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**CALCULATION OF RELATIVE TOLERANCES IN THE NUMBER OF OFF TYPES**

*Document prepared by experts from Germany*

Introduction

1. In specific cases, the off-type procedure can be appropriate for the assessment of uniformity in cross-pollinated varieties. See document TGP/10.2 paragraph 5(b):

“Most characteristics in cross pollinated varieties show continuous variation within varieties (for assessment of uniformity see Section 10.2.2). If, especially in qualitative characteristics, the great majority of individuals of a variety have the same expression, plants with a clearly different expression can be detected as off-types (e.g. root color in fodder beet). In such cases the off-type procedure is appropriate for cross pollinated varieties (including synthetic varieties). The recommended limit for the number of off-types should then be based on the number of off-types in comparable varieties; ... ”

2. There is not yet a recommended procedure for the calculation of relative tolerances for off-types. The TWC agreed at its twenty-first meeting that the subject of relative tolerances for off-types should be incorporated in a section within document TGP/10.3.2.

3. The present document will elaborate a practical example where relative tolerances should be applied. An approach for the calculation of relative tolerance limits will be proposed.

Example for the Observation of Off-types in Cross-pollinated Varieties

4. In Fodder Radish, root color is expressed qualitatively with the four states white, red, violet, blackish brown (document TG/178/3). The varieties have one clearly dominating state of expression and are described with one note. Only a small number of off-types can be observed. The off-types are clearly visually detectable. The following recommendations are given in the Test Guidelines for the assessment of uniformity of this characteristic:

- Visual observation of 100 plants.
- The variability within the variety should not exceed the variability of comparable varieties already known.
- Interpretation of results should be made according to the rules for cross-pollinated varieties as stated in the General Introduction to the Test Guidelines.

5. The following results were found in the DUS test in Germany between 1996 and 2003.

Year	Number of reference varieties	mean number of off-types in reference varieties (n=100)	allowed number of off-types
1996	36	1.31	3
1997	38	1.11	3
1998	44	0.95	3
1999	46	2.17	5
2000	43	0.98	3
2001	37	1.11	3
2002	47	1.66	4
2003	46	1.60	4

The number of reference varieties reflects the changes in the reference collection. The different composition of the reference collection results in a different mean number of off-types. The number of off-types can be influenced by a change of reference varieties or a change of standard samples.

Calculation of the Number of Off-types Allowed

6. The tolerated number of off-types was calculated according to the procedure for fixed population standards in self-pollinated varieties as presented in document TGP/10.3.2 "Statistical methods: Off-Types". The mean number of off-types observed in the reference varieties was taken as the tolerated population standard. The binomial distribution was applied with an acceptance probability of 95%.

7. The same procedure could generally be applied. If in some crops the number of off-types in a characteristic is very low, the relative tolerance could lead to a higher stringency than generally recommended in self-pollinated varieties. In such cases, an appropriate fixed population standard should be defined. Depending on the species this could be the often in self-pollinated varieties recommended standard of 1% or a higher tolerance for partly self-pollinated varieties.

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