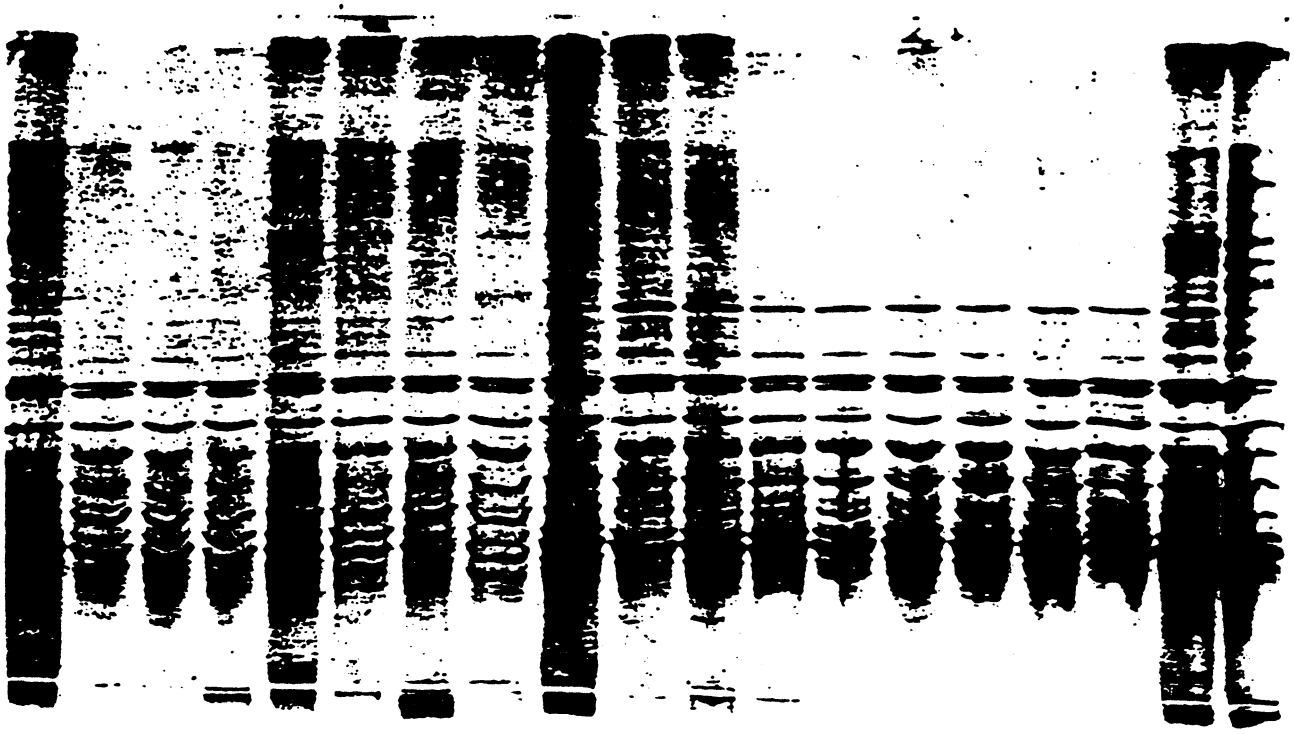
Newport Olympriap	Prime Alsa Berbi	Julia Ikone	Melba Sheba	Arnolda Topten	Enaldo Touchdown	Parade Haga Rugby Banff Classic Freedom Georgetown	Park S21 Mervel Eska 46	Victa Gnome Marquis Abbey Kelly	Merit Topform	Merion Petit	Topfit Trampas	Golf Sydsport	Coventry Star Estate Leuroba

[Annex IV follows]

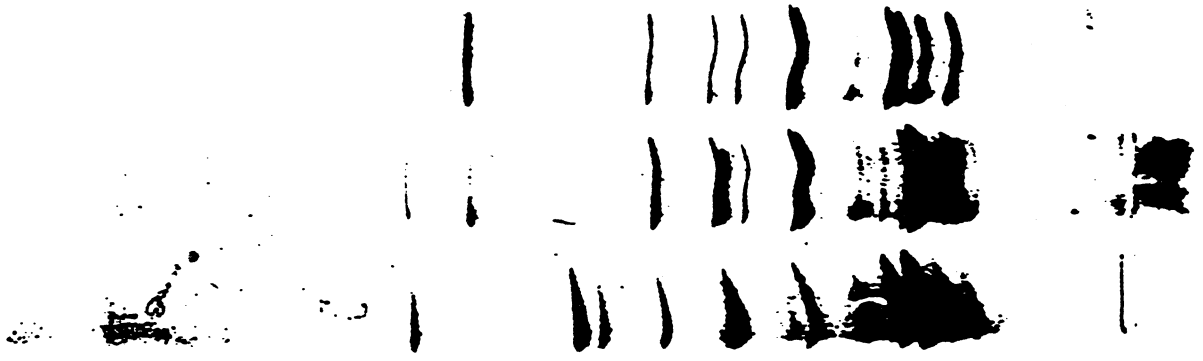
TWA/24/13

ANNEX IV

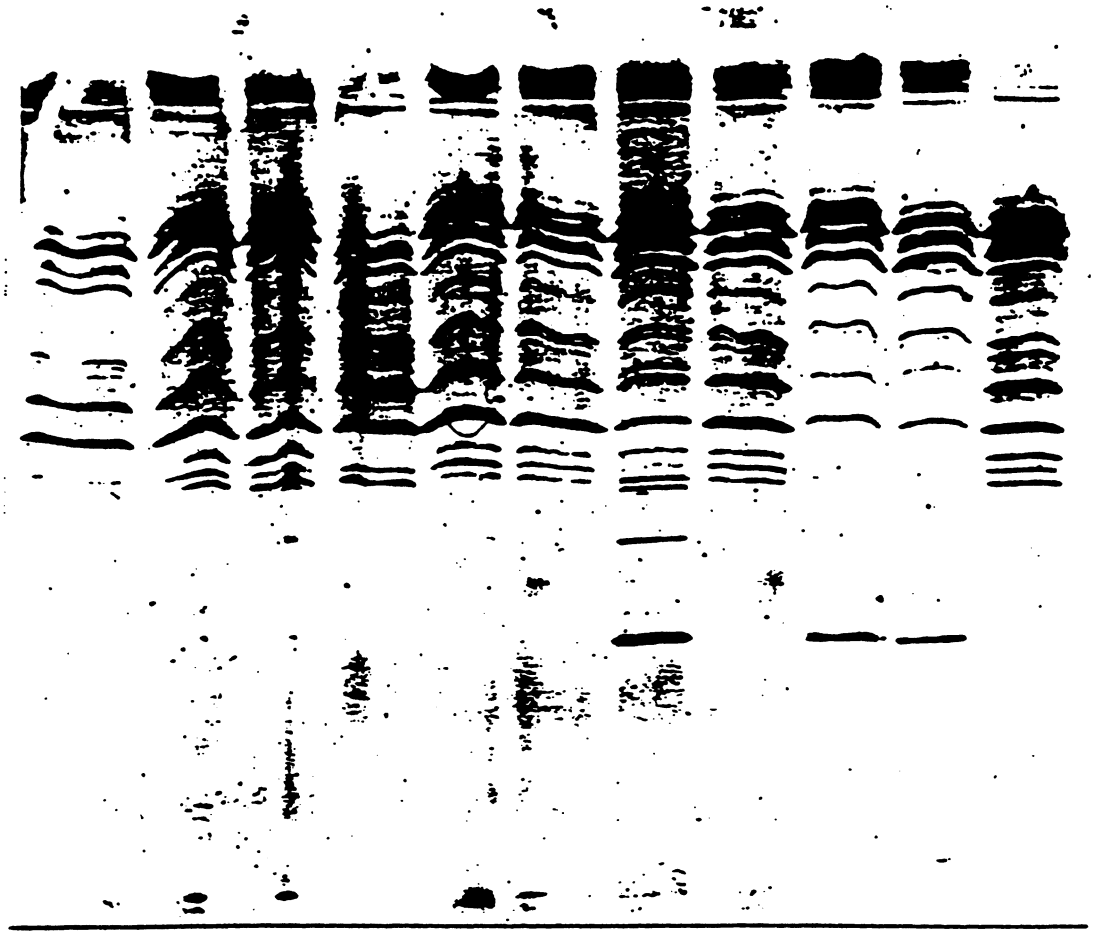
Application of the IEF-Electrophoresis in Poa pratensis

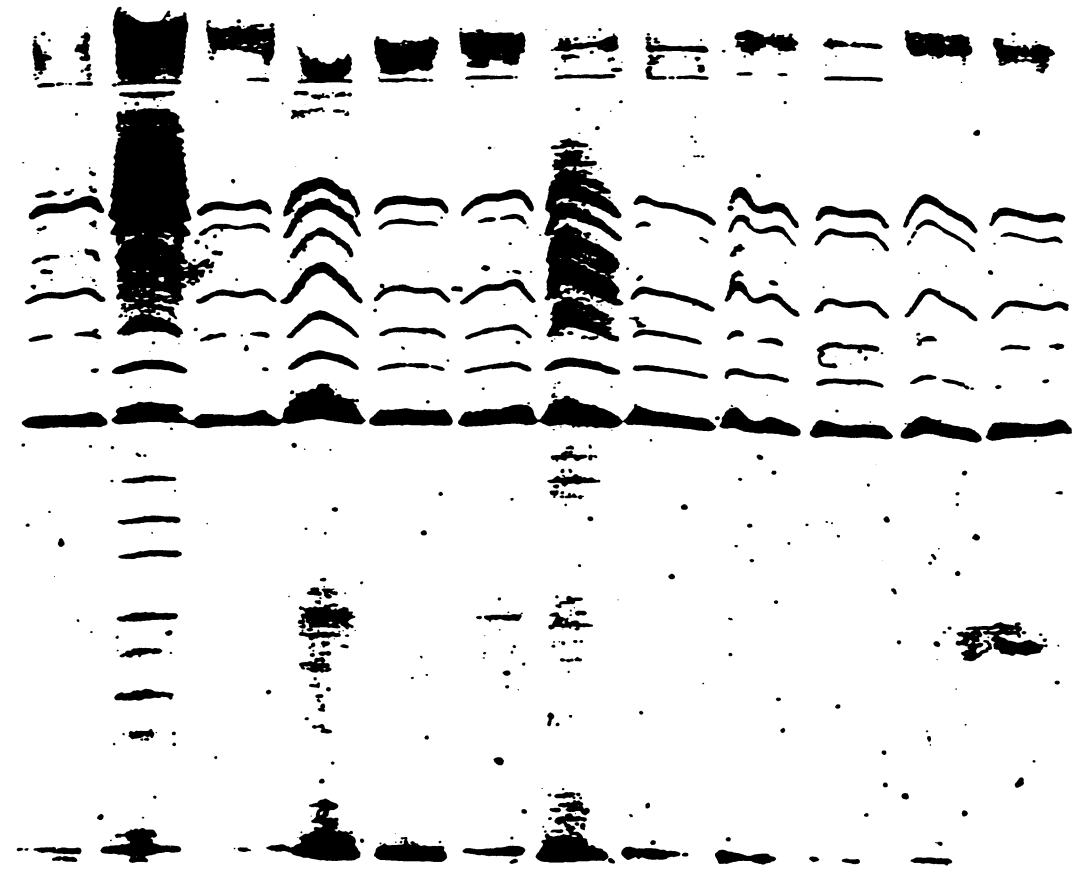


Control of Hybridization



Verification of off-types.





Poa pratensis

Identical varieties according to electroferograms and morfological characters

Newport	**Melba**	**Parade**	**Park**	**Merit**	**Golf**
Olymprisp	Sheba	Haga	S21	Topform	Sydsport
		Rugby	Mervel		
Primo	**Arnolda**	Banff	Eska 46	**Merion**	**Coventry**
Alsa	Topten	Classic		Petit	Star
Berbi		Freedom	**Victa**		Estate
	Enaldo	Georgetown	Gnome	**Topfit**	Leuroba
Julia	Touchdown		Marquis	Trampas	
Ikone			Abbey		
			Kelly		

Poa pratensis

Clearly distinct varieties with an identical electroferogram

variety	distinct for
Nugget-Ryss	date of inflorescence emergence
Baron - Fortuna	date of inflorescence emergence
Baron - Victa	plant height leaf width growth habit
Ampellia - Enoble	leaf sheath anthocyanin colour date of inflorescence emergence flagleaf length plant height

Conclusions

- Electroferogram to te regarded as a unique combination of characters

- Electroferogram can be used as an identification label for selecting similar reference varieties

- Morfological characters have a better distinguishing ability. For distinctness electrophoresis is not necessary

- The combination of morfological characters and electroferograms give a strong evidence of the varietal identity

Limiting the number of reference varieties in trials.

- Grouping
- Pre-selection

  * Description in TQ
  * Fotograph (ornamentals)
  * Expert committees

---

  * Electrophoresis
  * DNA fingerprinting

[Annex V follows]

ANNEX V

UPOV-QUESTIONNAIRE ON IMAGE ANALYSIS IN VARIETY TESTING

The results of the UPOV-Questionnaire (Annex to Circular U 2155) on Image Analysis in Variety Testing are presented. A total of 26 answers were received and all replicants are acknowledged for completing the questionnaire. The answers are summarised per question in annex 1.

GENERAL RESULTS

Based on the reactions it can be observed that image analysis (IA) is gaining more and more interest in variety testing. Two replicants apply IA in their routine variety testing and three more are investigating the possibilities. Twenty replicants (77 %) indicated to be interested in using IA, two (8 %) indicated that IA was under consideration and four (15 %) were not interested at this moment (question 7). A larger group is interested in future application.

From the answers on questions 2, 5 and 9 it can be seen (Table 1) that in two member states the same characteristics, although for different crops, are under investigation for measurement by IA.

Table 1. For some crops image analysis is applied for corresponding plant parts in the following countries.

Character	Faba Bean	French Bean
pod length	GB	NL
pod width	GB	NL
beak length	GB	NL

Hard- and software used for IA shows a difference between UPOV-members as can be seen from the answers on question 3 and 6 (Table 2).

Table 2. Hard- and software used for IA by UPOV members (BW = black-white; C=colour; CCD=charge-coupled-device).

Country/Equip.	GB-England	GB-Scotland	FR-France	NL-Netherlands
Hardware	BW-CCD PC-IBM	C-CCD SUN	C-scanner SUN	BW+C-CCD SUN+Apple+PC
Software	ITEX + Microsoft C + Visilog	Visilog	Visilog	Scil-Image

CONCLUSIONS

At this moment some countries have already started the application of IA in their routine variety testing. In addition, several other countries indicated to be interested in the application of IA in the near future. As was already concluded by the TWC on Computers and Automation at their meeting in April 1994 it would be most profitable to co-operate and standardize before research and applications of members start to diverge. Based on the answers on question 6 it can be concluded that there is already a divergence in the choice of hard- and software in the respective UPOV-members. However, we think that at this time it is still possible to standardize the equipment (more or less), using the criteria stated in document TWC/12/6. If we wait untill more countries have implemented IA, it will be much more difficult. It can also be concluded that the dissemination of research results already present needs attention to prevent as much as possible duplicate research. Besides the harmonization of the IA applications needs attention.

UPOV-Questionnaire on Image Analysis in Variety Testing 2

PROPOSAL

Based on the results of the questionnaire we propose to form a UPOV working group on Image Analysis. This working group could also expand on the work done by a previous sub-group on Colour Measurements. Fifteen replicants have indicated that they are prepared to join such a working group. This working group should be responsible for standardisation of IA-applications and dissimination of results of the various countries.

From the answers of the questionnaire it can be concluded that there are three criteria to select (a) crop(s) for standardisation of IA-applications:

1. A crop of which characteristics are already measured with IA (Table 1).
2. A crop that is already under investigation (Table 3 and 4).
3. A crop that is mentioned to be of great interest (Table 4).

Table 3. For some characteristics image analysis is being investigated for corresponding plant parts from different crops in the following countries:

Crop/character	Chrysanthemum	White Clover	Lettuce	Lucerne	Radish	Rose
leaf character	GB	N-Ireland	NL	FR	FR	FR

Table 4. Shape characteristics mentioned as being of interest or already being investigated.

Crop	Onion	Tomato	Radish	Apple	Pear	Mango	Cereals
Shape of	bulb	fruit	bulb	fruit	fruit	fruit	seed

Although this UPOV working-group will be necessary for standardisation, UPOV has no means to finance any research to develop IA-applications. We therefore depend on research efforts of individual countries. To increase these efforts, we propose to apply for a "Concerted Action" from the European Community (EC) with a limited number of countries. If this is granted, it will offer the possibility to standardize equipment and write a research project for IA-applications which can be submitted to the EC for research funding. The UPOV working group might act as a sounding board for the EC-project group.

UPOV-Questionnaire on Image Analysis in Variety Testing

ANNEX 1

The questions were:

1. Does your country apply image analysis in routine variety testing?
2. For which crops is image analysis applied and for which characteristics per crop?
3. What is the hardware and software being used for the application of image analysis?
4. Does your country do research on image analysis for variety testing?
5. Which crops are investigated, and which characteristics per crop?
6. Is the research equipment (hardware and software) different from the application equipment? If so, what is used, and why is it different?
7. Are you interested in using image analysis for variety testing in your country in the near future?
8. Are you prepared to join an international working group on image analysis if such a group would be established?
9. For which crop and characteristics do you think image analysis would be most beneficial?
10. Who should be contacted for image analysis research in your institute?
11. Is your institute using image analysis for other purposes than variety testing? If so, can you give some examples?

The following 26 answers on UPOV-Questionnaire on Image Analysis in Variety Testing were received.

Countries:	Answers to the questions:										
	1	2	3	4	5	6	7	8	9	10	11
Argentina	-	-	-	-	-	-	+	+	+	+	-
AU Australia	-	-	-	-	-	-	+	±	+	+	-
Austria	-	-	-	-	-	-	+	+	-	-	-
CH Switzerland (Fed. Agri. Res. Station)	-	-	-	-	-	-	-	-	-	-	-
CH Switzerl. (Res. Stat. Fruit-Viti- and Hort.)	-	-	-	-	-	-	-	-	-	+	-
Czech Republic	-	-	-	-	-	-	+	+	+	+	-
DE Germany	-	-	-	-	-	-	+	+	+	+	-
DK Denmark	-	-	-	-	-	-	+	+	+	+	+
ES Spain	-	-	-	-	-	-	+	-	-	+	-
Finland	-	-	-	-	-	-	-	-	-	-	-
FR France	-	-	-	+	+	-	+	+	+	+	+
France GEVES	-	-	-	+	+	-	-	-	-	-	-
GB England	+	+	+	+	+	+	+	+	+	+	±
GB Northern Ireland	-	-	-	+	+	-	+	+	+	+	+
GB Scotland	-	-	-	+	+	+	+	+	+	+	+
IE Ireland	-	-	-	-	-	-	-	-	-	+	-
IL Israel	-	-	-	-	-	-	+	+	+	+	-
IT Italy	-	-	-	-	-	-	+	+	-	+	+
JP Japan	-	-	-	-	-	-	-	+	-	+	-
Kenya	-	-	-	-	-	-	+	+	+	+	-
NL Netherlands	+	+	+	+	+	+	+	+	+	+	+
Norway	-	-	-	-	-	-	+	+	-	+	+
NZ New Zealand	-	-	-	-	-	-	±	-	+	+	-
Poland	-	-	-	-	-	-	+	-	+	+	-
SE Sweden	-	-	-	-	-	-	+	-	+	+	+
ZA South Africa	-	-	-	-	-	-	+	+	-	+	+

UPOV-Questionnaire on Image Analysis in Variety Testing

QUESTION 2: For which crops is image analysis applied and for which characteristics per crop (indicate relevant UPOV guideline and characteristic nr. if possible)?

GB England:
Faba bean, Guideline ref. TG/8/4
UPOV characters: leaf width (upov 10)
leaf length (upov 3)
pod length (upov 21)
pod width (upov 22)

NON UPOV characters: pod beak length
distance from leaf base to widest point

Oilseed rape cotyledons, Guideline ref. TG/36/3
UPOV characters: cotyledon width (upov 2)

NON UPOV char's: distance from leaf base to widest point
lobe separation
area
overall length
cotyledon length

NL Netherlands:
Onion, Guideline ref. TG/46/3
UPOV characters: bulb height (upov 9)
bulb diameter (upov 10)
bulb shape (upov 11)

NON UPOV char's: position of largest diameter

French bean, Guideline ref. TG/12/4
UPOV characters: pod length (upov 17)
pod width (upov 18)
length of the beak (upov 30)
degree of curvature (upov 26)
shape of curvature (upov 27)

Flax, Guideline ref. TG/59/3
UPOV characters: seed length
seed width

Carrot, Guideline ref. TG/49/6
UPOV characters: carrot length (upov 7)
carrot width (upov 8)

UPOV-Questionnaire on Image Analysis in Variety Testing

QUESTION 3: What is the hardware and software being used for the application of image analysis?

GB England:
Hardware IBM-PC (compatible) - software written in-house based on ITEX

NL Netherlands:
Hardware Apple-Macintosh - software written in-house based on Scil-Image 1.2

QUESTION 5: Which crops are investigated, and which characteristics per crop (indicate relevant UPOV guideline and characteristic nr. if possible)?

GB England:
Chrysanthemum: leaf characters

GB Northern Ireland:
Ryegrasses, Guideline ref. TG/04/7
UPOV characters: inflorescence: length (upov 13)
inflorescence: no. of spikelets (upov 14)
inflorescence: spikelet density (computed)

White clover, Guideline ref. TG/38/6
UPOV characters: leaf: length of central leaflet (upov 1)
leaf: width of central leaflet (upov 2)
leaf: size (- computed)
leaf: shape (- computed)
leaf: frequency of plants with white marks (upov 3)

GB Scotland:
Celery and *Brussels sprouts*
whole plant colour images

FR France:
Rose, Guideline ref. TG/11/7
UPOV characters: 23, 24, 29, 30, 31, 32, 33
NON UPOV characters: petal, position of the maximal width, perimeter area, area of the several zones of colour.

Radish, Guideline ref. TG/64/3
UPOV characters: 6, 7, 8, 11, 12, 13, 14, 19, 20, 21, 22, 23, 27

Lucerne
leaf length, width, shape, number and measurement of leaflets

FR France GEVES
Bi-dimensional electrophoresis, *Wheat, Sunflower, Alfalfa*

NL Netherlands:
Cucumis sativus, Guideline ref. TG/61/3
UPOV characters: fruit length (upov 16)
fruit width/length (upov 17)

neck (upov 20)
length of neck (upov 21)

Tomato, Guideline ref. TG/44/7
UPOV characters: fruit length/width (upov 21)
fruit shape (upov 22)

Lettuce, Guideline ref. TG/13/4
UPOV characters: leaf blistering (upov 26)

QUESTION 6: Is the research equipment (hardware and software) different from the application equipment? If so, what is used, and why is it different?

GB England:
Research and application hardware identical; Research software based on Visilog

GB Northern Ireland:
Research and application hard- and software are identical

GB Scotland:
Research equipment consists of SUN workstations and Z, Visilog and Xview software.

NL Netherlands:
Research hardware SUN (powerful); Application hardware Apple and PC (easy_to_use, price)
Research and application software are identical (Scil-Image)

QUESTION 7: Are you interested in using image analysis for variety testing in your country in the near future?

yes (17); not before 1996 (2); under consideration (1); no (3).

QUESTION 8: Are you prepared to join an international working group on image analysis if such a group would be established?

yes (14); not yet (2); no (7).

QUESTION 9: For which crop and characteristics do you think image analysis would be most beneficial, i.e. in which crop are there problems (for example shape-classification) that might be solved with image analysis?

The following crops and/or subjects were mentioned:
fruits - shape classification, apple, pear, mango
vegetables - morphological characteristics - colour distribution - shape onion, carrot, legumes
ornamentals - morphological characteristics - shape - colour distribution
fodder crops - maize, fodder beets, Ryegrasses, White Clover
cereals - shape of seeds, rye shape, Pelargonium leaf shape
mushrooms
seeds - shape classification
shape - characteristics currently visually classified
leaf shape in Brassica

UPOV-Questionnaire on Image Analysis in Variety Testing

QUESTION 10: Who should be contacted for image analysis research in your institute?

Argentina:
-Ing. Agr. R. Lavignolle. Instituto Nacional de Semillas. Paseo Colón 922 3°, (1063) Cap. Fed. Argentina, Buenos Aires.

Australia:
-Dr. H.L. Lloyd, PBR-Office, GPO Box 858, Canberra ACT 2601, Australia.

Czech Republic:
-J. Souček, SKZÚZ, Brno, Sedlec, 250 65 Líbeznice.

Denmark:
-M. Rudemo or K. Kristensen, Department of Biometry and Informatics, c/o DINA-KVL, Thorvaldsensvej 40, 1871 Frederiksberg C.

France:
-Mrs M-.H. Gandelin, Unité expérimentale de Sophia-Antipolis, ZAC Saint-Philippe, Route des Colles, 06410 Biot.

Germany:
-Dr. F. Laidig, Bundessortenamt, Osterfelddamm 80, 30627 Hannover.

Ireland:
-Dr. J. Bourke, Teagasc, Oak Park Research Centre, Carlow.

Israel:
-B. Bar-Tel, ARO, PBR-Council, P.O.B. 6, Bet Dagan 50 250.

Italy:
-Prof. A. Bergamini, Istituto Spurimentale per la Frutticoltura, 38057 Vigalzano Pergine (Trento).

Japan:
-Mr Maekawa or Mr Tanaka, MAFF, Seed & Seedlings Division, 1-2-2, Kasumigaseki, Chiyoda-ku, 150-Tokyo.

Kenya:
-J.M. Shuma, Kenya Agricultural Research Institute, National Seed Quality Control Research Center, P.O.Box 1679, Nakuru.

Netherlands:
-G.W.A.M. van der Heijden, CPRO-DLO, P.O.Box 16, 6700 AA Wageningen.

New Zealand
-C. Barneby, Plant Variety Rights Office, P.O.Box 24, Lincoln.

Norway:
-H. Sønju, Fellesbygget, 1432 Ås.

Poland:
-J. Malinowski, Research Centre for Cultivars Testing. (COBORU), 63-022 Slupia Wielka.

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Spain:
-D. Vicente Sotes, Departamento de Produccion Vegetal, E.T.S. Ingenieros Agronomos, Ciudad Universitaria, 28040 Madrid.

South Africa:
-Directorate of Plant & Quality Control, Private Bag X258, Pretoria 0001.

Sweden:
-G. Sällvik, Stateus Utsädeskontroll, Onsjövägen, S-26881, Svalöv.

United Kingdom:
-Dr. P.D. Keefe, NIAB, Huntingdon Road, Cambridge CB3 0LE.
-Dr. M.S. Camlin, Department of Agriculture for N.-Ireland, Plant Testing Station, 50 Houston Road, Crossnacreevy, Belfast BT6 9SH.
-M. Talbot, SASS, University of Edinburgh, The King's Buildings, Mayfield Road, Edinburgh EH9 3JZ.
-P. Dodd, Wye College, University of London, Wye, Ashford, Kent TN25 5AH.

QUESTION 11: Is your institute using image analysis for other purposes than variety testing? If so, can you give some examples?

The following crops and/or subjects were mentioned:
DK Denmark:
classification of weed seeds; classification weed plants at an early stage; eggs of nematodes

GB Northern Ireland:
straw characteristics in cereals, diameter, wall thickness, cell structure to examine characteristics which may be linked to straw damage-necking, brackling, lodging.

GB Scotland:
satellite imagery, body scans for measuring tissue, two-dimensional electrophoresis, soil pore analysis.

IT Italy:
leaf area analysis, apple and other species

NL Netherlands:
quantification of damage on leaves caused by insects or fungi; cell-wall characteristics of stem cells (Gerbera); measurements of calli in tissue culture; measurement of characteristics of seeds of Soy-bean; quantification of corolla shape (Potato); measurement of characteristics of mushroom.

Norway:
quality of flower plants; Filtration (?) of plant tissue affected by microorganisms

SE Sweden :
seed-scanner for routine determination of other species in cereals

ZA South Africa :
identification of seeds (SIS ready bought system)

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