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**“SELECT”: A METHOD FOR IDENTIFICATION OF VARIETIES TO BE EXCLUDED
FROM THE GROWING TRIAL**

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Introduction

1. The SELECT method was developed by experts from Germany for cereal crops in order to handle the continuously increasing number of reference varieties to be considered in the assessment of distinctness of new varieties.
2. The method identifies varieties within the reference collection which can be excluded from the growing trial because of clear differences in the expression of at least one relevant characteristic in comparison to all candidate varieties. The method uses variety descriptions of candidate and reference varieties based on the same location, but which may be produced in different years.
3. The GAIA method is based on a combined phenotypic distance, which is the sum of distances for individual characteristics. The SELECT method determines individual characteristics in which clear differences can be expected in a direct comparison in the same growing trial. Thus, the SELECT method is restricted to individual characteristics with larger differences.
4. In Germany, the DUS test for cereals is conducted over three years. In SELECT, the choice of reference varieties for the growing trial is based on descriptions of the candidate varieties produced in the first growing cycle, and the descriptions of the reference varieties obtained over at least two years from preceding growing cycles, stored in a database. As a

second step in distinctness testing, the candidate varieties are grown together with the similar reference varieties in the same trials in the second and third growing cycle.

5. The individual criteria for the application of SELECT need to be developed on a crop-specific basis with consideration of the specific conditions of the testing location. Because variety comparisons are carried out on the basis of observations from different growing cycles, it is necessary at the start to evaluate the variation of variety descriptions over years. A set of useful characteristics and reliable minimum distances for distinctness need to be defined.

6. The development of SELECT is illustrated for winter barley.

Selection of Useful Characteristics

7. Useful characteristics for inclusion in SELECT should be identified according to the following criteria:

- low level of variation over years
- high value for distinguishing varieties (high level of variation between varieties)
- time of observation (because of the short period between harvest and sowing in winter cereals, observations on harvested seeds are not included)

8. After analyzing a comprehensive set of data for the varieties over at least 6 years, a set of 18 characteristics were selected in winter barley from the 28 characteristics in TG/19/10 (see Table). Ten characteristics were not considered to be sufficiently informative or reliable.

Appropriate Descriptions for Reference Varieties

9. Descriptions of candidate varieties are based on observations in the first growing cycle. Many reference varieties might not be grown in the same year and cannot be compared directly to the candidate varieties. In order to minimize the environmental effect on the descriptions of reference varieties, the effect of using the means of descriptions obtained over several years was checked. There was a significant increase of stability of descriptions from 1 to 3 years.

10. It was concluded that all comparisons should be based on the mean descriptions over at least 2 years for reference varieties. As a consequence, a new variety in the reference collection should be grown for at least two years before it is considered in non-orthogonal comparisons. Each time a reference variety is included in the growing trial, all characteristics are observed again and a full description is added to the database. By this process, the descriptions of the reference varieties are stabilized and updated continuously.

Definition of Criteria for Distinctness

11. The assessment of distinctness in SELECT is based on notes/single variety records (see document TGP/9/1 Draft 7, Section 5.2.3). A reference variety is considered to be distinct from all candidate varieties if there is a clear difference in at least one characteristic. If a reference variety is distinct from all candidate varieties, it is excluded from the growing trial.

12. With SELECT, distinctness is assessed characteristic-by-characteristic. The method considers the probability of observing a clear difference in a characteristic if the varieties were compared in the same growing trial (direct comparison). Any difference in a qualitative characteristic makes a variety distinct. The assessment is independent of the growing cycle. For quantitative characteristics, the origin of the data being compared needs to be considered. If variety descriptions originate from different growing cycles (indirect comparison) a larger difference in a characteristic might be required to be sure that the difference would be clear in a direct comparison.

13. The probability of confirming a clear difference in at least one characteristic in a direct comparison increases if differences have been observed in several characteristics in indirect comparisons. Therefore, SELECT allows a simple combination of characteristics. A difference should only be considered if the probability that it would be clear in a direct comparison is at least one third.

14. For technical reasons the differences are given weights. A weight of 6 represents a clear difference. A weight of 2 or 4 is given if the difference is at least as large as the difference to be considered clear in a direct comparison in the same trial.

15. The differences in notes and the related weights for the winter barley example are presented in the Table. The difference required between varieties in SELECT is 6 and can be reached by one characteristic, or by a combination of two characteristics. In three of the 18 selected characteristics, a weight of 2 is possible. Only in those cases, a combination of two characteristics might not be sufficient.

16. An appropriate SELECT matrix with weights of differences for all chosen characteristics needs to be developed on a crop-specific basis by the crop experts.

SELECT matrix for winter barley – list of characteristics (TG/19/10) and indication of weights for differences in notes in pair-wise comparisons of descriptions

UPOV No.	Characteristic	Notes	Difference between descriptions in notes								
			1	2	3	4	5	6	7	8	
1	Growth habit	1 - 9	0	0	2	4	4	4	4	6	
2	Hairiness of leaf sheaths	1, 9	6								
(3+4)*	Anthocyanin auricula	1 - 9	0	2	4	4	4	4	6		
7	Time ear emergence	1 - 9	0	0	4	4	4	4	6		
(8+9)*	Anthocyanin awns	1 - 9	0	0	0	4	4	4	4	6	
10	Ear glaucosity	1 - 9	0	2	4	4	4	4	6		
12	Plant length	1 - 9	0	4	4	4	4	6			
13	Ear number rows	1, 2	6								
15	Ear density	1 - 9	0	4	4	4	4	4	6		
16	Ear length	1 - 9	0	4	4	4	4	4	6		
17	Awn length	1 - 9	0	4	4	4	4	4	6		
-	Development sterile spikelet	1, 2	6								
20	Sterile spikelet attitude	1, 2, 3	0	6							
22	Rachilla hair type	1, 2	6								
23	Grain: husk	1, 2	6								
24	Anthocyanin lemma nerves	1 - 9	0	0	4	4	4	4	4	6	
26	Hairiness ventral furrow	1, 9	6								
28	Color aleurone	1, 2, 3	0	6							

- *) According to the Technical Protocol of the CPVO (CPVO-TP/19/2):
Characteristic 3 and 4 have been combined with note 1 = absent or very weak
Characteristic 8 and 9 have been combined with note 1 = absent or very weak

Validation of Distinctness Criteria

17. The development of a SELECT matrix should include validation checks in order to ensure the quality of the decisions on distinctness. For validation, independent sets of descriptions for the reference varieties (descriptions from different testing periods) can be screened against several yearly descriptions for the candidate varieties. The results should be compared with the results of direct comparisons within the same growing trial.

Implementation

18. Currently the SELECT methodology is implemented at the Bundessortenamt for DUS testing of barley, wheat, triticale and oats. The efficiency of the method depends on the crop. It is mainly influenced by the variation of characteristics within the crop and the number of candidate varieties.

19. In the tested cereals, it was considered necessary to use descriptions for the candidate varieties obtained from the same location as for the reference varieties. The information provided by the breeder in the technical questionnaire would require larger differences and would, therefore, result in much reduced efficiency.

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