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UPOV

International Union for the Protection of New Varieties of Plants

DATA PROCESSING FOR THE ASSESSMENT OF DISTINCTNESS AND FOR PRODUCING VARIETY DESCRIPTIONS

Document prepared by the Office of the Union

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EXECUTIVE SUMMARY

1.   The purpose of this document is to present developments concerning the possible development of new guidance for document TGP/8 on "Data Processing for the Assessment of Distinctness and for Producing Variety Descriptions" describing different methods used by UPOV members for measured quantitative characteristics.

2.   The TWPs are invited to note that:

        (a)   the TC agreed to invite the experts from France to check the highlighted values in the table in Annex II, paragraph 6 of this document for possible data inconsistency; and

        (b)   the TC agreed to invite participants in the practical exercise to provide a short description of their methods to transform measurements into notes and provide examples when these methods might be used, such as for particular characteristics, types of propagation or different situations, on the basis of the short descriptions provided by France and the United Kingdom, as set out in Annexes III to V to this document;

3.   The TWC is invited to:

        (a)   consider the information to be provided by the expert from France in relation to the comparison of methods used for producing variety descriptions, as set out in Annex II to this document;

        (b)   review the explanations to be provided by the participants in the practical exercise to be considered as a possible basis for guidance for revision of document TGP/8;

        (c)   consider the summary of the presentation in document TWC/34/12, to be presented by the experts from Finland and Italy; and

(d)   consider the report on the work done by Germany on "Variability of assessment data over years in apple", on the basis of the presentation reproduced in Annex VI to this document.

4.   The following abbreviations are used in this document:

CAJ: Administrative and Legal Committee
TC: Technical Committee
TC-EDC: Enlarged Editorial Committee
TWA: Technical Working Party for Agricultural Crops
TWC: Technical Working Party on Automation and Computer Programs
TWF: Technical Working Party for Fruit Crops
TWO: Technical Working Party for Ornamental Plants and Forest Trees
TWPs: Technical Working Parties
TWV: Technical Working Party for Vegetables

5.   The structure of this document is as follows:

ANNEX I   "Different forms that variety descriptions could take and the relevance of scale levels", document prepared by an expert from Germany

ANNEX II   "Comparison of methods used for producing variety descriptions: results of the practical exercise", document prepared by an expert from France

ANNEX III   "Short explanation on the French methods for producing varieties descriptions for measured characteristics", document prepared by an expert from France

ANNEX IV   "Short explanation on measured, quantitative characteristics for United Kingdom veg & herbage", document prepared by an expert from the United Kingdom

ANNEX V   "Reasons and situations that determine use of approaches", document prepared by an expert from the United Kingdom

ANNEX VI   "Variability of assessment data over years in apple", presentation by an expert from Germany

BACKGROUND

6.   The Technical Committee (TC), at its forty-eighth session, held in Geneva from March 26 to 28, 2012, considered Annex III: "TGP/8 PART I: DUS Trial Design and data analysis, New Section 6 – Data processing for the assessment of distinctness and for producing variety Descriptions" in conjunction with Annex VIII: "TGP/8 PART II: Techniques used in DUS Examination, New Section 13 - Methods for data processing for the assessment of distinctness and for producing variety descriptions" of document TC/48/19 Rev. It agreed that the information provided in Annex VIII of document TC/48/19 Rev. and at the UPOV DUS Seminar, held in Geneva in March 2010, together with the method provided by Japan and the method used in France for producing variety descriptions for herbage crops, as presented at the TWC at its twenty-sixth session (see documents TWC/26/15, TWC/26/15 Add. and TWC/26/24), provided a very important first step in developing common guidance on data processing for the assessment of distinctness and for producing variety descriptions, but concluded that the information as presented in Annex VIII of document TC/48/19 Rev. would not be appropriate for inclusion in document TGP/8. It agreed that the Office of the Union should summarize the different approaches set out in Annex VIII of document TC/48/19 Rev. with regard to aspects in common and aspects where there was divergence. As a next step, on the basis of that summary, consideration could be given to developing general guidance. The TC agreed that the section should include examples to cover the range of variation of characteristics. It further agreed that the detailed information on the methods should be made available via the UPOV website, with references in document TGP/8 (see document TC/48/22 "Report on the Conclusions" paragraph 52).

7.   At their sessions in 2012, the TWPs received a presentation prepared by the Office of the Union on "Summary of different approaches of transformation of measurements into notes for Variety Description", as reproduced in the Annex I of document TC/50/25 "Revision of document TGP/8: Part II: Selected Techniques Used in DUS Examination, New Section: Data Processing for the Assessment of Distinctness and for Producing Variety Descriptions".

8.   The TWC, at its thirtieth session, held in Chisinau, Republic of Moldova, from June 26 to 29, 2012, agreed that the experts from Finland, Italy and the United Kingdom would support the Office of the Union to summarize the different approaches for further developing common guidance on data processing for the assessment of distinctness and for producing variety descriptions (see document TWC/30/41 "Report", paragraph 42). It also agreed that experts from the United Kingdom in cooperation with experts from France and Germany should conduct a practical exercise. The exercise would be to process a common data set to produce variety descriptions in order to determine the aspects in common and where there was divergence among the methods (see document TWC/30/41 "Report", paragraph 43)

9.   The subsequent developments concerning a possible new section for document TGP/8 "Data Processing for the Assessment of Distinctness and for Producing Variety Descriptions" prior to the Technical Working Party session in 2017 are reported in documents TWA/45/12, TWC/34/12, TWF/47/12, TWO/49/12 and TWV/50/12 "Revision of document TGP/8: Part II: Selected Techniques Used in DUS Examination, New Section: Data Processing for the Assessment of Distinctness and for Producing Variety Descriptions", respectively.

DEVELOPMENTS IN 2016

Consideration by the Technical Working Parties in 2016

10.   At their sessions in 2016, the TWC, TWO, TWV, TWA and TWF considered documents TWC/34/12, TWC/34/12 Add, TWO/49/12, TWV/50/12, TWA/45/12 and TWF/47/12, respectively.

11.   The TWC and TWA agreed to request the expert from France to continue developing the study on the comparison of methods used for producing variety descriptions to provide further information to explain the results obtained in the practical exercise.

12.   The TWC agreed to invite the experts from France, Germany, Italy and Japan to provide a short description of their methods to transform measurements into notes and to provide examples where the methods would not be appropriate using a similar structure to the information submitted by the United Kingdom, as presented in Annex IV to this document. The TWC agreed that the description of the methods and example situations where they could or should not be used could form the basis for future guidance.

13.   The TWC received an oral presentation by an expert from the United Kingdom and noted that the method used for peas used a combination of delineating example varieties and crop expert judgement, as set out in Annex V to this document. The TWC noted the explanation that example varieties were not used when the range of values was not continuous, to avoid distortion in the division of the scale of notes into equally spaced states ("notes stretching").

14.   The TWC noted that in China some quantitative characteristics without normal distribution were transformed (e.g. log) before dividing the range of expression into equally spaced states for the conversion of observations into notes (see document TWC/34/32 "Report", paragraphs 39 to 43).

15.   The TWC, received a presentation by experts from Finland and Italy on "Genotype by Environment Interaction (GEI) - DUS test and data transformation into notes", a copy of which is reproduced in the Annex to document TWC/34/17 (see document TWC/34/32 "Report", paragraphs 100 and 101).

16.   The TWC agreed that the information presented by the experts from Finland and Italy should be considered along with the guidance currently being developed on transformation of observations into notes and the criteria for choosing among different existing approaches. The TWC agreed to request the experts from Finland and Italy to provide a summary of the presentation to support the development of guidance in document TWC/34/12, to be presented to the TWC at its thirty-fifth session.

17.   The TWO and the TWA noted that the expert from the United Kingdom in the practical exercise to determine the aspects in common and divergence among methods had provided information to the TWC on

the reasons and situations in which example varieties, crop expert judgement and equal-spaced states would/would not be appropriate for transforming observations into notes (see documents TWO/49/25 Rev. "Revised Report", paragraphs 35 to 37 and TWA/45/25 "Report", paragraph 38), respectively.

18.   The TWV considered the information provided by the participants in the practical exercise on the reasons and situations in which example varieties, crop expert judgement and equal-spaced states would/would not be appropriate for transforming observations into notes.

19.   The TWV agreed on the different relevant elements that needed to be taken into consideration when transforming measurements into notes, as the importance of a good set of example varieties (in UPOV Test Guidelines and regional or national set of example varieties), the expert's knowledge about the influence of the environment and the variation within the species. Therefore, the TWV agreed that a case-by-case approach was needed in relation to assessment of distinctness and for producing variety descriptions when processing data (see document TWV/50/25 "Report", paragraphs 39 to 41).

20.   The TWA agreed with the TWC that the study on the comparison of methods used for producing variety descriptions should continue to be developed to provide further information to explain the results obtained in the practical exercise.

21.   The TWA considered the table presented in document TWA/45/12, Annex I, page 2, "Results by Method" with the notes attributed to the candidate varieties using the methods described in the practical exercise. The TWA noted that candidate varieties were sorted by "average note by variety" values and agreed to propose sorting by values in the "over-years means" column to facilitate interpretation of results.

22.   The TWA agreed with the TWC that participants in the practical exercise should provide a short description of the methods used to transform measurements into notes and examples where the methods would and would not be appropriate. The TWA noted the report by an expert from the United Kingdom that information had already been provided to the TWC.

23.   The TWA received a presentation on "Genotype by Environment Interaction (GEI) - DUS test and data transformation into notes" by an expert from Italy. A copy of the presentation is provided in the Annex to document TWA/45/12 Add. The TWA agreed on the relevance of the information provided on genotype by environment interaction for possible future guidance on converting observations into notes and for producing variety descriptions (see document TWA/45/25 "Report", paragraphs 37 to 42).

24.   The TWF recalled the presentation made by the experts from Germany and New Zealand under agenda item "Number of growing cycles in DUS examination" (see document TWF/47/15 Add.) and agreed on the importance of an appropriate range of expression and number of states for each characteristic for assessing distinctness and producing accurate variety descriptions. The TWF agreed to report to the TWC on the work done by Germany on "Variability of assessment data over years in apple", on the basis of the presentation reproduced in Annex VI to this document (see document TWF/47/25 "Report", paragraph 36).

25.   The expert from France provided an updated version of the "Comparison of methods used for producing variety descriptions: Results of the practical exercise" a copy of which is reproduced in Annex II of this document. The expert from France has also provided a short description of the French methods to transform measurements into notes, as reproduced in Annex III of this document.

DEVELOPMENTS IN 2017

Consideration by the Technical Committee

26.   The TC, at its fifty-third session, held in Geneva from April 3 to 5, 2017, noted the developments reported in document TC/53/18 "Data Processing for the Assessment of Distinctness and for Producing Variety Descriptions" (see document TC/53/31 "Report", paragraphs 117 to 119).

27.   The TC considered the analysis made by the expert from France in Annex II of this document and agreed to invite the expert from France to check the highlighted values in the table in paragraph 6 for possible data inconsistency. The expert from France informed the UPOV Office about the plans to provide further information to the TWC, at its thirty-fifth session.

28.   The TC agreed that participants in the practical exercise should be invited to provide a short description of their methods to transform measurements into notes and provide examples when these methods might be used, such as for particular characteristics, types of propagation or different situations, on

the basis of the short descriptions provide by France and the United Kingdom. The TC agreed to invite the TWC to review the explanations to be provided by the participants in the practical exercise to be considered as a possible basis for guidance for revision of document TGP/8. The experts participating in the practical exercise informed the UPOV Office that they intended to provide a short description of their methods and provide examples to the TWC, at its thirty-fifth session.

29.   *The TWPs are invited to note that:*

(a)   the TC agreed to invite the experts from France to check the highlighted values in the table in Annex II, paragraph 6 of this document for possible data inconsistency; and

(b)   the TC agreed to invite participants in the practical exercise to provide a short description of their methods to transform measurements into notes and provide examples when these methods might be used, such as for particular characteristics, types of propagation or different situations, on the basis of the short descriptions provided by France and the United Kingdom, as set out in Annexes III to V to this document;

30.   *The TWC is invited to:*

(a)   consider the information to be provided by the expert from France in relation to the comparison of methods used for producing variety descriptions, as set out in Annex II to this document;

(b)   review the explanations to be provided by the participants in the practical exercise to be considered as a possible basis for guidance for revision of document TGP/8;

(c)   consider the summary of the presentation in document TWC/34/12, to be presented by the experts from Finland and Italy; and

(d)   consider the report on the work done by Germany on "Variability of assessment data over years in apple", on the basis of the presentation reproduced in Annex VI to this document.

[Annexes follow]

ANNEX I

DIFFERENT FORMS THAT VARIETY DESCRIPTIONS COULD TAKE
AND THE RELEVANCE OF SCALE LEVELS

Document prepared by an expert from Germany

Variety descriptions can be based on different data depending on the purpose of the description. Different variety descriptions may be used for the assessment of distinctness or in the official document which forms the basis for granting protection. When variety descriptions are used for the assessment of distinctness it is important to take into account on which data the descriptions for different varieties are based. Special attention has to be given to the potential influence of years and locations.

The different forms of variety descriptions and their relevance for the assessment of distinctness can be classified according to the different process levels to look at a characteristic. The process levels are defined in document TGP/8: Part I: DUS trial design and data analysis. Section 2 (New): Data to be recorded (see TC/50/5, Annex II) as follows:

Table 5: Definition of different process levels to consider characteristics

Process level	Description of the process level
1	characteristics as expressed in trial
2	data for evaluation of characteristics
3	variety description

The process levels relevant for the assessment of distinctness are level 2 and 3. Any comparison between varieties in the same trial (same year(s), same location) is carried out on the actual data recorded in the trial. This approach relates to process level 2. If varieties are not grown in the same trial, they have to be compared on the basis of variety descriptions which relates to process level 3. In general, the identification of similar varieties to be included in the growing trial ("Management of variety collection") relates to process level 3, whereas data evaluation within the growing trial relates to process level 2.

Process level	Measurements (QN)	Visual assessment (QN/QL/PQ)	Remark
2	Values	Notes	Basis for comparison within the same trial
3	Transformation into notes Notes	Same Notes as in Process level 1 Notes	Notes resulting from one year and location
	"**Mean variety description**" If varieties are assessed in several trials/years/locations mean descriptions can be established.		Basis for management of variety collection

In general, quantitative characteristics are influenced by the environment. An efficient way to reduce the environmental influence is the transformation of actual measurements into notes. The notes represent a standardized description of varieties in relation to example varieties (see TGP/7). In addition, the comparability of variety descriptions for varieties not tested in the same trial can be improved by calculating a mean description over several growing cycles. In particular, the mean description over several growing cycles at the same location can provide a representative description related to the location. The calculation

of a mean description over different locations should only be considered if the effects of the locations are very well known and variety x location interactions can be excluded for all characteristics. The calculation of mean descriptions over locations should be restricted to the cases where these conditions are fulfilled.

If variety descriptions from different growing trials are used for the assessment of distinctness - that means for the management of variety collections - it is important to take into account the origin of the different variety descriptions of the candidate variety and the varieties of common knowledge. The comparability of variety descriptions is influenced by many factors, for example:

- Description based on a single year or a mean over several years?
- Description based on the same location or different locations?
- Are the effects of the different location known?
- Varieties described in relation to the same variety collection or a variety collection which might cover a different range of variation?

The potential bias of variety descriptions due to environmental effects between candidate varieties and varieties in the variety collection have to be taken into account in the process of distinctness testing, and in particular, for the identification of varieties of common knowledge to be included in the growing trial.

[Annex II follows]

COMPARISON OF METHODS USED FOR PRODUCING VARIETY DESCRIPTIONS: RESULTS
OF THE PRACTICAL EXERCISE

Document prepared by an expert from France

<table>
<tr><td>New Version</td></tr>
<tr><td><u>**Underlining (highlighted in grey)**</u> indicates insertion or modification to the text of the Annex presented to the TC and the TWPS at their session in 2016.</td></tr>
</table>

1.   The main purpose of this practical exercise is to help developing a common guidance by clarifying and comparing the different methods used by UPOV members to transform quantitative characteristics into notes.

Dataset : Description

2.   A common dataset on Flax varieties was produced by experts from France for this practical exercise. The dataset is based on observations made on UPOV characteristic 21 ("Stem: length from cotyledon scar to top boll", see document TG/57/7, Test Guidelines for Linseed, Flax). It's a restriction of a larger dataset, which finally has been restricted to observations on the first 20 plants of the varieties and years where 20 or more plants of the variety were observed in the year. This reduced common data set consists of 936 variety-by-year combinations for 153 reference varieties and 30 candidates in 10 years from 2002 to 2012, for which the variety-by-year means were calculated on the original scale of the characteristics.

Methods used by the UPOV members

3.   The different methods used by UPOV members in order to assign notes to the candidate varieties are briefly summarized in the table below.

COUNTRY		Method : description	Example varieties	Crop expert judgment	Equal-spaced state
France	**Method 1**	Combined use of example varieties and reference collection	x	x	
	Method 2	Adjusted means from COY program + linear regression method calibrated with example varieties	x	x	
Italy		Average range of historical means + median used as "reference point" + partitioning into equal spaced states + calibration with crop expert judgment and example varieties	x	x	x
Germany		Adjusted mean from COY program + partitioning based on example varieties and crop expert judgment	x	x	
Japan		Adjusted Full Assessment Table (FAT) : states determined with historical data of example varieties	x		x
United Kingdom	**Method 1**	Range of expression of the over-year means for the reference collection varieties (for the past 10 years) divided into equal spaced states			x
	Method 2	Crop experts define delineating varieties whose over-year means are used to delineate each state	x	x	

4.   We can first notice that all the UPOV members who performed the exercise use example varieties in their process to assign notes. In particular, the method used by Japan and the number 2 French method 2 rely directly on UPOV example varieties (or any other own example varieties), whereas UPOV example varieties are used by crop expert for final calibration in the German and the Italian methods.

5.   Italy, Japan and United Kingdom (method 1) divide the total range of expression of the characteristic for the reference varieties into equal-spaced states in order to set a note and Italy and Japan also adjust each state according to crop expert judgment or example varieties.

Results by method

6.   The table below shows the notes attributed to the 30 candidate varieties with each method.

Variety	2011 mean	2012 mean	Over-year mean	Note France method 1	Note France method 2	Note Italy	Note Germany 2012	Note Japan 2012	Note GB method 1	Note GB method 2	Average note by variety
Variety 262	247	301	274	1	1	1	1	2	1	1	1.1
Variety 287	0	349	349	1	-	1	2	3	1	1	1.5
Variety 263	234	353	293.5	1	2	1	2	3	1	1	1.6
Variety 284	0	357	357	2	-	1	2	3	2	2	2.0
Variety 283	0	381	381	2	-	2	2	4	2	2	2.3
Variety 288	0	422	422	4	4	2	3	4	3	3	3.3
Variety 290	0	433	433	5	-	3	4	4	3	3	3.7
Variety 289	0	434	434	5	-	3	4	4	3	3	3.7
Variety 303	0	449	449	5	-	3	4	4	3	3	3.7
Variety 277	417	456	436.5	5	5	3	4	5	4	4	4.3
Variety 297	0	463	463	5	-	3	4	5	3	4	4.0
Variety 269	351	467	409	5	4	2	4	5	3	4	3.9
Variety 302	0	468	468	5	-	3	4	5	4	4	4.2
Variety 275	341	469	405	5	4	2	4	5	3	3	3.7
Variety 274	405	481	443	5	5	3	4	5	4	4	4.3
Variety 270	557	616	586.5	7	7	5	6	7	7	6	6.4
Variety 228	467	624	545.5	6	6	5	6	7	6	5	5.9
Variety 267	591	642	616.5	8	8	5	7	7	7	7	7.0
Variety 293	0	650	650	7	-	6	7	7	7	7	6.8
Variety 295	0	677	677	8	-	6	7	8	7	7	7.2
Variety 292	0	685	685	8	-	6	8	8	7	8	7.5
Variety 300	0	700	700	8	-	7	7	8	8	8	7.7
Variety 291	0	704	704	8	-	7	7	8	8	8	7.7
Variety 294	0	707	707	8	-	7	8	8	8	8	7.8
Variety 299	0	713	713	8	-	7	7	8	8	8	7.7
Variety 273	549	716	632.5	8	8	6	8	8	7	7	7.4
Variety 272	580	726	653	9	8	6	7	8	8	8	7.7
Variety 298	0	751	751	9	-	7	8	9	9	9	8.5
Variety 296	0	783	783	9	-	8	9	9	9	9	8.8
Variety 301	0	784	784	9	-	8	9	9	9	9	8.8
Mean by method				5.9	5.2	4.3	5.3	6.0	5.2	5.2	
Standard deviation				2.6	2.3	2.3	2.4	2.1	2.7	2.7	

7.   Only 13 out of the 30 candidate varieties have been noted with the French method 2 because this method requires having data of two years for the candidate varieties in order to calculate an adjusted mean with the COY program and then to assign the corresponding note.

8.   The presence of both linseed and flax varieties in the complete dataset is responsible for a non-normal distribution with a peak of small varieties with low notes (linseed) and a peak of tall varieties with high notes (flax). Consequently, the probability for a candidate variety to obtain a medium note (between the two peaks) is low. That's why, for several methods, one of the medium note has never been attributed to a candidate variety. For example, with the Italian method, each note but the note 4 has been assigned to at least one candidate variety.

9.   Some methods try to take into account the annual effect using COY adjusted means (French method 2, German method, GB method) or by calibrating their model with data of the year, as in the Japanese method with the FAT sliding adjustment or in the French method 1.

Comparison of the results (New graph)
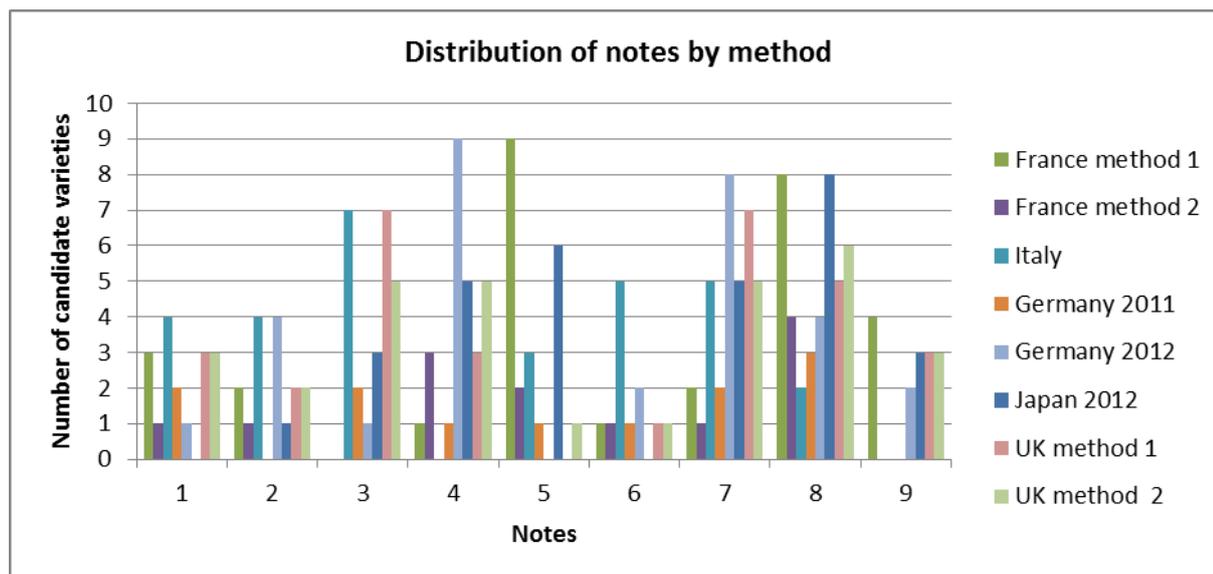
Figure 1 : Distribution of notes by method.

10.   The graph above shows that the distribution of notes is not normally distributed in the tested methods. But in most of the cases, distributions reveal two distinct peaks, which correspond to the two kinds of varieties: the first one corresponds to linseed varieties (smaller varieties with low notes) and the second one to flax varieties (taller varieties with higher notes).
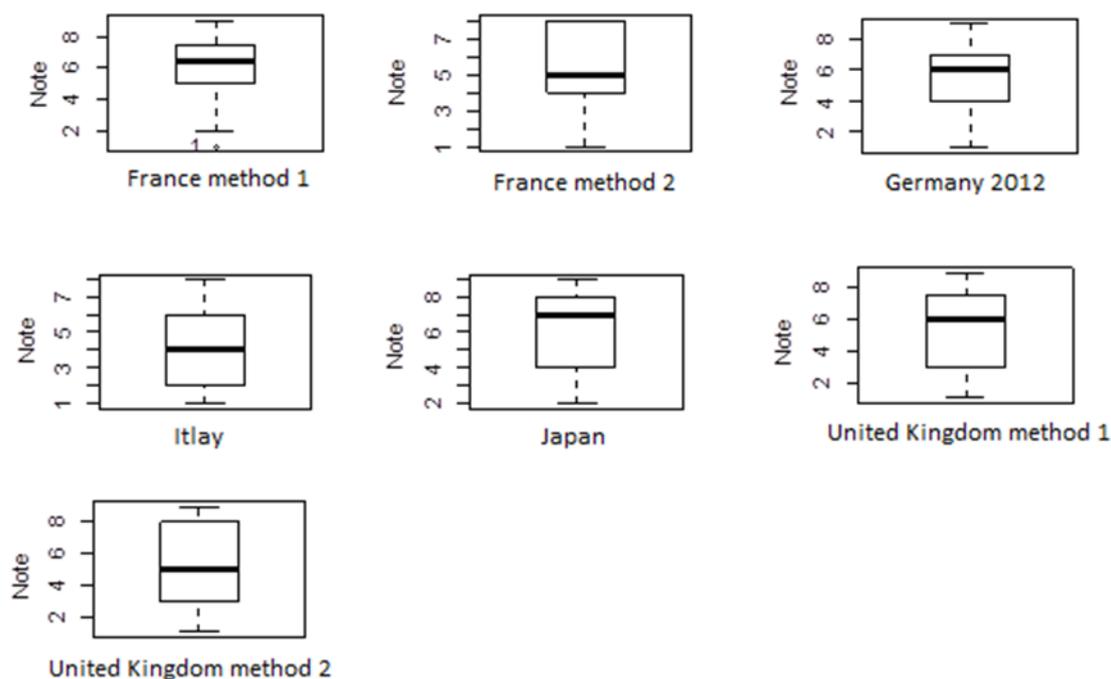
Figure 2 : Boxplot of notes for candidate varieties by method.

11.   The boxplots show that the median of notes is higher with the Japanese method than the median of the French method 2 or the Italian method. 50% of the candidates' notes are concentrated between 2 and 6 with the Italian method.

12.   The percentage of common notes between each pair of methods has been calculated (number of varieties with identical notes divided by number of varieties notated with both methods) and summarized in the following table.

Method	Note France method 2*	Note Italy	Note Germany 2012	Note Japan 2012	Note GB method 1	Note GB method 2
Note France method 1	84,6%	18,5%	57,1%	53,6%	39,3%	39,3%
Note France method 2*		8,3%	46,2%	46,2%	30,8%	23,1%
Note Italy			16,7%	0,0%	26,7%	26,7%
Note Germany 2012				35,5%	48,4%	58,1%
Note Japan 2012					38,7%	38,7%
Note GB method 1						83,9%

Table 1: Percentage of candidate varieties with identical notes.
*: total number of candidate varieties notated inferior to 30 (13 for the French method 2)

13.   The two French methods are the closest ones because 85% of the candidate varieties obtain the same note with these two methods. The Japanese method also shares nearly 50% of common notes with these two methods. These three methods seem to assign close descriptions.

14.   The two GB methods give very similar results (84% of identical notes) and the German method is also close to both GB methods. This can define a second group of close methods.

15.   The Italian method doesn't share many common notes with the other methods. In particular, the Japanese and the Italian methods appear to be quite distinct because they never produce identical notes for a candidate variety. A candidate variety obtains always a higher note with the Japanese method than with the Italian method. The average note for a candidate variety varies from 4,3 with the Italian method to 6,0 with the Japanese method. Moreover, the range of notes varies from 1 to 8 with the Italian method and from 2 to 9 in the case of the Japanese one.

16.   All the methods have then been compared with a non-parametric test, namely the Wilcoxon signed rank test for paired samples, because the distributions are not normally distributed. According to that test, the notes obtained with these methods are significantly different from one method to another, except for the two French methods, each French method with the Japanese method, the two GB methods and each GB method with the German method. Therefore, we can consider three different groups: a first one composed by the two French methods and the Japanese method, a second composed by the two GB methods and the German method. The third group contains only the Italian method which seems to be significantly distinct from every other method. This confirms the groups previously defined on the percentage of common notes.

17.   We can't distinguish a special common point between the methods used in each group.

Conclusion

18.   The methods used by UPOV members to assign a note to the candidate varieties rely on a combination of division into equal-spaced states, use of the results of examples varieties and crop expert judgment.

19.   The non-normal distribution of notes in most of the methods is explained by the composition of the dataset, which includes two different types of linseed and flax varieties among the candidate varieties.

20.   Despite the diversity between the UPOV member methods, the notes set for the candidate varieties are finally close. Nevertheless, we can distinguish 3 groups of methods which are significantly different based on the Wilcoxon signed rank test for paired samples:

-    the two French methods and the Japan method;

-    the two GB methods and the German method; and

-    the Italian method. On average, a note assigned by the Italian method is lower than with the others methods.

[Annex III follows]

SHORT EXPLANATION ON THE FRENCH METHODS FOR PRODUCING VARIETIES DESCRIPTIONS
FOR MEASURED CHARACTERISTICS

Document prepared by an expert from France

In France, two main methods have been developed to produce varieties descriptions from measurements. The first one is used mainly on agricultural and vegetable crops and the second one mainly on herbage and some other agricultural crops. A third method can be used only on very stable characteristics observed under controlled conditions: variety description produced according to a fixed scale.

Method 1

Method 1 is based on experience on reference collection varieties and on example varieties. It can only be used for species with a living reference collection.

The first step is to determine the range of notes of the year. To do that, for example for note 5, we calculate the mean of year n of all the reference varieties which were noted 5 the year n-1. This mean becomes the middle of note 5 for year n. Then we determine the limits of notes by this simple formula:

Max (Note 5) = Middle note 5 + [Middle note 6 – Middle note 5] / 2

The main interest of this method is the fact that more reference varieties than only example varieties are taken into account. It increases the power of the transformation of measures into notes. It also takes into account the environmental effect of the considered year. This method is used in France on several species such as maize, oilseed rape or flax.

Method 2

Method 2 is based on a regression calculation from a set of example varieties to determine the notes of candidate varieties.

Means of example varieties are used to set the following regression model:

$Y = a + bX$

Y is the note of the example variety

X is the mean of the measurement for this example variety (depending on the specie, the mean can be the arithmetic mean or the adjusted mean using COY analysis).

An equation is then obtained for each measured characteristic, which allows to calculate the notes of each candidate variety.

The choice of example varieties is crucial in this method and it can be difficult to find good example varieties for all the notes. However it is a reliable method which shows a good stability of descriptions and notes and takes into account the environmental conditions of the year.

This method is used in France mainly on herbage and sunflower.

Example for the characteristic flowering time of sunflower:

$y = 0.3702x - 69.064$
$R^2 = 0.9399$
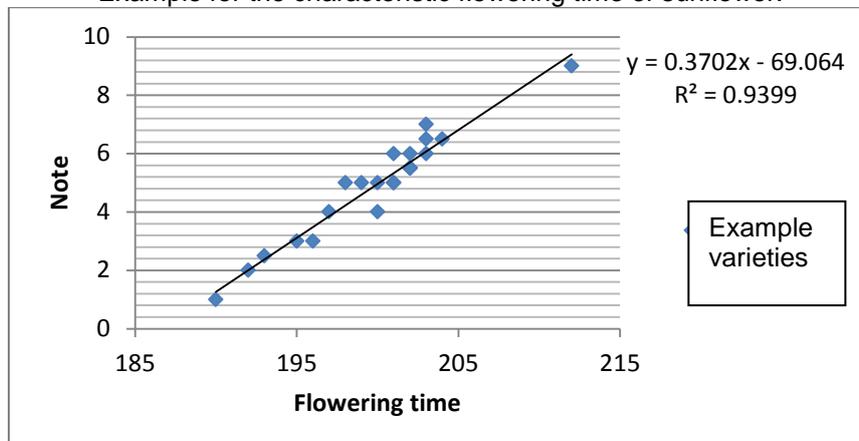
In any methods, the crop expert judgment is fundamental to validate the transformation each year and he/she can perform adjustments if needed.

ANNEX IV

SHORT EXPLANATION ON MEASURED, QUANTITATIVE CHARACTERISTICS
FOR UNITED KINGDOM VEG & HERBAGE

Document prepared by an expert from the United Kingdom

SHORT EXPLANATION ON THE UNITED KINGDOM METHODS FOR DATA PROCESSING FOR THE ASSESSMENT OF DISTINCTNESS AND FOR PRODUCING VARIETY DESCRIPTIONS

In the United Kingdom, to develop variety descriptions in vegetable and herbage crops, which are mostly cross-pollinated except for pea which is self-pollinated, the trials are conducted according to the UPOV Test Guidelines. Over-year variety means are calculated from the yearly trial means. Trial means from the past 10 years' trials are used for herbage crops. Trial means from all years where the reference collection varieties have been tested are used in vegetable crops. The over-year means are calculated using a fitted constants analysis to adjust the over-year means for the different years varieties were present in. Finally, the over-year means are converted to notes. For vegetable crops excluding potato this is done so that the states are equally spaced. For herbage crops this is done by use of delineating varieties.

For greater detail and worked examples, see TWC/30/32.

[Annex V follows]

ANNEX V

REASONS AND SITUATIONS THAT DETERMINE USE OF APPROACHES

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REASONS AND SITUATIONS WHEN CERTAIN APPROACHES WOULD/WOULD NOT BE APPROPRIATE FOR TRANSFORMING OBSERVATIONS INTO NOTES

1.   Cases when use of example varieties / crop expert judgement would/would not be appropriate for transforming observations into notes

Example varieties / crop expert judgement would **not be used if**

- the example variety did not express the same state as in previous years, ie if the delineating varieties "drifted", or

- new varieties regularly arose that showed more extreme expression.

Example varieties / crop expert judgement would **be used if**

Such as with herbage crops, which are fairly stable species so the delineating varieties do not drift. There are annual changes according to field and climate conditions, but then all the varieties tend to be affected in the same way by these. It is also used for cereals and winter oilseed rape crops.

2.   Cases when use of equal-spaced states would/would not be appropriate for transforming observations into notes

Equal-spaced states would **not be used if**

- reference varieties with more 'extreme' states cannot be sourced

- where the range of values is not continuous, eg in pod width characteristic in peas (and to a certain extent also the length characteristic). In peas there are two types of pod the "normal" and the "balloon". Below are pictures and a histogram of the over-years mean pod width. This shows that there is a normal distribution for the "normal" type but a scattering of "balloon" types at the top end. If you use the "Equal-spaced method" in this case the individual notes get stretched. There are really two discrete scales here which reflect the two different pod-types.

Balloon pods
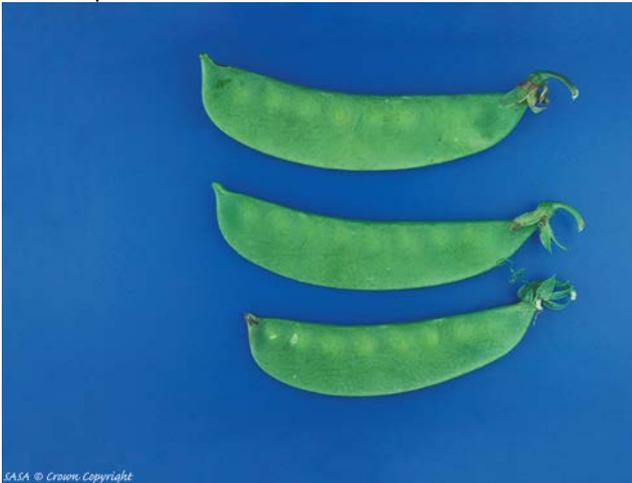
Normal pods

Histogram of pea pod width characteristic
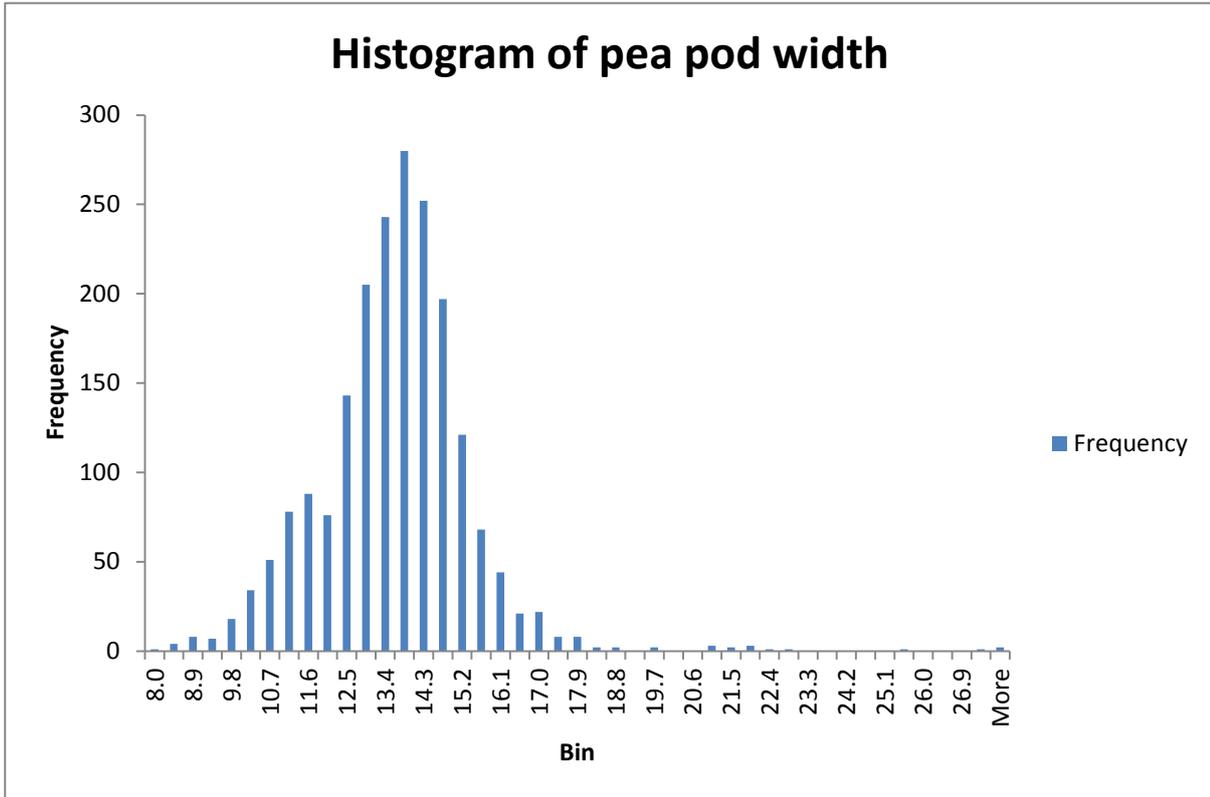
VARIABILITY OF ASSESSMENT DATA OVER YEARS IN APPLE

Presentation by an expert from Germany
Technical Working Party for Fruit Crops
Forty-Sixth session, Angers, France, November 14 to 18, 2016

Bundessortenamt

Variability of assessment data over years in apple

Erik Schulte, Bundessortenamt
UPOV-TWF 2016

Bundessortenamt

DUS examination in apple

- **Records since 1992**
- **Large living collection   (2016: 550 varieties)**
- **Datas stored in database (2016: 600 varieties)**

- **Long term data comparison revealed variation over years:**

  What are the reasons? How to deal with?

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Factors with influence on DUS characteristics:

- **Alternate bearing** (effect on e.g.: type of bearing, shoot thickness, leaf [green] coloration)

- **Age of tree** (e.g. type of bearing, tree habit, internode length, fruit size)

- **Climatic conditions** (e.g. ballon stage color, anthocyanin coloration, fruit over color, fruit russetting, stalk length, all phenological data)

- **Shoot thickness** (e.g. shoot pubescence [shoot thickness itself depends on fruit set])

- **Pollination** (e.g. fruit ratio length/width)

- **Flower set** (e.g. flower diameter)

- **Fruit set** (e.g. tree vigor and habit, shoot thickness, leaf [green] coloration, fruit ground and over color, fruit size, fruit ribbing)

- **Fruit maturity** (e.g. fruit skin and flesh color, fruit firmness, greasiness of skin)

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Can this be proved?

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(to focus on:)

- **Age of the trees**
- **Alternate bearing effect**

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(to focus on:)

- **Age of the trees**

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Influence of age of tree on fruit size
(variety 'Elstar', plantation in 1993 and 2003)

year	fruit set (note)	fruit size (note)
1995	2	7
1996	5	6
1997	5	5
1998	5	5
1999	3	4
2000	4	4
2001	4	3
2002	4	5
2005	3	6
2006	5	5
2007	4	4
2008	7	5

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(to focus on:)

- Age of the trees
- **Alternate bearing effect**

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low flower set

high flower set

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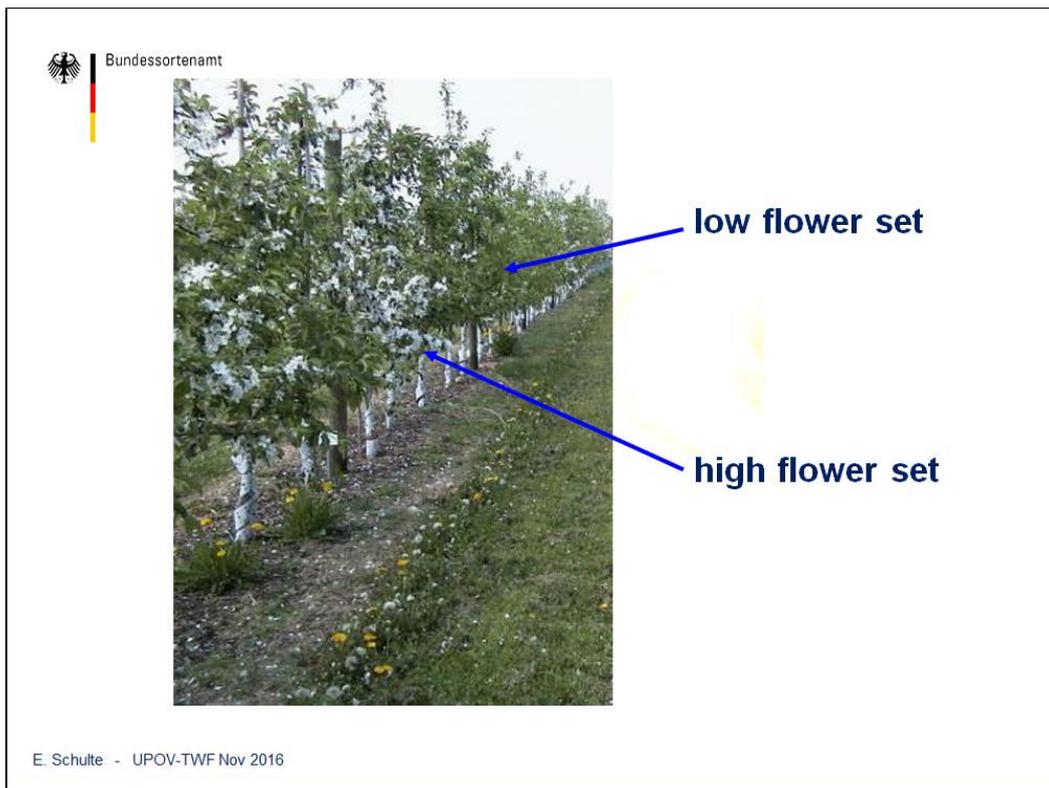
Bundessortenamt

Influence of year and alternate bearing on flower diameter
(variety 'Ingrid Marie')

testing year	flower set (note)	flower diameter [mm]	mean value (all varieties) [mm]
1996	7	44	47
1997	4	56	49
2000	2	64	59

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Thickness of shoot

with yield   without yield

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Variation of characteristic assessments
(exam. years 2011+2012, 56 varieties)

TG/14/9	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
+ 5 notes																														
+ 4 notes																												1		
+ 3 notes						1	1				1						1			1						2			
+ 2 notes	1		1	1	5	5	2	4	5		3	5			2	7	3	1	3	1	5			9	3	3	2	1	2	
+ 1 note	13		17	12	17	17	9	9	12		5	23	15	10	8	8	19	14	10	10	21	6	6	25	8	11	6	9	2	6	5
0 notes	18	56	33	37	16	28	30	22	20	41	19	22	28	22	37	32	29	16	42	16	34	44	21	24	23	29	32	34	41	40
- 1 note	18		5	5	12	4	11	10	14	10	9	13	15	20	4	2	11	19	4	11	17	7		13	15	19	10	4	8	11
- 2 note	6		1	6	2	1	7	5		2		3	3		1	6		2			7	3	1	3	1	1				
- 3 notes				2	1				1			1			2							1			1					
- 4 notes				2										1					6											
- 5 notes																										3				

green = no, or very low, variation between 1st and 2nd exam. year
yellow = variation in > 50% of varieties

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(part 2)

TG/14/9

Characteristics:

- 31 – Fruit: size of eye
- 32 – Fruit: length of sepal
- 33 – Fruit: bloom...
- 34 – Fruit: greasiness...
- 35 – Fruit: ground color
- 36 – Fruit: ...area of over color
- 37 – Fruit: hue of over color...
- 38 – Fruit: intensity of over color
- 39 – Fruit: pattern of over color
- 40 – Fruit: width of stripes
- 41 – Fruit: ...russet around stalk attachment
- 42 – Fruit: ...russet on cheeks
- 43 – Fruit: ...russet around eye basin
- 44 – fruit: no. of lenticels
- 45 – Fruit: size of lenticels
- 46 – Fruit: length of stalk
- 47 – Fruit: thickness of stalk
- 48 – depth of stalk cavity
- 49 – Fruit: width of stalk cavity
- 50 – Fruit: depth of eye basin
- 51 – Fruit: width of eye basin
- 52 – Fruit: firmness of flesh
- 53 – Fruit: color of flesh
- 54 – Fruit: ...locules
- 55 – ...beginning of flowering
- 56 – Time for harvest
- 57 – Time of eating maturity

	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
+ 5 notes									2																		
+ 4 notes		1							1																		
+ 3 notes		1				1								1			3	1				1					
+ 2 notes	6	4			1	5	3	3	3					1	2	4	2	6	6		2	1	1	2	2		1
+ 1 note	21	10	7	10	1	9	3	20	14	2			10	8	12	14	10	20	15	9	8	9	2	14	6	3	3
0 notes	14	22	45	37	40	38	46	25	32	51	44	53	34	30	20	21	20	18	33	18	21	32	36	30	25	33	44
- 1 note	10	11	4	8	4	4	2	6		1	9	3	11	11	13	17	14	7	4	22	24	8	13	10	19	18	8
- 2 notes	4	7		4			2	1			2	3		3	5	2	6	2	3	5	2	5	1			5	2
- 3 notes	1		2	1		1								1	1									1	1		1
- 4 notes									5								1										
- 5 notes									2																		

green = no, or very low, variation between 1st and 2nd exam. year
yellow = variation in > 50% of varieties
red = variation in > 75% of varieties

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Bundessortenamt

Conclusions:

- **apply Equal treatment (pruning, fertilization etc.)**

- **try to reduce Alternate bearing effect (by thinning, pruning etc.),**

- **minimize Environmental effect + Age effect on final description by testing >1 year**

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[End of Annex VI and of document]