

'Reducing the number of obligatory observation periods in DUS testing for candidate varieties in the fruit sector'

Final report

BACKGROUND

Costs of DUS testing for candidate fruit varieties are relatively high compared to varieties in other crop sectors. This fact has been subject of discussions in several circles over the recent years. The CPVO has committed itself to investigate how such cost could be reduced. The issue was discussed in the group with the CPVO fruit experts in 2009. Several options for a possible cost reduction which need further investigation have been identified. One of them was the reduction of the number of obligatory DUS cycles for candidate varieties.

At the moment, each CPVO fruit protocol states in chapter III.5 thereof that "The minimum duration of tests (independent growing cycles) will normally include at least two satisfactory crops of fruit". This is a principle that has been taken over from UPOV guidelines, but one can question the logic behind it. Ornamental crops (which for the most part are - like fruit crops - vegetatively propagated) are often observed for one growing DUS cycle before concluding the technical examination. An apple tree in the ornamental sector is for example generally tested for two years, with one establishment year and one year of observation.

OBJECTIVES OF THE PROJECT:

Partners of the project should investigate for the pilot species they are entrusted for the influence of the reduction of the number of observation periods issues on:

- the assessment of distinctness
- the assessment of uniformity, including impact for new varieties bred by mutation
- the variety description

The pilot species identified are peach, strawberry, apple, raspberry and grapevine. Varieties where the CPVO technical protocol has been implemented and which have been registered (National Listing, National Plant Variety Rights, CPVO Plant Variety Rights) in the past 5 years have been considered.

The following table indicates the breakdown of partners and the number of varieties – to be considered as defined above - by species.

Species Name	DE	FR	PL	HU	IT	CZ	ES
Prunus persica		148			18		30
Fragaria x ananassa	69 ⁽¹⁾		9	5			40
Malus domestica	87 ⁽²⁾	38	14	8		29	
Vitis L.	49			12		14	10
Rubus idaeus L.	34		1	1			

Total	239	186	24	26	18	43	80
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(1) 54 Variety descriptions checked

(2) 179 Variety descriptions checked

Situations where such a reduction has no influence might be defined and the DUS testing could be shorter in such cases, with a potential reduction of costs.

RESULTS

Partners submitted their results in Annex, organised by country. The Office sometimes asked for additional information which is also annexed.

Influence of the reduction of the number of observation periods on the assessment of distinctness

PL, CZ, HU, IT and ES could not identify any variety issued from seedlings or mutations where a lack of distinctness was suspected after the first year of observation but the second year revealed a possible problem on distinctness for a few varieties.

DE found that for apple (mutations only), strawberry and grapevine, some varieties would have been declared non-distinct on the basis of one growing cycle. All varieties were distinct in a test over two years, except one apple variety which was finally rejected. In case of raspberry all candidate varieties were clearly distinct already after one growing cycle due to the large variation in many highly discriminating characteristics in the collection.

FR did not find cases of candidate varieties where the second year of obligatory observation period revealed a possible problem on distinctness, and in no case lack of distinctness was suspected after the first year of observation for peach and apple varieties obtained by hybridization. However, 2 apple varieties issued from mutation revealed a problem on distinctness in the second year, not revealed during the first year

Influence of the reduction of the number of observation periods on the assessment of uniformity

PL, CZ, HU, DE, IT and ES could not identify any variety issued from seedlings or mutations where a lack of uniformity was suspected after the first year of observation but the second year revealed a possible problem on uniformity. In case of variety mixtures, one year of satisfactory crop was sufficient to identify the situation.

Nevertheless, FR had the case of an apple variety issued from mutation where the last year of technical examination revealed a lack of uniformity not observed during the first year of observation.

DE and ES also remarked that for grapevine, it is difficult to assess uniformity in the first year of observation.

Influence of the reduction of the number of testing periods on the variety description

The analysis of this aspect raised a lot of comments, which can be summarized at species level as follows.

Grapevine

- Changes in the score of notes between the 2 years for a minority of QN characteristics
 - ✓ (12-29%) in DE, 13,4% in ES, (0-12%) in HU, (17-41%) in CZ
 - ✓ Grouping characteristics are very stable (CZ)
- Some notes affected by the environment
- Plants too young / juvenile during the first year



- ✓ In the first year of observation the plants may not have been sufficiently developed yet so that no stable expressions of characteristics can be observed (DE, ES)
- ✓ For some notes, there is apparently a discrepancy during the 2 years with the necessity to opt for an average or to opt for one of them (ES)
- ✓ Very often reactions of example varieties are not consistent between the years (CZ), 'vintage effect' (HU)

Apple

- Changes of notes between the 2 years for a minority of QN characteristics
 - ✓ (0-8) in DE, (3-16) in PL
- Some notes affected by the environment
 - ✓ There are QN characteristics which are relatively highly influenced by weather condition of the particular year and very often reactions of example varieties are not consistent within the years. However the adjustments vary within 2 notes max (CZ) but up to 4 notes (PL)
- Plants too young / juvenile during the satisfactory fruiting period
 - ✓ The first flower set of the young trees occurs at the terminal ends of the long shoots, only. These fruits occur later, and are of different shapes than those growing on lateral spurs, later on, which is typical for apple trees. Therefore the first examination year in apple may result in different expressions for a certain number of flower and fruit characteristics compared to assessments obtained in the following year, where both flowers and fruits from long shoots and from spurs are assessed. (DE)
 - ✓ Some characteristics are influenced by the age of the tree and differences between the first and the second year are to some extent predictable (FR)
 - ✓ It may be interesting to check if the age of the tree and the number of fruit crops influence the expression of the characteristics by establishing a specific trial with more varieties and a specific protocol for the age of the tree (more than two years of observation) (FR)
- Conclusion after one year of observations possible in some cases
 - ✓ Two varieties had a positive DUS conclusion after only one satisfactory crop of fruit. Both were sufficiently distinct from other existing varieties and sufficiently uniform. Descriptions of the varieties have been made from the first and single year of observation (FR)

Remark: these cases were possible before the standardization of the duration of the DUS test with 4 cycles as a minimum, and two satisfactory crop of fruits as minimum, either hybrid or mutant type.
- Descriptions more precise where distinctness is at stake
 - ✓ FR: The process of description is different between the hybrid and the mutant varieties type. For mutant varieties we observe 2, 3 or 4 satisfactory crops of fruit, whereas only two for hybrid. In this study we only considered the last and the penultimate year of observation, whatever the varietal type.

Peach

- Identification of problematic traits
 - ✓ During the note score, we found traits whose notes were uniform and easy to assess. However, other traits were not so easy to define, mainly due to the observation of two or more notes in the same trait and to a not clearly predominant frequency (ES)



- Differences due to the environment
 - ✓ Most of the differences caused by the influence of the environment were identified and adjusted by contrasting data from the two testing periods with obtained in the reference varieties. Other differences were due to the fact that trait expression for one year was in the transition of two notes, or that notes were found in similar ratios... In these cases, a second testing period helps greatly to clarify the correct note, adjusting the note to the average value in-between two levels, or opting for one of them (ES)
- Influence due to the age of the tree
 - ✓ In the case of fruit trees, as peach, data of the 2nd testing period are more reliable, since the trees are larger and have a more uniform crop. Sometimes, although it was not the case in the studied varieties, the definition of the correct note for a particular trait during a third testing period was necessary (ES)
 - ✓ For the characteristics of the tree, flowering shoots, flowers and leaves, the descriptions are usually realized during the second satisfactory crop of fruit, once the tree is considered well established and has reached physiological maturity (FR)
 - ✓ The representative colours of the fruit and stone are expressed and sufficiently stabilised from the fourth year of implantation, once the tree is well established (FR)

Strawberry

- Identification of problematic traits
 - ✓ During the note score, we found traits whose notes were uniform and easy to assess. However, other traits were not so easy to define, mainly due to the observation of two or more notes in the same trait and to a not clearly predominant frequency. Checking the problematic traits of the draft variety description from the 2011 testing period with the data of 2012, we could confirm that we choose correctly 90.29% of the notes. However, a second testing period provided the necessary information to be resolved in favour of the other possible note in the rest of the problematic traits. Forcing to generate a draft variety description from one testing period data, an incorrect variety description would be obtained. (ES)
- Change of notes between the 2 years for a variable number of characteristics
 - ✓ All variety descriptions were modified in many characteristics after the second growing cycle. Changes were necessary in at least 9 characteristics (1 description) up to 29 characteristics (also 1 description) (DE)
 - ✓ An incidence of 5 characteristics maximum by variety (HU)
 - ✓ Influence of the second season was found depending on the variety, in case of 5-17 out of 41 characteristics (12-41%); mainly QN characteristics were affected and the differences ranging from 1 to 4 notes were found. There were also some PQ characteristics for some varieties and only one QL characteristic for one variety affected (PL)
 - ✓ A great variability was observed for a number of traits, showing different notes in an average of 16.88 % of traits. This implies that the draft variety description from one testing period data may differ with the year, mainly by environment influences and difficulty to assess the correct note with one year data in several traits. Most differences caused by the influence of the environment were easily identified and adjusted by contrasting the data from the two testing periods. Other differences were solved adjusting the note to the average value in-between two levels, or opting for one of them. (ES)
 - ✓ Some strawberry varieties descriptions issued after one fruiting period could be acceptable, but it will be doubtful to apply this rule for all varieties in advance, as a general rule (PL)
- Influence of the conditions of cultivation of the plants



- ✓ In case of strawberry, the plants used for the assessment in the first examination years, are submitted by the breeders. Before arrival, they have been cultivated in different ways, at different places and under different climate conditions. Some of the characteristics may be influenced by this treatment. Only with the second year, once multiplied by runners at the testing office's facilities, the plants of all candidate varieties, as well as of the similar varieties, are best homogenized compared to each other (DE)

Raspberry

- Raspberry
 - ✓ In case of **raspberry**, between the first and the second year, between 6 and 28 characteristics were recorded with a different stage of expression considering the range of varieties subject of the investigation (DE)
 - ✓ Only in the case of raspberry the reduction of the examination duration from two to one year did not affect the decision on distinctness for the analysed candidate varieties (DE)

OPINIONS FROM PARTICIPANTS

Poland

According to the presented data we are of the opinion that only in case of some strawberry varieties descriptions issued after one fruiting period could be acceptable, but it will be doubtful to apply this rule for all varieties in advance, as a general rule.

Variety descriptions are very often adjusted during the second fruiting period, when the expression of characteristics is more representative for the variety – it makes the variety description more precise, valuable and reliable.

We are of the opinion that the rule concerning providing variety descriptions after two satisfactory fruiting seasons should be kept.

Italy

As a general conclusion the EO is of the opinion that the observation of the variety over two independent fruiting cycles is needed to issue a consistent final variety description for the new varieties.

Hungary

The reducing of the costs is highly desirable for the applicants because it is an expensive and long time process to create a new variety. To make more cost- and time-efficient the final official step in the life of a new variety, is important for the breeders. One of the opportunities is the reduction of the number of obligatory DUS cycles for candidate varieties. The distinctness and uniformity could be assessed after the first year in the majority of cases. Nonetheless the second year has additional function. It means to verify the final result of the examination.



France

Peach

The reduction of the duration of the DUS test probably does not have consequences on the assessment of distinctness and on the assessment of uniformity of varieties issued from hybridization.

As for the variety description, a reduction of the duration of the DUS test may have consequences on the quality of the description, taking into account that 100% of the varieties descriptions have been established at the end of the second year of observation; providing that the observations made during the first significant production are essentials because it allows adjusting the characteristics of the variety (including maturity).

Apple

Distinctness:

In the case of some mutant candidate varieties, the reduction of the duration of the DUS test have consequences on the assessment of distinctness since we observed for two varieties problems of distinctness in the second year of observation, and not only after the first year.

For hybrid candidate varieties, we did not observe problems of distinctness the second year, so the reduction of the duration of the DUS test probably does not have consequences on the assessment of distinctness.

Uniformity:

For mutant candidate varieties, we observed only one case of uniformity problem and it has been revealed during the third and last year of observation. So the reduction of the duration of the DUS test may affect the assessment of the uniformity.

This case underlines the needs to check uniformity of mutant varieties during a number of significant cycles and with a significant number of buds and fruits.

For hybrid candidate varieties, we did not observe problems of uniformity the second year, so the reduction of the duration of the DUS test probably does not have consequences on the assessment of uniformity.

Variety description:

For hybrid and mutant candidate varieties, one year of observation would not be enough to realise a final description of the varieties. All the years of observation were necessary even if it was the second, the third or the fourth year of observation, especially for the mutant candidate varieties.

So a reduction of the duration of the DUS test has consequences on the quality of the description.

We observed two hybrid candidate varieties for which the first year of observation was sufficiently satisfactory to have the DUS conclusions and the varieties descriptions. For these cases the reduction of the duration of the DUS test does not have consequences on the quality of the description.

For mutant varieties, recently, the situation changed significantly considering applications still under test in 2012 and 2013:

- the rate of problematic applications for Distinctness and Uniformity increases
- the number of satisfactory crops studied increases with the request of appeal from the applicants.

The questions are:

- in case where the examiner is convinced of the lack of Distinctness and Uniformity, how to manage with the request of applicants claiming for additional DUS cycles and characteristics?



- in case where the requests of the applicants for Distinction and Uniformity are probably funded, or at least need to be checked, how to manage the process of the DUS examination:
 - quality of the material (sanitary status, rootstock and age of the plants),
 - number of plants and replicates,
 - place of complementary examination

For hybrid varieties, what will be the situation? As we recently had several applications still under test in 2012 and 2013, where Distinction difficulties were pointed out during the first year of observation.

Spain

Peach

In the case of fruit trees, as peach, data of the 2nd testing period have higher weight, since the trees are larger and have a more uniform crop. Sometimes, although it was not the case in the studied varieties, the definition of the correct note for a particular trait during a third testing period was necessary.

This implies that a draft variety description from one testing period data will differ with the year, mainly by environment influences and difficulty to assess the correct note with one year data in several traits. Our experience has indicated that a 2nd testing period provide the necessary information to clarify doubts and choose the correct note.

Grapevine

Once we have developed the ideas above, we can state the following:

- A clear lack of uniformity or plants out of type can be identified after one year of research.
- The data observed after one year of research are not enough to give an accurate description of the variety.
- Since the variety draft after one year of research cannot be defined clearly enough, it is not possible to provide an accurate assessment of the distinction either.

Strawberry

Variety descriptions from data of one testing period showed some traits with incidences or uncertainties about the definition of their note, and consequently are not accurate.

A second testing period contributed decisively to the final definition of the notes and to obtain an accurate variety description.

As a consequence, it is not possible to assess correctly the distinction of the candidate variety from variety descriptions obtained with data of only one testing period.

It is possible to assess the uniformity of the variety with one testing period, but it is not possible to obtain an accurate variety description and to assess the distinctness.

Germany

Environmental effects have a clear impact on the expression of many quantitative and pseudo-qualitative characteristics in the analysed species. Differences may be due to the conditions of the year but also to the age of the plants.



For trees and shrubs, young plants of candidate varieties are observed together with older plants of reference varieties. In order to allow for a full comparability, the candidate plants need to be sufficiently developed, so that their expressions correspond to those of mature plants. In apple and grapevine the plants are established for two years before the first observations are done. In raspberry observations start after one establishing year. Nevertheless, it was shown that the expression of a number of characteristics is still influenced by the plant age in the first year of observation.

In spite of these effects the first year of observation provides very important information for the characterisation of the variety and the assessment of distinctness and it would not be appropriate to use an additional establishing year. Many characteristics are already fully expressed. They can be used for the identification of similar varieties and will be incorporated in the data for a reliable variety description. Differences between varieties planted at the same time are normally consistent between the first and the second year. But the definite variety description can only be established after the second year of observation, when the variety is fully comparable with older plants in the reference collection. For new candidate varieties the influence of environmental factors is much less known, than for the reference varieties, forming part of the collection for a longer time.

If a decision on distinctness shall be taken after one growing cycle, it is important that the similar varieties have the same plant age as the candidate, i.e. the potential similar varieties must have been replanted together with the candidate. In addition, larger minimum distances are necessary to be considered as a clear and consistent difference in QN and PQ characteristics. As a result, fewer varieties can be declared to be distinct after one growing cycle.

In many cases similar varieties chosen for a particular examination, on the basis of the information provided by the breeder in the technical questionnaire, turn out not to be sufficient, so that additional, more similar, varieties from the reference collection have to be included into the trial, once data from the characteristic assessment of the candidate have been obtained. A full comparison is possible in the second year, provided that the potential similar variety is available in the living reference collection.

The annual planning of the new trials, and the identification of similar varieties, need to refer to a perennial solid data basis. Variety descriptions based on one year assessments are not appropriate for that purpose.

An examination on the basis of one year of observation, only, would cause a weakening of the variety protection, as the variety description would become vague, and cannot provide reliable information for the variety identification, and for defending intellectual property rights. The increased thresholds for distinctness would not allow protection for many new varieties. The results after the second year reveal that a rejection due to lack of distinctness after one year would not be appropriate.

Summary

- In case of apple, strawberry and grapevine, an examination period of a single year would not be sufficient to take a profound decision on distinctness. Only in case of raspberry the reduction of the examination duration from two to one year did not affect the decision on distinctness for the analysed candidate varieties.
- The assessment of uniformity was not affected by the duration of the examination in any of the four crops.
- Variety descriptions obtained after the first year of examination differ profoundly from biennial descriptions in all four crops. Such unreliable descriptions cannot be used for trial planning and the selection of similar varieties.
- The currently used period for establishing the trials is appropriate.
- After all, a biennial DUS test and a variety description, based on a biennial characteristic assessment, is essential for granting plant breeders' rights and for enforcement.

Czech Republic



Even though the adjustments have no impact to our decision in our small sample we fully support two year DUS testing. The main reason is huge number of new varieties with closer and closer genetic background. Reduction of the year would lead to the big problems with distinctness.

Detail descriptions are very important also in the process of certification of plant material.

CONCLUSIONS

Results indicate that in the big majority of cases, the second year of observation confirms the result of the first year in respect of Distinctness, Uniformity and Stability in a context where variety descriptions are made on the basis of 2 years of observations. However, if the DUS test were to be limited to the first fruiting period, there are other consequences that must be taken into account. Firstly, in the first satisfactory fruiting period, trees are still young and do not express some of the characteristics under the present protocol in the same way as they would do in the second year of observation.

Secondly, switching to a system where observations would be limited to the first fruiting period as a routine would have consequences when comparing variety descriptions based on observations during the second year of testing which are stored in databases. A comparison between varieties described in different ages of the plant material is less reliable and would probably have a consequence when deciding on which varieties to be included in the growing trial for a side by side comparison.

This is the reason why most participants are in favour to keep 2 periods of observation as a standard for all fruit species.

Some partners underlined that in case observations are based on only one fruiting period, then this fruiting period should be the second one, since there will be little or no negative consequences on the reliability of the variety description and the DUS test. Still the situation needs to be assessed on a species basis and there are some situations like apple varieties issued from mutation where 2 years of observation are definitely necessary.

