

## Technical Working Party for Agricultural Crops

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**IMPACT OF THE NUMBER OF GROWING CYCLES ON VARIETY DESCRIPTIONS AND DISCRIMINATION POWER IN POTATO**

*Document prepared by an expert from Germany*

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1. The TWA, at its its forty-sixth session, held in Hanover, Germany, from June 19 to 23, 2017, considered several examples on the impact of using different numbers of growing cycles on DUS decisions and the establishment of variety descriptions (see document TWA/46/8, TWA/46/8 Add.). Members of the Union were invited to provide further examples to be considered in 2018. The present document provides a potato example.

2. In the Test Guidelines for Potato (document TG/23/6), it is recommended that the minimum duration of tests should normally be two independent growing cycles. This study was performed to validate whether two growing cycles are necessary or the duration of test could be reduced. The impact of the number of growing cycles was analyzed for quantitative characteristics in potato on the basis of data from actual DUS trials.

Material and methods

3. The German DUS growing trials comprise about 360 potato varieties every year. 50 to 70 varieties are candidate varieties, half in the first and half in the second year. Discrimination power of individual characteristics was calculated based on candidate varieties after the second growing cycle. Each 2<sup>nd</sup>-year-candidate variety was compared to all other varieties in the same growing trial. Two distinctness tests were performed:

- (a) '1-cycle': second year only. Two varieties are considered to be distinct if a clear difference was observed.
- (b) '2-cycles': second year and first year. Two varieties are considered to be distinct if a clear difference in the same direction was observed in both years.

4. Discrimination power of each characteristic was calculated as percentage of clear differences in relation to all pairwise comparisons.

The same analysis was performed for 2013 to 2017. In total, about 130 candidate varieties were compared to 350 reference varieties resulting in about 45,000 pairwise comparisons for '1-cycle' and '2-cycles' each.

5. A different data set was used to calculate the impact of the number of growing cycles on variety descriptions. Orthogonal DUS observations for 211 varieties in 6 successive growing cycles (2012-2017) were used to establish annual variety descriptions and descriptions over 2 cycles. Six annual descriptions and six descriptions over two cycles were produced for each variety and variation between these descriptions was calculated.

6. DUS tests were conducted according to document TG/23/6. The numbering of characteristics follows these Test Guidelines.

Results and discussion

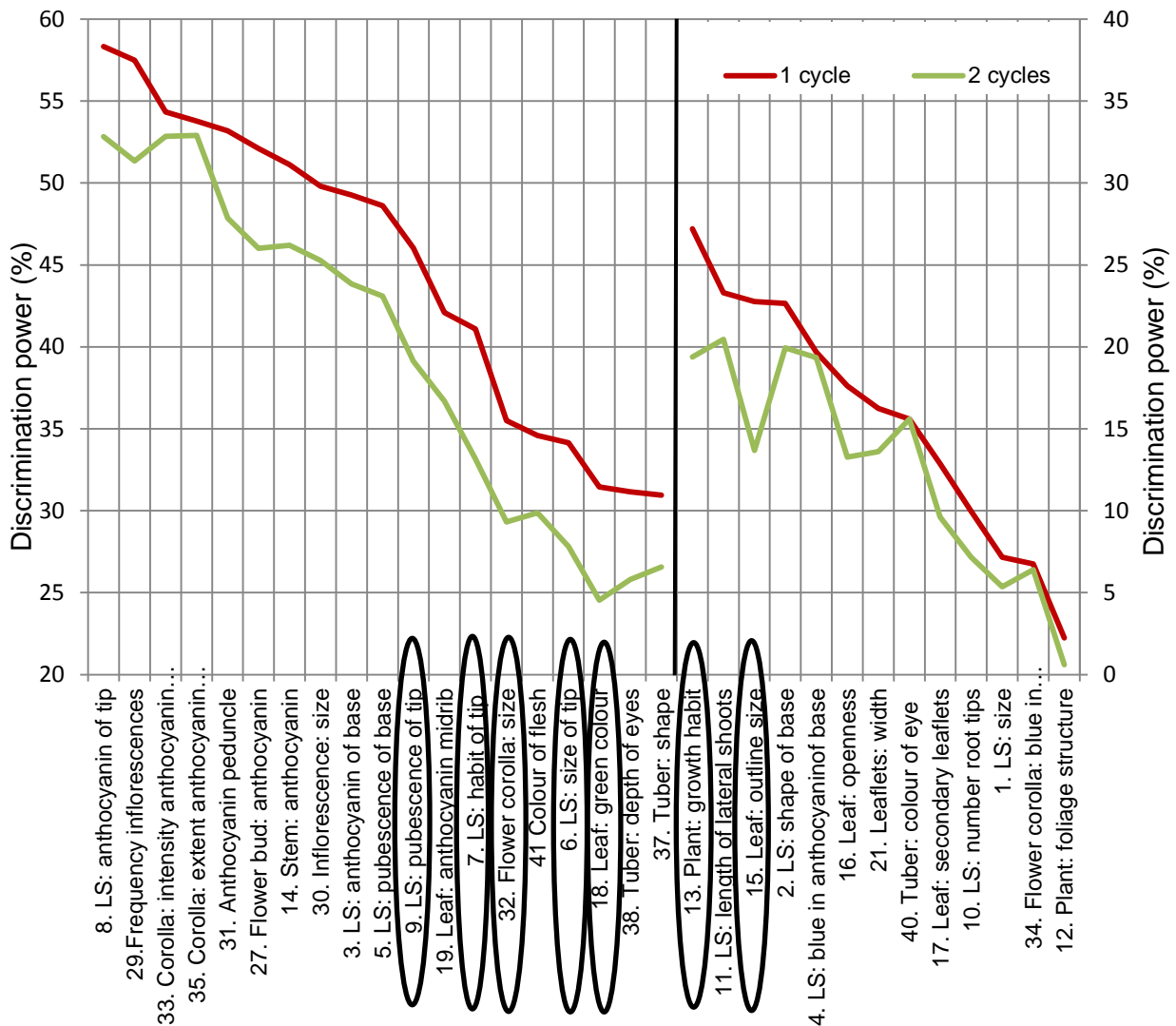
*Discrimination power:*

7. The mean discrimination power based on a single cycle and over two cycles is presented in figure 1. Characteristics were sorted according to the discrimination power in a single cycle with a range between 58 % and 2 % discrimination power. The decision on distinctness was significantly influenced by the number of growing cycles. A clear difference observed in one cycle was not always confirmed in the second cycle. Consequently, the discrimination power was lower after 2 cycles. If varieties were compared in a single year, for some characteristics distinctness was up to 10 % higher than after 2 cycles. Characteristics with the highest 'overestimation' in discrimination power were marked in figure 1.

8. A clear difference observed in only one of the cycles might be confirmed in a third cycle. But in general, a third cycle is not necessary to establish distinctness in potato due to clear differences in at least one of the other characteristics. Therefore, the '2 out of 3 cycles' option was not analyzed in this study.

9. If distinctness shall be based on a single cycle, larger minimum differences have to be applied for several characteristics in order to allow reliable decisions. This would lead to lower discrimination power.

Figure 1: Impact of the number of growing cycles on discrimination power



*Variety descriptions:*

10. The maximum difference between six 1-cycle variety descriptions and between six 2-cycle variety descriptions is presented in figures 2 and 3. Characteristics have the same order in both figures, sorted according to the frequency of identical 1-cycle descriptions (0 note difference). Some characteristics were very stable with conformity between the six 1-cycle descriptions for more than 90 % of the varieties, see characteristics 40. Tuber: color of base of eye, 34. Flower corolla: proportion of blue in anthocyanin coloration on inner side and 4. Lightsprout: proportion of blue in anthocyanin coloration of base. On the other side, the percentage of zero notes difference was less than 20 % for characteristics 9. Lightsprout: pubescence of tip, 13. Plant: growth habit and 15. Leaf: outline size.

11. The stability of descriptions was clearly improved with a second cycles (figure 3).

12. The frequency of zero notes difference is significantly higher between 2-cycle descriptions compared to 1-cycle descriptions. The following frequencies of differences were observed across all characteristics:

Differences	1-cycle	2-cycles
0 notes	47 %	62 %
1 note	47 %	36 %
>1 note	6 %	2 %

13. Variation in variety descriptions of 1 note from year to year can be considered as quite stable. Nevertheless, a clear difference between two varieties e. g. of two notes in a testing period might decrease to 1 or 0 notes in another testing period. Two growing cycles produce more robust variety descriptions.

14. Databases with descriptions for varieties of common knowledge can play an important role in the process of assessing distinctness. Descriptions are often used for the identification of similar varieties to be grown together with new candidate varieties. The efficiency of excluding varieties from the growing trial is strongly influenced by the consistency of variety descriptions over years. The potential environmental influence has to be taken into account for defining thresholds and to decide whether a difference between two varieties can be considered as clear and consistent. Less consistency of descriptions leads to more similar varieties in the growing trial.

Figure 2: Difference between 1-cycle variety descriptions  
(Maximum difference between 6 descriptions per variety, 211 varieties)

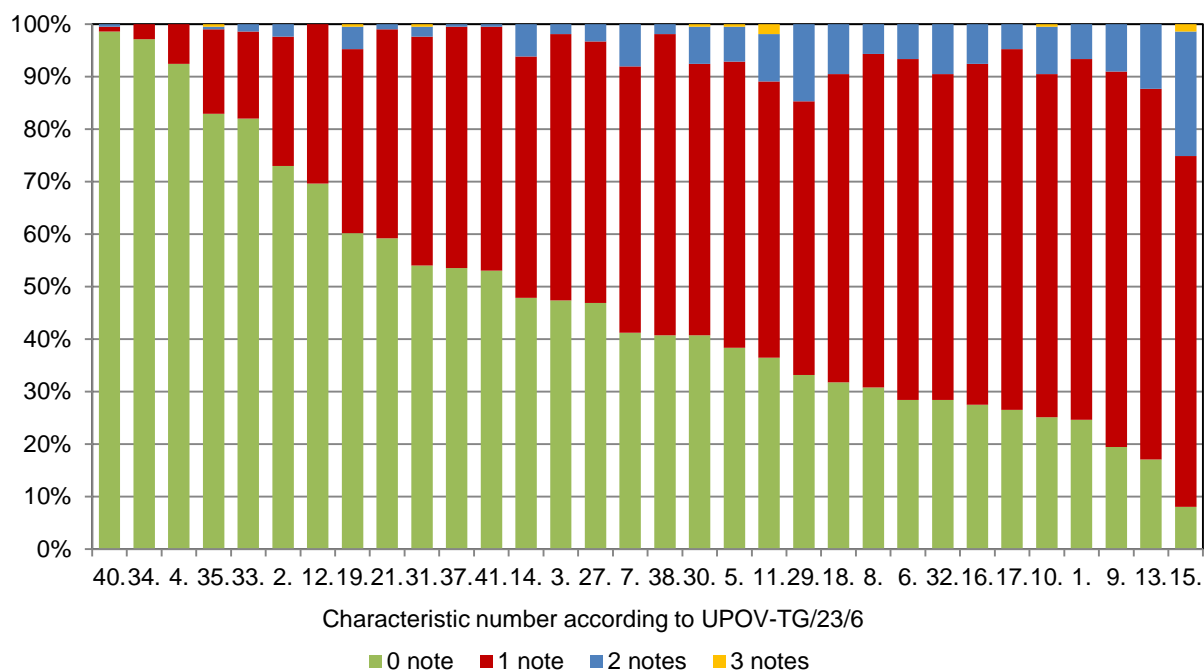
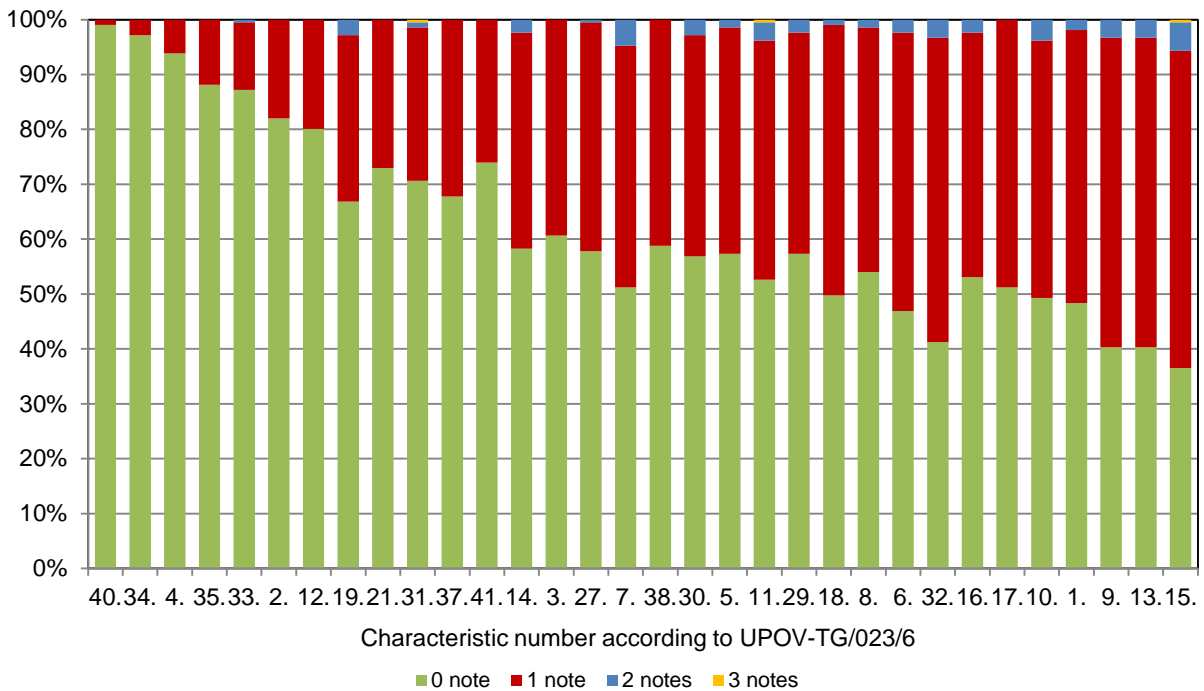


Figure 3: Difference between 2 cycle- variety descriptions  
(Maximum difference between 6 descriptions per variety, 211 varieties)



Conclusion

- The number of growing cycles has a significant impact on distinctness decisions and variety descriptions. An impact was observed on distinctness decisions for varieties compared in the same growing trials as well as on the management of the reference collection on the basis of descriptions stored in a database.
- Two growing cycles produce more robust variety descriptions and DUS decisions.
- The recommended minimum number of two growing cycles should be followed.
- Variety descriptions based on two cycles provide a better basis for enforcement.

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