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UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

TECHNICAL WORKING PARTY ON AUTOMATION AND COMPUTER PROGRAMS

Nineteenth Session
Prague, June 4 to 7, 2001

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 Working Party") held its nineteenth session in Prague, Czech Republic, from June 4 to 7, 2001. The list of participants is reproduced in Annex I to this report.

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

Adoption of the Agenda

3. The Working Party adopted the agenda as reproduced in document TWC/19/1, after having agreed to the change of order, proposed by the Chairman.

Overview of the Czech System of DUS Testing

4. Mr. Jiří Souček, Head of Department of Plant Breeders' Rights and DUS Tests, Central Institute for Supervising and Testing in Agriculture (ÚKZÚZ), gave a report on the situation and structure of DUS testing in the Czech Republic. A copy of his report appears in Annex II.

Report on Subjects of Special Interest to the Working Party Raised During the Thirty-Seventh Session of the Technical Committee and by other Technical Working Parties

5. The TWC was informed about the implementation of the new structure of the Office of the Union. It noted that since its last meeting the following staff had been incorporated in the Office of the Union; Dr. Rolf Jördens as Vice Secretary-General; Mr. Peter Button as Technical Director; Mrs. Yolanda Huerta as Legal Advisor; Mr. Makoto Tabata as Regional Officer for the Asian and Pacific Region and Mr. Paul Senghor as Regional Officer for the African and Arab Region.

6. The Technical Director informed the TWC that the Technical Working Parties during their meetings in the year 2000 had discussed several issues of interest to the Working Party. The Technical Working Party for Agricultural Crops (TWA) considered the Glossary of Statistical Terms, discussed the level of involvement of the breeder in DUS testing, the management of reference collections and decided to pursue this topic further (see documents TWA/29/9, TC/36/7, pages 55 to 61, TWA/29/19 and TWA/29/21). The Technical Working Party for Fruit Crops (TWF) discussed the number of plants required for testing fruit crops (see document TWF/31/12). The Technical Working Party for Ornamental Plants and Forest Trees (TWO) discussed the uniformity assessment of seed propagated varieties of ornamental crops (see documents TWO/33/16 and TWO/33/17). The Technical Working Party for Vegetables (TWV) discussed the selection of different types of characteristics in the UPOV Test Guidelines, and the possibility of developing a procedure for a partial updating of the Test Guidelines without the necessity to change the whole document (see document TWV/34/15).

7. The Technical Director also reported on the meetings of the *ad hoc* crop subgroups on molecular techniques for Maize, Oilseed Rape, Rose, Tomato and Wheat, which had been established by the Technical Committee at its thirty-sixth session in April 2000. The five a*d hoc* crop subgroup meetings were held in February and March 2001:

(a) *Maize and Wheat*: NIAB, Cambridge, United Kingdom, February 26 to 28, 2001
(b) *Oilseed Rape, Rose and Tomato*: GEVES, Le Magneraud, France, March 19 to 21, 2001

8. He explained that each subgroup had been invited to consider the potential for use of molecular techniques on the basis of a work program developed by the Technical Committee. He added that, in particular, each subgroup had discussed the need for the development of molecular techniques in DUS testing and considered various possible application models for molecular techniques, possible impacts of each application model and outstanding technical problems in their potential application.

9. The TWC noted that, with regard to the need for molecular techniques in DUS testing, the a*d hoc* subgroups had agreed that the greatest need for the development of molecular techniques was in the management of reference collection. Microsatellite markers had been

identified as the best available technique and Single Nucleotide Polymorphism (SNP) was mentioned as a new technique still at the initial stage of development. The subgroups agreed that further work should be focused on the harmonization of both markers and methodology. Three models for the possible introduction of molecular techniques had been proposed at the *ad hoc* subgroup meetings: 1) molecular techniques as predictors of traditional characteristics, through a direct link (gene specific marker) or as an estimator of the traditional characteristic; 2) calibration of threshold levels for molecular characteristics against the minimum distance in traditional characteristics, and 3) the development of a completely new system. The Technical Director explained that the support of the TWC might be necessary for the development of these proposals.

10. The Technical Director reported on the thirty-seventh Technical Committee meeting, which was held in Geneva from April 2 to 4, 2001, and reported on the following subjects considered to be of particular interest to the TWC: the creation of a database of variety descriptions, the development of the UPOV Code, the development of the New Revised General Introduction to the Assessment of Distinctness, Uniformity and Stability in New Varieties of Plants. The TWC also noted that the Technical Committee had given highest priority to TGP/7 and thereafter priority to the associated TGP documents TGP/4 Management of Reference Collection; TGP/7 Development of Test Guidelines; TGP/9 Examining Distinctness and TGP/10 Examining Uniformity. He finally added that the Technical Committee had proposed Mr. Mike Camlin and Mrs. Julia Borys, as its Chairman and Vice Chairman respectively, to the Council which would consider this proposal during its session in October 2002.

Report on New Developments in Member States

11. The Working Party received short reports on plant variety protection from a number of countries. The expert from Poland reported that a new Seed Law had been passed in October 2000. The expert from Ukraine reported on the development of a database and the advance work for the preparation of national test guidelines for wheat (winter and spring types), maize and potato. The expert from Colombia said that they had a new database under preparation. The expert from Mexico reported on the organization of local activities with the aim of explaining the concept of plant variety protection within UPOV, the improvement of the DUS field trials with the aim of obtaining data of better quality and explained that they were in the process of identifying laboratories that could perform DNA analysis for the purpose of technical examination of varieties in the future. The expert from Romania reminded the TWC that, as from March 16, 2001, her country had become a UPOV member State. She said that a national database had been created, that a Seed Law had been presented to Parliament and that training activities for technical examiners had been set up. The expert from Slovenia said that a new Seed Law had been introduced to Parliament. The expert from Germany reported on the successful introduction of new software in 2001. The expert from France reported on developments in 2001 with the ORACLE database, which had become accessible to experts of all the national testing stations.

Uniformity

12. Methods for testing uniformity on characteristics where samples have been bulked. The expert from Denmark introduced document TWC/19/7 which proposed some possible methods for carrying out a uniformity test. The document recalled that the within plot

standard deviation between individual plants was used as a measurement of uniformity and it proposed that its components could be calculated and used to show the change in the Least Significant Difference (LSD) that could be expected if the number of degrees of freedom was changed. A generalized linear model was used for analysis. The expert noted that the variance components for blocks and plots were assumed to be identical for all varieties in a certain year and, therefore, the effect of these variance components would be absorbed by and confounded with the year effect. Compared to a situation where individual plants were recorded, he explained that bulked samples would cause some loss of information due to the loss of degrees of freedom available for the calculation and more losses could be expected when it was not known from which plot each individual plant came. Data from pea, ryegrass and sugarbeet varieties was used. The expert added that, using the generalized linear model, the varieties were weighted differently than in the COY-U and, therefore, few reference varieties with large variances might increase the mean. He concluded that generalized linear models could be used for testing uniformity in bulk sample under some assumptions, that a low number of degrees of freedom might cause problems in the calculation process, that some loss of power could be expected compared to measurements on individual plants but nevertheless the COY-U method could be used provided that the sub-samples were obtained within plots.

13. At the request from an official from UPOV, it was clarified that more than a single sub-sample was required for the assessment of uniformity using bulk samples and that no problems could be envisaged provided that a large enough number of plants was used. The expert from France asked whether there was any UPOV guideline for the use of bulk samples. An official from UPOV replied that there was no agreed recommendation at the moment and that very few characteristics involving bulk sampling had been included in the UPOV Test Guidelines. An expert from the United Kingdom asked about the effect of the presence of a big block effect in the trial. The expert from Denmark considered that it was possible to bulk within blocks and that a big block effect would increase the variability but would not invalidate the method. He added that nevertheless experts should be aware of the loss of power of the assessment if bulking within plots was not possible.

14. An expert from the United Kingdom asked whether bulking plots from different plots would reduce the effect of incomplete block design, which was used in some cases for the assessment of distinctness. The author of the document considered that for the assessment of distinctness it was only possible to bulk within plots.

15. Conclusion: the TWC agreed that a new document would be prepared by the expert from Denmark which would be drafted as a section within TGP/8 – Use of Statistical Practices and Procedures in DUS Testing.

Size of trial

16. Determination of Optimum Trial Size. The TWC considered proposals for optimizing the size of trials. One expert from Poland explained that DUS testing in Poland was usually conducted in three-year series and presented a paper which applied a three-stage method of checking uniformity of rye varieties (inbred lines) to find a sample size guaranteeing the smallest probability of error of the 2nd kind (error of accepting a non uniform variety) whilst simultaneously controlling the level of probability of the error of 1st kind (error of rejecting a uniform variety). The final aim was to reduce the costs of trials by means of the reduction of

the sample size. The expert concluded that the calculated number of measured plants would be lower for the case of a three-stage test than for traditional annual DUS tests.

17. Presentation on Qalstat program from the expert from France. The expert from France referred to Qalstat, a multi purpose software to determine the efficiency of a given procedure and its decision rule, to find the optimum procedure for some given quality objectives for single or multiple steps procedures and which allowed different solutions to be easily compared. A copy of his presentation is given in Annex III of this document. He clarified that working with samples, instead of the whole population, meant there was a zone between the situations of clear acceptance or rejection, where the efficiency of the test was unknown. He considered the use of Qalstat to address some issues, such as the possibility to reduce the number of years, to estimate the loss of precision of a test if the same number of plants was kept, or to determine the number of plants that should be included in a test in order maintain the level or precision. To show how efficiency of a given procedure can be analyzed, he used data from document TWC/19/6 and data from document TWC/19/2 to find the appropriate procedure when quality objectives were available. He concluded that Qalstat made it possible to calculate the optimum sample size for every population standard and acceptance probability and could also give the sample size for every year.

18. Conclusion: The TWC concluded that methods for calculating the optimum size of trial would increase efficiency, which might reduce the number of years involved, and that Qalstat allowed the calculation of the optimum plot size for every population standard and acceptance probability.

Revision of the Latest Working Document for a New Revised General Introduction to the Assessment of Distinctness, Uniformity and Stability in New Varieties of Plants (document TC/37/9(a)) and the Associated TGP Series of Documents

19. The Technical Director introduced document TC/37/9(a). He explained that the revised document (TC/36/8), considered by the TWC during its eighteenth session, had been amended according to the comments received by the TWP's during the year 2000 and had resulted in a further version (document TC/36/9) that had been presented to the Administrative and Legal Committee (CAJ) at its session held in Geneva in October 2000. In response to comments from the CAJ, a new draft (document TC/37/5, Annex I) had been produced by the Enlarged Editorial Committee and considered by the Technical Committee and the CAJ at their following sessions in Geneva in April 2001. At the end of this drafting process, the Technical Committee agreed that a later version would be produced (document TC/37/9(a)) and circulated among all the TWP's for a final round of comments. In the absence of any need for substantial revision of the document by the TWPs, the document could be submitted to the Council for adoption as document TG/1/3 in October 2001, or if substantial changes were necessary, the Enlarged Editorial Committee would be invited to produce a revised document for consideration at the April 2002 session of the Technical Committee.

20. General Introduction: The TWC reviewed document TC/37/9(a) and proposed the following amendments:

4.4.1 Qualitative Characteristics

38. Qualitative characteristics are those that are expressed in discontinuous states (e.g. sex of plant: dioecious female (1), dioecious male (2), monoecious unisexual (3),

monoecious hermaphrodite (4)). These states are self-explanatory and independently meaningful. All states are necessary to describe the full range of the characteristic, and every form of expression can be described by a single state. ~~The states do not necessarily have any logical order~~ The order of states is unimportant. As a rule the characteristics are not influenced by environment.

4.4.2 Quantitative Characteristics

39. Quantitative characteristics are those that can show the full range of variation from one extreme to the other and whose expression can be recorded on a one-dimensional, continuous or discrete, linear scale.

21. Associated TGP series of documents; TGP/7: The Technical Director introduced document TC/37/10. The expert from France mentioned that harmonization and guidance could be considered in two ways. One of them was to develop a system with harmonized testing conditions and the other one was to look for the same results in different countries. He noted that the second situation would have to deal with the interaction between the genotype and the environment.

22. The TWC reviewed document TC/37/10 (draft for TGP/7)and proposed the following amendments:

4.2.2 Clear differences – delete STD wording and make reference to the General Introduction.

4.3 Uniformity

(a) Self-Pollinated and Vegetatively Propagated Varieties

"The acceptable number of off-types in a sample size of **[number specified in section 4.1 of Test Guidelines]** is **[x]** on the basis of a population standard of **[y]** and an acceptance probability of **[Z]**." **[Guidance to be developed in TGP/10]**

Standard wording where appropriate:

"When the uniformity is assessed by COYU the acceptance probability should be **[P]**." **[Guidance to be developed in TGP/10]**

(b) Cross-Pollinated Varieties

"For the assessment of uniformity, COYU should be applied with an acceptance probability of [P]**." [Guidance to be developed in TGP/10]**

Standard wording where appropriate:

"In case of uniformity assessment on the basis of off-types the variability within varieties should not exceed the variability of comparable varieties already known. The

accepted number of off-types in a sample size of **[number specified in section 4.1 of Test Guidelines]** has to be calculated using [method X] **[Method has still to be named!]** with an acceptance probability of **[P]**." **[Guidance to be developed in TGP/10]**

(c) Hybrid Varieties

Single-Cross Hybrids Resulting from Inbred Parent Lines

"The acceptable number of off-types in a sample size of **[number specified in section 4.1 of Test Guidelines]** is **[x]** on the basis of a population standard of **[y]** and an acceptance probability of **[Z]**." **[Guidance to be developed in TGP/10]**

Standard wording where appropriate:

"In addition, a population standard for the occurrence of self-pollinated inbred parent plants should be applied. The acceptable number of off-types in a sample size of **[number specified in section 4.1 of Test Guidelines]** is **[u]**." **[Guidance to be developed in TGP/10]**

Other points for consideration:

- There is the possibility of other additional tolerances, like out-crossed and isogenic fertile plants in a male sterile inbred line (see e.g. sunflower).
- Different sample sizes used for different characteristics (field vs. electrophoresis). Therefore it might not be appropriate to indicate only one sample size.

When the uniformity is assessed by COYU the acceptance probability should be [P]. **[Guidance to be developed in TGP/10]**

Single-Cross Hybrids not Resulting Exclusively from Inbred Parent Lines

"For the assessment of uniformity COYU should be applied with an acceptance probability of [P]." **[Guidance to be developed in TGP/10]**

Standard wording where appropriate:

"In addition, a population standard for the occurrence of self-pollinated inbred parent plants should be applied. The acceptable number of off-types in a sample size of **[number specified in section 4.1 of Test Guidelines]** is **[u]**." **[Guidance to be developed in TGP/10]**

"In the case of uniformity assessment on the basis of off-types, the variability within varieties should not exceed the variability of comparable varieties already known. The accepted number of off-types in a sample size of **[number specified in section 4.1 of Test Guidelines]** has to be calculated using [method X] **[Method has still to be named]** with an acceptance probability of **[P]**." **[Guidance to be developed in TGP/10]**

Multiple-Cross Hybrids

(i) unchanged

Comment: Is it necessary to indicate a method or a standard [Guidance to be developed in TGP/10]

(ii) "If the heredity of the characteristic is not known, it is treated in the same way as in cross-pollinated varieties.

For the assessment of uniformity, COYU should be applied with an acceptance probability of [P]." **[Guidance to be developed in TGP/10]**

Standard wording where appropriate:

"In the case of uniformity assessment on the basis of off-types the variability within varieties should not exceed the variability of comparable varieties already known. The accepted number of off-types in a sample size of **[number specified in section 4.1 of Test Guidelines]** has to be calculated using [method X] **[Method has still to be named]** with an acceptance probability of **[P]**." **[Guidance to be developed in TGP/10]**

(iii) "In addition, a population standard for the occurrence of self-pollinated inbred parent plants should be applied. The acceptable number of off-types in a sample size of **[number specified in section 4.1 of Test Guidelines]** is **[u]**." **[Guidance to be developed in TGP/10]**

23. Associated TGP series of documents; TGP/8, TGP/9 and TGP/10: The TWC proposed the following work-plan:

Ref.		**Title**
TGP/8		USE OF STATISTICAL PRACTICES PROCEDURES IN DUS TESTING *(Coordinator: Office of UPOV)*
8.1 TWC 2002	Mr. Grégoire (FR) Mr. Keizer (NL)	Introduction
8.2 TWC 2002	Mr. Kristensen (DK) Mr. Thissen (NL):	Validation of data and assumptions
8.3 end July 2001	TWC Mr. Thissen (NL) Mr. Meyer (DE)	Experimental Design Practices (to cover TGP/7) Selection of trial site Size and elements of the trial: plot size and shape, number of replications, design, etc.. Sampling from the trial Type I and Type II error
8.4 end next week	TWC TWC/19/10 Mr. Meyer (DE)	Type of characteristics and their scale levels 8.2.1 Ratio scale data 8.2.2 Interval scale data 8.2.3 Ordinal scale data 8.2.4 Nominal scale data 8.2.5 Combined scale data
8.5 next TWC	Ms. Watson (GB) Mr. Grégoire (FR)	Statistical methods List to be prepared – General STS Methods Multivariate analysis methodology
8.6 next TWC	TWC Mr. Kristensen (DK)	Examining DUS in Bulk Samples

Ref.		Title
TGP/9		EXAMINING DISTINCTNESS *(Coordinator: UPOV Office)*
9.1 next TWC	UPOV Office	Consideration of the Application of Statistical Methods - details are given in TGP/8
9.2	**Not TWC**	Consideration of All Varieties of Common Knowledge in the Examination of Distinctness: 9.2.1 Categorization of Varieties (Test Guidelines) 9.2.2 Pre-screening using variety descriptions (Descriptions from the same or different locations) 9.2.3 Organizing the growing trial (Grouping; Randomization)
9.3 end July	TWC Ms. Rücker (DE)	Examining Distinctness in Different Types of Variety
9.4	TWA	Use of the Parental Formula for Examining Distinctness in Hybrids
9.5 next TWC	TWC Mr. Grégoire (FR)	Use of Multiple Locations in the Examination of Distinctness TWC/17/10 TWC/18/2
9.6	**Not TWC**	Model Systems for Determining Distinctness
9.7 next TWC	Ms. Watson (GB) Mr. Roberts (GB)	Recommended Statistical Methods COYD - (TC/33/7) Annex - Probability levels Long Term LSD – TWC/14/16
TGP/10		EXAMINING UNIFORMITY *(Coordinator: UPOV Office)*
10.1	UPOV Office	Consideration of the Application of Statistical Methods - details are given in TGP/8
10.2 end July	TWC Ms. Rücker (DE)	Assessing uniformity according to the features of propagation – including explanation of relative tolerance etc... 10.2.1 Uniformity using off-types 10.2.1 Uniformity assessment on the basis of variances
10.3 next TWC	Mr. Roberts (GB) Ms. Watson (GB) Mr. Law (GB)	Recommended Statistical Methods COYU - (TC/33/7) Annex – Probability levels (UPOV Office to prepare Questionnaire) Off/types TC/34/5 Rev. (absolute and relative) Segregation ratios

24. Review of uniformity standards for grasses. Experts from the United Kingdom reported to the TWC (see document TWC/19/5) on an analysis of the recommended UPOV uniformity standard of COYU P=0.002 for grasses, which had been undertaken because of increasing problems with refusal of varieties using this standard. It was noted that the current recommended UPOV standard for COYU of P=0.002 was known to be more strict than the previous 2 x 1% within-year standard and, therefore, a five year transitional period of operation at the more lenient P=0.001 standard had been permitted. An expert observed that the COYD standard at P=0.001 had given closer agreement with the 2 x 1% within-year standard, whilst noting that this also appeared to be more stringent than the 2 x 1% within-year standard.

25. The expert from France noted the same problem in his country. Several experts at the meeting recalled that, when it had been decided to change for a new uniformity standard, the aim had been to keep the same stringency as before. One expert suggested that it was probably necessary for each country to have its own probability level to achieve the same level of stringency. It was observed that the interaction between the genotype and the environment was an important factor in the level of stringency.

26. Conclusion: The TWC agreed that an expert from the United Kingdom would collect information and would prepare a new paper for the next year.

27. Statistical practices in DUS testing – types of characteristics and their scale levels: An expert from Germany introduced document TWC/19/10, which was an update of the one presented the year before at the Working Party. He recalled that the main objective of the paper was to connect the characteristics as expressed in the trial (level 1) and the data used for the evaluation of characteristics (level 2).

28. The expert from France considered that this document should be part of the TGP documents associated to the General Introduction. Several experts considered that only new and agreed methods should be included in Table 3, and therefore, proposed to delete references to old methods. It was also suggested that non-parametric methods should also be included and that an explanation on nominal scale and on Category 1 and Category 2 of Table 5 should be added.

29. Conclusion: The TWC agreed that an expert from Germany would prepare a new paper for the next year.

30. The Technical Director introduced document TC/37/11 “Notes for drafting TGP documents”, which explained the nature of the TGP documents and included an annex with a summary of the different matters to be covered within each TGP document. He clarified that the document was intended to be a guide for the many drafters involved in the preparation of the series of TGP documents. The Working Party welcomed the document.

Experimental Design

31. Incomplete block design (alpha design) - the efficiency of incomplete block designs in DUS trial on pea varieties. An expert from Poland introduced document TWC/19/3 which considered the efficiency of different designs in pea trials for DUS purposes. He mentioned that the experiment had been conducted in a row-column design. For the analysis the variances of the experimental error had been compared for different factors (rows, columns or

both) including the mathematical models of observation. The expert concluded that randomized complete blocks and completely randomized design, attained the same level of efficiency as incomplete blocks for some characteristics and were slightly better for other characteristics. He observed that, after three years of research with peas, randomized complete blocks and completely randomized designs proved to be better methods than incomplete block design.

32. The expert from Denmark said that they used incomplete block design for a matter of simplification but that they recovered the inter-block information. An expert from Germany considered that experts lost the possibility of doing pair-wise comparison. He added that in his country incomplete block design was used for testing maize but he clarified that it was not generally recommended. He also mentioned that the kind of randomization required by the crop experts was not suitable for incomplete block design. One expert considered that there is no difference in the possibility of doing pair-wise comparisons using the COY approach even with incomplete block design.

33. Conclusion The Working Party concluded that for the cases studied, alpha design did not prove to be very beneficial, probably due to the low genotype/environment interaction in the characteristics considered in the paper.

34. Spatial dependency and block design An expert from the United Kingdom introduced document TWC/19/4 which reported on data from nine herbage DUS trials which were investigated for evidence of spatial dependence. Spatial dependence was most evident in variates measuring the overall dimensions of the plants, especially late season variates. On average, 45% of the residual variation in the plot means of the spatially dependent variates was estimated to be of a spatial nature. Consequently, it is likely that the efficiency of analysis of these variates would be improved by using spatial analysis instead of non-spatial analysis, or by using alpha (incomplete block) designs instead of complete block designs. The spatial information was used to determine the optimal incomplete block sizes and the likely increase in efficiency due to using alpha designs instead of complete block designs. She concluded that the results showed that the use of spatial analysis would improve the efficiency of the trial. She added that designs to address spatial dependency could be complex but noted that the use of incomplete block design might help to decrease the cost of the trial.

35. Some experts of the Working Party expressed their surprise about the size of the blocks that had been used, which could be considered rather small. An official from UPOV asked whether this method would reduce the minimum distance between varieties and. if this is the case, what was the opinion of the breeders. An expert from the United Kingdom clarified that the objective is to maintain the stringency of the examinations and that the following year there would be more results to examine this point. The expert from France considered that, even though spatial dependency was not considered in a typical DUS field trial, crop experts are working with a good degree of security as they grow similar varieties next to each other in the field.

36. Conclusion The TWC concluded that spatial dependency will improve the efficiency of the trial when there is sufficient spatial dependence in enough characteristics. It might cause some additional complications in the interpretation of the data.

37. Image analysis – matching of plant variety images from different sowings: An expert from the United Kingdom introduced document TWC/19/6. He explained that in his paper,

an approach was described for summarizing a composite of two features taken from photographs, shape and color of roots, with the aim of automating the matching of variety images. A combination of statistical techniques was used to extract the main characteristics contained in a digitized image of a plant. The information was then used to search for varieties with similar features in an image database. The operation of the system using four seasons of data from carrot (*Daucus carota* L.) trials was described, with particular focus on the problem of matching images from different sowings, for which three methods of matching were used. He mentioned that, in the case study, it was possible to identify the correct morphological group for a candidate variety with around 80% success and that images could be used in combination with other information to improve the accuracy of matching. He advised that it was planned that this technique would be developed for other crops.

38. The Technical Director asked about the assessment of uniformity using this technique and also about possible use for the management of reference collections. An expert from the United Kingdom replied that he thought that uniformity could not be assessed but, as the technique was looking for similarities, he considered it would be possible to use it for pre-screening dissimilar varieties. The expert from Mexico asked about the effect of the environment when photographs were taken in different places, by different devices, and one expert from the Netherlands expressed his concerns about the decrease in discriminating power due to the large variability of the color between years. An expert from the United Kingdom considered that, for the possible use of photographs taken by the breeder, it should be requested that some reference varieties be sown jointly with the candidate for the purposes of calibration. He concluded that, in practice, color had proved to be a good characteristic. Some experts mentioned the possibility of requesting the breeder for both a photo and a sample of material from the variety.

39. Flores, a pictorial database: An expert from the Netherlands made an oral presentation about some improvements to the Flores database, which had been explained in detail to the TWC at its seventeenth meeting in 1999 (see document TWC/17/5) He recalled that the main objectives of that database were for it to be used for comparison, identification and variety testing. He mentioned that the system compared new images with others in a database and that it was possible to connect the image to administrative data and that several views could be used. The expert explained that the color information was obtained by spectral imaging, which, on the one hand, was considered much better than the r.g.b. (red-green-blue) color info, because it was independent from the equipment, thus avoiding the obsolescence of data when changing devices; and enabled color normalization which meant independence from the light source. On the other hand, he recognized that spectral images required good calibration of the system, and were more time consuming to take and produced a larger data set.

40. The expert from France wondered whether different growing conditions would result in large differences which might cause difficulties for successful matching. He asked if the data of each individual variety was kept or if there was an average image of each variety. The expert from the Netherlands explained that research was being done using data from three stages of development, different growing seasons and sites.

41. UPOV Questionnaire on Image Analysis in Plant Variety Testing: The Office of the Union introduced document TWC/19/11. The questionnaire had been sent out with Circular U 2908 and it comprised two parts. The first part, to be completed by crop experts, was related to the use of image analysis and the second part related to specific technical information about the hardware and software used and how the information was filed. The

completed questionnaires had been collected by experts from France and the Netherlands. The TWC noted that fourteen countries had replied to the questionnaire on Image Analysis: Australia, Denmark, Finland, France, Germany, Hungary, Netherlands, New Zealand, Ireland, Poland, Russian Federation, South Africa, Switzerland and United Kingdom. Eight of these, namely Australia, Denmark, Finland, New Zealand, Ireland, Poland, Russian Federation and Switzerland mentioned that they were not using image analysis at that time (February 2000). However, Australia, Poland and the Russian Federation expressed interest in the possible use of image analysis in the future.

42. Conclusion: The TWC noted the potential of image analysis in the process of "pre-screening". However, it noted that until now, it had only been investigated for the assessment of distinctness and that it was also necessary to investigate how it would be able to consider uniformity.

Telecommunications, Exchangeable Software and Contacts

43. DUS for Windows (DUSTNT), report on new developments: An expert from the United Kingdom introduced document TWC/19/8. She explained the improvements that had been made to the DUST system as requested by the Working Party. She mentioned that the latest version of DUSTNT is available from http://www.afsni.ac.uk/services and anyone seeking further information could contact Dr. Sally Watson, Biometrics Division, Department of Agriculture and Rural Development, Newforge Lane, Belfast BT9 5PX, UK, Phone: +(44) 2890 255292, Fax: +(44) 2890 681216, Email: sally.watson@dardni.gov.uk.

44. Telecommunications, exchangeable software and contacts: An expert from the United Kingdom introduced document TWC/19/9, which was an update of the previous version (TWC/18/11). It contained information downloaded from the Web site http//www.bioss.sari.ac.uk/upov: an e-mail list of participants in the different UPOV Technical Working Parties, exchangeable software used by member States, database management systems in use, a COYD on-line demonstration and an index of TWC papers from 1986 to 2000. The expert from France suggested including information about the latest versions of the General Introduction and its TGP associated documents.

45. The TWC welcomed the documents and thanked the experts from the United Kingdom for their preparation. The TWC also noted that the above-mentioned Web site would not be updated in the future.

Future Program, Date and Place of the Next Session

46. At the invitation of the expert from Mexico, the Working Party agreed to hold its twentieth session in Texcoco, Mexico, from June 17 to 20. During the nineteenth session, the TWC planned to discuss or re-discuss the following items:

General

1. Report on subjects of special interest to the Working Party raised during the thirty-seventh session of the Technical Committee

2. Questions raised by other Technical Working Parties

3. Report on new developments in member States (oral reports)

4. Revision of the Latest Working Document for a New Revised General Introduction to the Assessment of Distinctness, Uniformity and Stability in New Varieties of Plants (document TC/37/5) and the associated TGP series of documents. (See pages 9 and 10 of this document.)

5. UPOV-ROM Plant Variety Database (oral report)

6. Report on developments in the subgroups on molecular techniques

7. Developments in the World Wide Web

8. List of statistical documents prepared by the TWC

9. List of statistical documents containing recommendations or methods of possible interest to the Technical Working Parties

Workshop on Data Handling

47. The TWC agreed to have a workshop on data handling in connection with the twentieth meeting of the Working Party in Mexico. It was agreed to have this activity from June 12 to 14, 2002.

Nomination of Chairman

48. The Working Party agreed to propose to the Technical Committee, that it nominate Mr. Uwe Meyer (Germany) as the next Chairman of the TWC.

Visit to Prague

49. On the afternoon of Tuesday, June 5, the participants of the Working Party were invited by the authorities of the Central Institute for Supervising and Testing in Agriculture to a tour to visit the main historical places of Prague and to a reunion dinner.

50. This report has been adopted by correspondence.

[Annex I follows]

ANNEX I

LIST OF PARTICIPANTS

I. MEMBERS

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[Annex II follows]

ANNEX II

PLANT VARIETY PROTECTION IN THE CZECH REPUBLIC

Mr. Jiří Souček, Head of Department of Plant Breeders' Rights and DUS Tests,
Central Institute for Supervising and Testing in Agriculture (ÚKZÚZ)

The Czech Republic provides for the protection of plant varieties of all plant genera and species by plant breeder's rights. Plant varieties as such are excluded from the Czech patent law.

The Czech Republic, member of UPOV since January 1, 1993, continues the 1991 accession of former Czechoslovakia which ratified the UPOV Act of 1978. The accession of the Czech Republic to the 1991 Act of the Convention is expected at the beginning of 2002. Since January 1, 1990, more than 1300 application for variety protection have been filed and 650 grants issued.

Legal bases:

Act No. 408/2000 Coll. of 25 October, 2000, on the Protection of Plant Variety Rights, entered into force on 1 February, 2001. This Act replaced fully the former Act No. 132/1989 Coll., on the legal protection of new varieties of plants and breeds of animals, as amended.

The Act is in conformity with the 1991 Act of the Convention and in alignment with the Council Regulation (EC) 2100/94.

An amending Act concerning maintenance fees is under preparation.

Basic principles:

- Plant variety rights may be granted to varieties of all plant genera and species.
- The plant variety rights may be granted to the variety which satisfies conditions of novelty, distinctness, uniformity, and stability.
- The variety denomination must comply with the conditions laid down by the Act.
- Duration of the rights shall run until the end of the twenty-fifth year after the year in which the grant of such rights came into effect; for varieties of trees, hops, vines and potatoes, until the end of the thirtieth year.
- The following acts of use of the propagating material of the protected variety require an authorization of the holder of rights: production or propagation, conditioning for the purpose of propagation, offering for sale, sale or other marketing, export, import and stocking for these purposes. This provision also relates to the harvested material of the protected variety, if obtained from the propagating material of the protected variety without authorization by the holder of rights who could not exercise these rights in respect of the above propagating material.
- These provisions also relate to: varieties essentially derived from the protected variety, varieties which are not distinct from the protected variety, varieties whose production requires the repeated use of the protected variety.
- Derogating from the provisions above, farmers are authorized to use "farm saved seed" of protected varieties of particular agricultural species, provided an equitable remuneration to

the holder is paid. Small farmers (ca. 25 ha) shall not be required to pay any remuneration to the holder of rights.

- The following acts of exploitation of the protected variety shall not require any authorization of the holder of rights: use for research purposes, use for breeding purposes, private use and for non-commercial purposes.

ÚSTŘEDNÍ KONTROLNÍ A ZKUŠEBNÍ ÚSTAV ZEMĚDĚLSKÝ
CENTRAL INSTITUTE FOR SUPERVISING AND TESTING IN AGRICULTURE
DIVISION OF PLANT VARIETY TESTING
HROZNOVÁ 2, 656 06 BRNO
http://www.zeus.cz

The Central Institute for Supervising and Testing in Agriculture, an administrative body governed by the Ministry of Agriculture, is the national authority in several fields of the state administration in agriculture, i.a. in the National Listing of plant varieties and Plant Variety Rights.

The Division of Plant Variety Testing of the Institute is in charge namely of the National Listing and publication of the National List of varieties, the granting of Plant Variety Rights, checks of maintenance of registered and protected varieties and of the international cooperation in this field. For technical examinations of prerequisites of registration and grant of protection of varieties, the Division operates 20 testing stations in diverse growing regions of the country.

Contact address in matters relating Plant Variety Rights:
CENTRAL INSTITUTE FOR SUPERVISING AND TESTING IN AGRICULTURE
Division of Plant Variety Testing
Department of Plant Variety Rights and DUS Tests
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Plant species to which provisions on the "agricultural exemption", authorizing farmers to use "farm saved seed" of the protected variety (except of a hybrid or synthetic variety), shall only apply to:

a)	Cereals:	Avena sativa L.	Oats
		Hordeum vulgare L.	Barley
		Secale cereale L.	Rye
		Triticosecale Wittm.	Triticale
		Triticum aestivum L. emend. Fiori et Paol.	Common wheat
		Triticum durum Desf.	Durum wheat
		Triticum spelta L.	Spelt wheat
b)	Fodder plants:	Lupinus luteus L.	Yellow lupin
		Medicago sativa L.	Lucerne
		Pisum sativum L. (partim)	Field pea
		Trifolium alexandrinum L.	Berseem/Egyptian clover
		Trifolium resupinatum L.	Persian clover
		Vicia faba L.	Field bean
		Vicia sativa L.	Common vetch
c)	Potatoes:	Solanum tuberosum L.	Potatoes
d)	Oil and fibre plants:	Brassica napus L. (partim)	Swede rape
		Brassica rapa L. (partim)	Turnip rape
		Linum usitatissimum L.	Linseed (except flax)

PLANT VARIETY RIGHTS STATISTICS 1990 – 2000

	1990*	1991*	1992*	1993	1994	1995	1996	1997	1998	1999	2000
Applications/year	229	59	119	90	120	112	86	111	96	108	73
Residents	229	50	88	50	72	64	47	40	31	33	33
Non-residents	--	9	31	40	48	48	38	71	65	75	40
Applications in total	229	288	407	497	617	729	815	926	1 022	1 130	1 203
Grants issued/year	--	--	--	--	92	193	72	80	86	57	49
Residents	--	--	--	--	57	125	53	57	53	32	14
Non-residents	--	--	--	--	35	68	19	23	33	25	35
Grants in force in total	--	--	--	--	92	283	355	419	466	492	517

** - data as valid for Czechoslovakia*

Slide 1

Czech Agriculture

■ Total area of agric. land	4,280 mil. ha (54 %)
■ - arable	- 3,091 mil. ha (39 %)
■ - meadows, pastures	- 0,953 mil. ha (12 %)
■ Forestry	2,632 mil. ha (33 %)
■ Main crops:	
- cereals (wheat, barley)	1 587 000 ha
- oilseed rape	352 000 ha
- maize (silage)	281 000 ha
- potato	71 500 ha
- sugar beet	59 100 ha

Slide 2

CENTRAL INSTITUTE FOR SUPERVISING AND TESTING IN AGRICULTURE

Plant Variety Testing Division

Headquarters:
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Phone: +420-5-43548111
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Slide 3

Organization of the Institute

Director-General

Directorate:

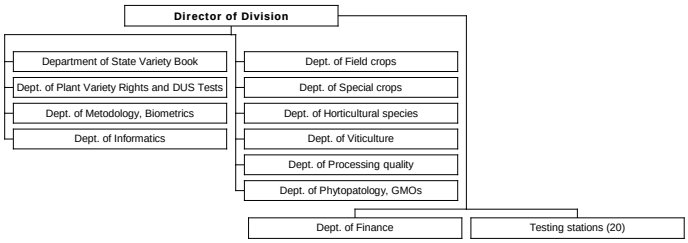
- Administration
- Finance
- Legal Affairs
- Information Technology
- Personnel

Technical Divisions:

- Plant Variety Testing
- Seeds
- Perennial Crops
- Feedingstuffs
- Agrochemistry, Soil and Plant Nutrition
- Laboratories

Slide 4

ORGANIGRAM
of Plant Variety Testing Division



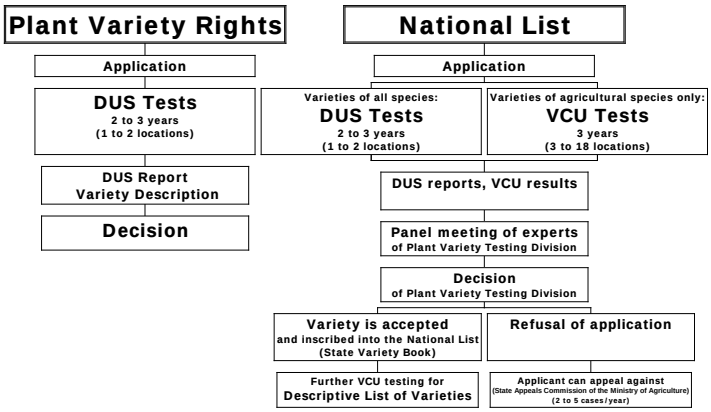
Slide 5

Legal Basis of Statutory Activities

- **Act No. 92/1996 Coll. on plant varieties, seeds and planting material of cultivated plants** as last amended by Act No. 153/2000 Coll.,
- **Act No. 408/2000 Coll. on plant variety rights protection,**
- **Act No. 153/2000 Coll. on use of genetically modified organisms and products.**

Slide 6

Statutory Activities



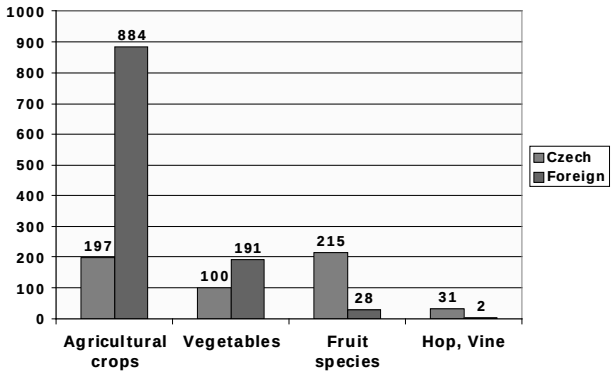
Slide 7

Statutory Activities Statistics

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
National List (Act No. 92/1996 Coll.)											
Applications/year	166	293	688	478	437	547	462	541	481	643	474
Varieties in process	789	850	1 367	1 404	1 367	1 388	1 335	1 869	2 274	2 251	1 416
Newly listed varieties	99	163	170	157	355	307	286	298	290	253	251
Plant Variety Rights (Act No. 408/2000 Coll.)											
Applications/year	229	59	119	90	120	112	86	111	96	108	73
Applications in total	229	288	407	497	617	729	815	926	1 022	1 130	1 203
Varieties in process	229	288	365	420	508	446	437	322	288	310	297
Grants issued/year	--	--	--	--	92	193	72	80	86	57	49
Grants in force in total	--	--	--	--	92	283	355	419	466	492	517
Field Trials											
Trials in total	1 127	1 028	1 123	1 211	1 246	1 343	1 251	1 230	1 097	1 064	1 092
inside UKZUZ	1 127	1 028	1 123	1 211	1 246	1 294	1 202	1 170	1 026	880	945
outside UKZUZ						49	49	60	71	184	147

Slide 8

Number of Varieties in Process for NL



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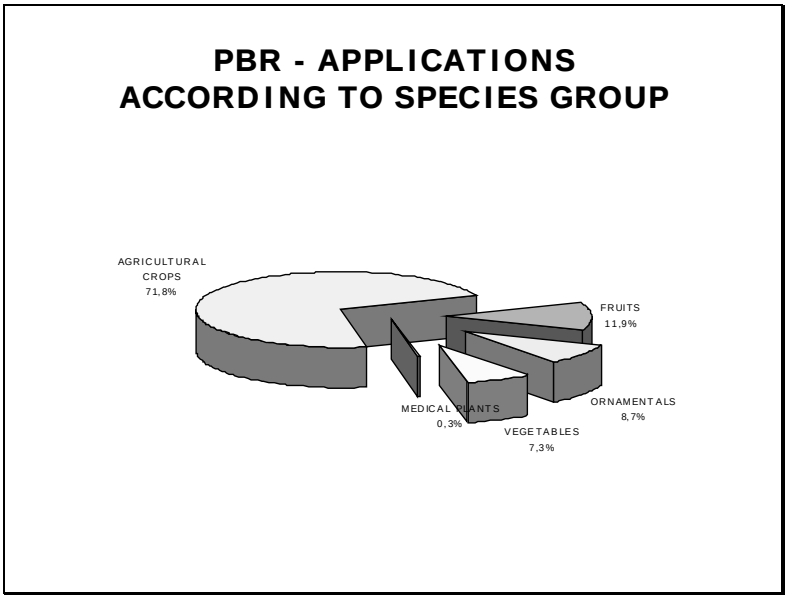

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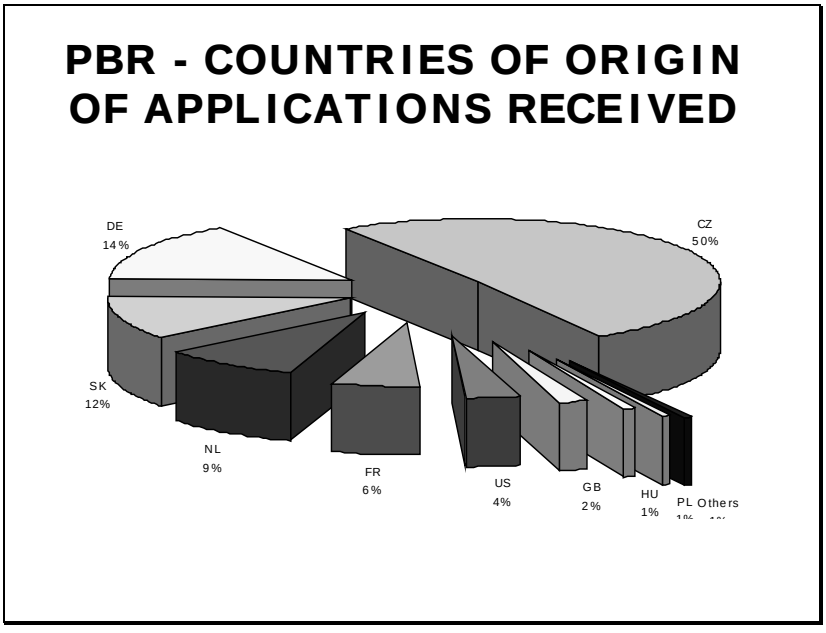


Slide 11

Genetically Modified Varieties

- **Legal basis: Act No. 153/2000 Coll. of 23 June 2000 on use of genetically modified organisms and products conforms to the provisions of Council Directives 90/219/EEC and 90/220/EEC. This Act shall apply from 1st January 2001. Several its provisions also amend the Seed Act (92/1996).**
- **Responsible authority: Ministry of Enviroment (MoEnv), in co-operation with Ministry of Health and Ministry of Agriculture. MoEnv established the Czech Commission for GMOs, as its scientific and advisory administrative body for the whole field of GMOs.**
- **Conditions to be satisfied: A GM variety must be on the list of GMOs and GM products approved for placing on the market by the MoEnv, before applied for and listed into NL.**
- **GM varieties in tests: None at present**

[Annex III follows]

ANNEX III

Presentation on Qalstat program from the expert from France

Slide 1

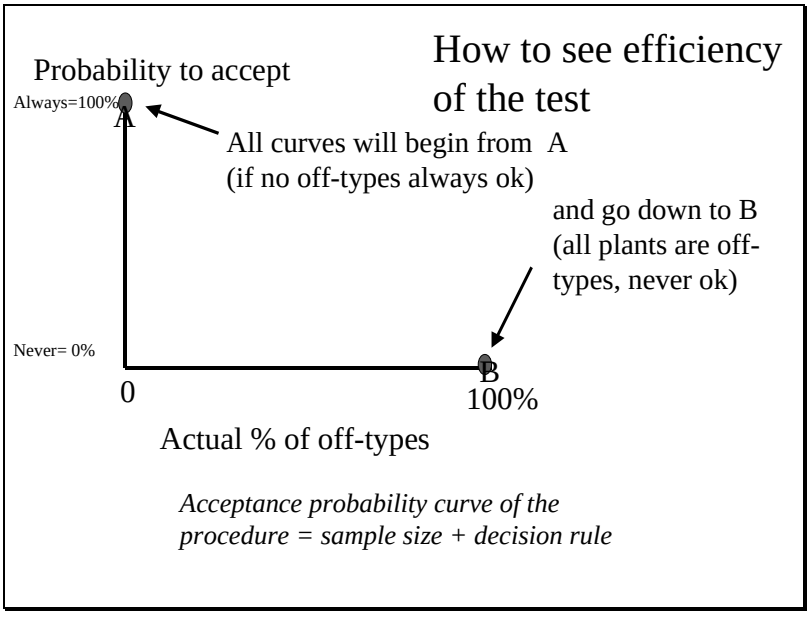
QALSTAT

A multi-purpose software when checking

True–type versus Off-type, defects,….

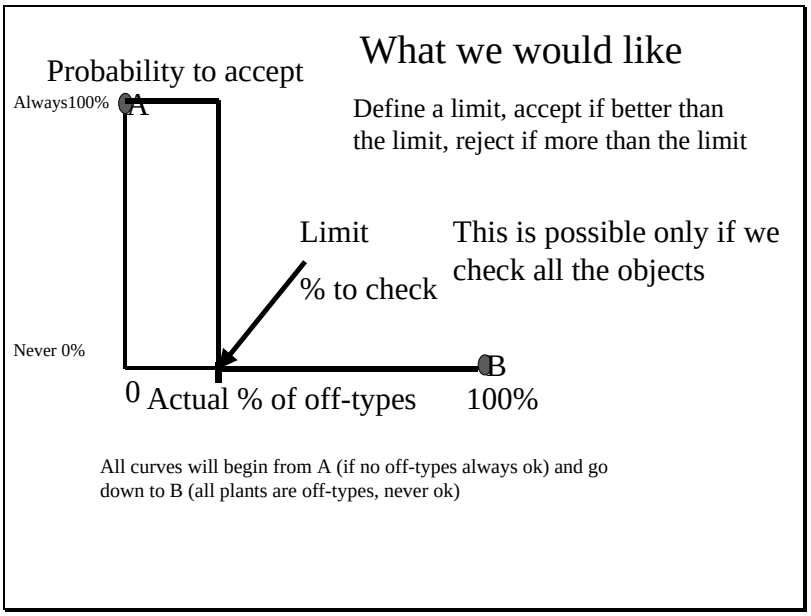
- Show efficiency of a given procedure + decision rule
- Find optimum procedure for given quality objectives
- Single or multiple steps (sequential analysis)
- Allow to compare easily different solutions
- …

Slide 2



Acceptance probability curve of the procedure = sample size + decision rule

Slide 3



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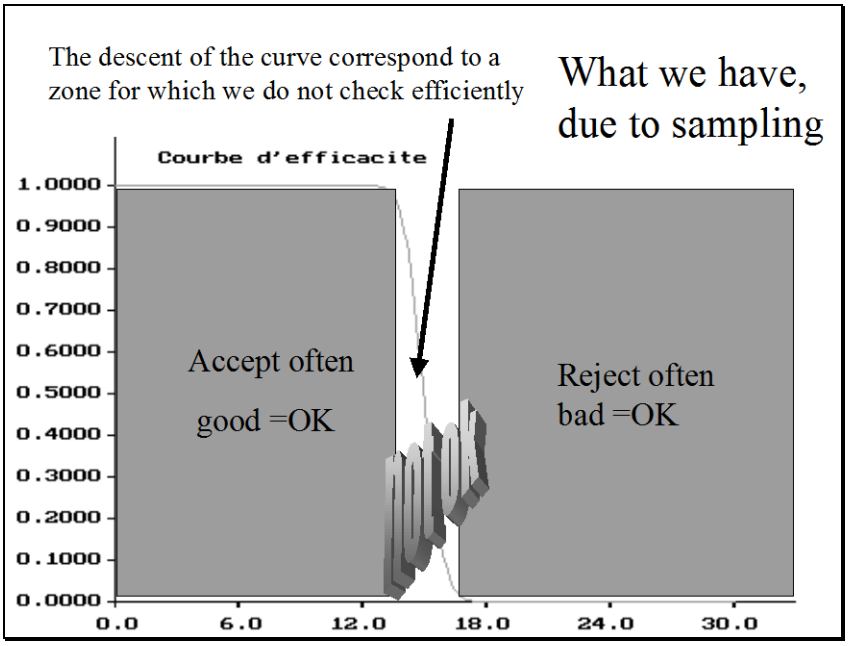

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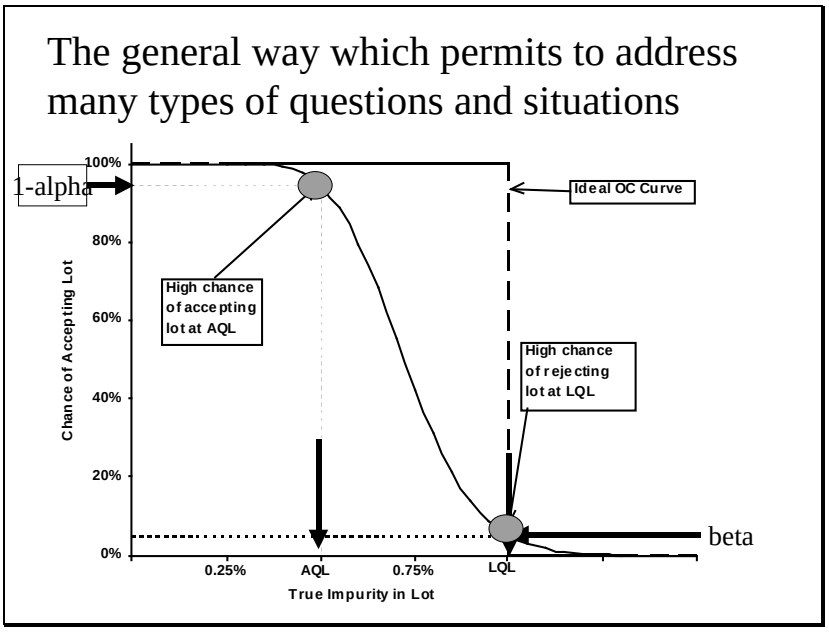


Slide 6

4 parameters when quality objectives are available or to be found

- AQL = UPOV Population Standard = good quality level to accept often
- LQL= poor quality level to reject often
- alpha = how often« good level » is rejected
  1-alpha = how often « good level » is accepted
- beta = how often « poor level » is accepted
  1-beta = how often « poor level » is rejected

Slide 7

Qalstat demo

Example of general questions

- See the efficiency of a given procedure
- Find appropriate procedure when quality objectives are available

Examples of one of the many possible questions in DUS trials

I think I can reduce the study from 3 years to 2 years

•If I keep the same number of plants, what will be the loss in precision?

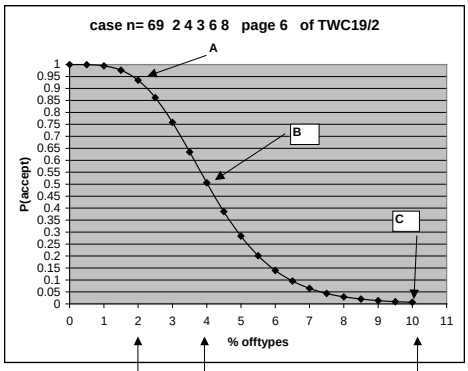
•I want to keep the same precision, how many plants shall I observe?

Slide 8

See the efficiency of a given procedure

Results from qalstat compared to those given in TWC/19/6 for a given sample scheme quality PS=2% alpha =5%

	% offtypes	P(accept)	
	0	1	
	0.5	0.99958	
	1	0.99453	
	1.5	0.97633	
A	**2**	**0.93452**	**alpha= 6.55%**
	2.5	0.8615	
	3	0.75817	
	3.5	0.63471	
B	**4**	**0.506**	**beta =50.6%**
	4.5	0.3858	
	5	0.28306	
	5.5	0.20129	
	6	0.1398	
	6.5	0.09553	
	7	0.06469	
	7.5	0.04368	
	8	0.02955	
	8.5	0.02009	
	9	0.01375	
	9.5	0.00948	
C	**10**	**0.00657**	**beta= 0.66%**



PS 2*PS 5*PS

Slide 9

Find appropriate procedure when quality objectives are availble

- AQL =Good level = 2% =UPOV Population Standard example chosen in TWC/19/2
- Alpha =5% probability to reject the good quality level
- 1-alpha= 95/100 = number of times the good quality level will pass the test with result = accept

Good level to accept often

Slide 10

Find optimum procedures for 3 years and 2 years of test

- LQL= Poor/Low level of quality

Please try 3 levels of quality 8% 7.5% 7%

- Beta = 5% = probability to accept a sample of poor quality

  1- beta = 95/100 = number of times the poor level of quality will be rejected

Quality objectives:	
AQL 2%	with alpha=5%
LQL 8 or 7.5 or 7%	with beta =5%

Slide 11

Qalstat Permits to find optimum solutions,

to compare different solutions (3 years compared to 2 years with the same efficiency), see the effort needed to reach a better precision LQL from 8% to 7%...

you can derive from the optimum a « more practical » solution, for instance 80 plants instead of 79 and check the effect on the quality objectives

Optimum solutions (green= 3 years, blue= 2 years) from qalstat for given objectives in yellow

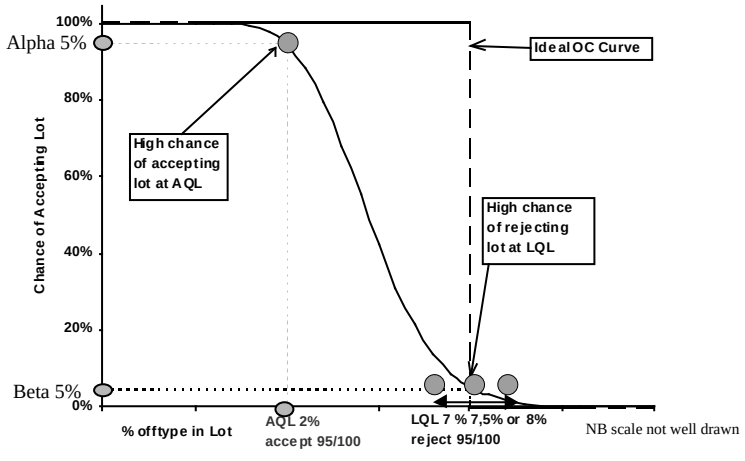
		3 years			2 years		
AQL	LQL		accept	reject		accept	reject
2%	8%	52	0	4	68	1	5
alpha	beta	52	3	6	68	5	6
5%	5%	52	6	7			

		3 years			2 years		
AQL	LQL		accept	reject		accept	reject
2%	7.5%	57	0	4	79	1	5
alpha	beta	57	2	6	79	6	7
5%	5%	57	6	7			

		3 years			2 years		
AQL	LQL		accept	reject		accept	reject
2%	7%	64	0	5	98	2	6
alpha	beta	64	3	7	98	7	8
5%	5%	64	7	8			

Slide 12

In this example we fixed 3 parameters AQL alpha, beta and we tried 3 values for LQL.
In qalstat any change/combination of the 4 parameters is easily tested.



Slide 13

Am I able to reach more precision?

- My procedure correspond to

AQL=2% (95/100 accepted) LQL=8% (95/100 rejected)

The jurist from my institute insist THE limit is 2%, the present limit at 8% is not acceptable for him.

He nevertheless understand we can not be always sure, so he accepts

AQL =1,9% (95/100 accepted) LQL = 2,1% (95/100 rejected)

If I wish to follow this objective I will have to look at more than 30 000 plants each year of test

Slide 14

Can we reduce the LQL from 8% to 4% (=2 times the AQL)

- I will have to look at more than 300 plants for 3 years, or more than 450 plants for 2 years.

I previously made my studies in 3 years, I think I am able to perform the tests in 2 years for distinctness, how will I change my procedure to test Uniformity

Slide 15

I am almost always able to distinguish/reject candidates for distinction in 2 years but as initially I made the study in 3 years; I wish to look how to reduce Uniformity check to 2 years, to prevent a 3rd year only for uniformity check

- My current 3 years procedure is :

Year 1 60 plants 0 accept 4 reject
Year 2 60 plants 2 accept 6 reject
Year 3 60 plants 7 accept 8 reject

The corresponding quality criteria are

AQL = 2% accepted 94/100 (alpha=6%)
LQL = 7,5% rejected 95/100 (beta= 5%)

I need to keep 60 plants per year in my trials for convenience and D test

I wish to keep as much as possible AQL and alpha, as well as LQL,
I prefer to increase the beta risk associated to LQL

A solution from qalstat:

Year 1 60 plants 1 accept 4 reject
Year 2 60 plants 5 accept 6 reject

AQL 2% (95/100 acepted) LQL=7,5% (88/100 rejected, beta= 12%)

Slide 16

I am almost always able to distinguish/reject candidates for distinction in 2 years tests but as initially I made the study in 3 years; I wish to look how to reduce Uniformity check to 2 years, to prevent a 3rd year only for uniformity check

- My current 3 years procedure is

Year 1 60 plants 0 accept 4 reject
Year 2 60 plants 2 accept 6 reject
Year 3 60 plants 7 accept 8 reject

The corresponding quality criteria are

AQL = 2% accepted 94/100 (alpha=6%)
LQL = 7,5% rejected 95/100 (beta= 5%)

I do not need to keep 60 plants per year in my trials

I wish to keep the same level of precison as

A solution from qalstat:

Year 1 80 plants 1 accept 5 reject
Year 2 80 plants 6 accept 7 reject

Quality criteria as kept unchanged from current procedure

Slide 17

Many other interesting features are available such as:

• the curves of acceptance at each stage

• the curves showing which lots will continue for a next stage

• the curves showing which lots will be rejected at each stage

• the average number of plants on all stages according to the quality level of the varieties checked

•...

[End of Annex III and of document]