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Technical Working Party on Automation and Computer Programs

Thirty-Sixth Session

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Technical Working Party for Vegetables

Fifty-Second Session

Beijing, China, September 17 to 21, 2018

Technical Working Party for Fruit Crops

Forty-Ninth Session

Santiago de Chile, Chile, November 19 to 23, 2018

Technical Working Party for Ornamental Plants and Forest Trees

Fifty-First Session

Christchurch, New Zealand, February 18 to 22, 2019

UNIFORMITY ASSESSMENT ON THE BASIS OF OFF-TYPES: METHOD FOR MORE THAN ONE SINGLE TEST (YEAR)*Document prepared by the Office of the Union**Disclaimer: this document does not represent UPOV policies or guidance*

EXECUTIVE SUMMARY

1. The purpose of this document is to report on developments concerning the revision of guidance in document TGP/8/2: Part II: Section 8: "The method of uniformity assessment on the basis of off-types" to reflect the practice within members of the Union on the use of methods for more than one single test (year), in conjunction with the revision of document TGP/10 on "Assessing uniformity by off-types on the basis of more than one growing cycle or on the basis of sub-samples".
2. The TWPs are invited to consider the draft proposal for the revision of guidance in document TGP/8/2: Part II: Section 8: Subsection 8.1.7: "Method for more than one single test (year)" as set out in Annex II to this document.

BACKGROUND

3. The TC, at its fifty-third session, held in Geneva from April 3 to 5, 2017, considered document TC/53/19 "Revision of document TGP/10: New section: Assessing uniformity by off-types on basis of more than one growing cycle or on the basis of sub-samples" and agreed that, in conjunction with the revision of document TGP/10, the guidance in document TGP/8/2: Part II: 8: "The method of uniformity assessment on the basis of off-types" should be revised to reflect the practice within members of the Union on the use of methods for more than one single test (year) (see document TC/53/31 "Report", paragraph 125).

Current guidance in document TGP/8

4. The current guidance in document TGP/8: Part II: Section 8: "The method of uniformity assessment on the basis of off-types", Subsection 8.1.7: "Method for more than one single test (year)" is reproduced as Annex I to this document.

Consideration by the Enlarged Editorial Committee

5. The TC-EDC considered document TC-EDC/Mar18/16 "Uniformity assessment on the basis of off types: methods for more than one single test (year)".
6. The TC-EDC agreed to invite the expert from the United Kingdom to draft a proposal for the revision of guidance in document TGP/8/2: Part II: Section 8: Subsection 8.1.7: "Method for more than one single test (year)" for consideration by the TWPs, at their sessions in 2018.

PROPOSAL

7. A proposal for the revision of guidance in document TGP/8/2: Part II: Section 8: Subsection 8.1.7: "Method for more than one single test (year)" prepared by the expert from the United Kingdom is provided in Annex II to this document.

8. The TWPs are invited to consider the draft proposal for the revision of guidance in document TGP/8/2: Part II: Section 8: Subsection 8.1.7: "Method for more than one single test (year)" as set out in Annex II to this document.

[Annex follows]

EXTRACT FROM DOCUMENT TGP/8: PART II: SECTION 8: "THE METHOD OF UNIFORMITY ASSESSMENT ON THE BASIS OF OFF-TYPES"

*"8.1.7 Method for more than one single test (year)**"8.1.7.1 Introduction*

"8.1.7.1.1 Often a candidate variety is grown in two (or three years). The question then arises of how to combine the uniformity information from the individual years. Two methods will be described:

- "(a) Make the decision after two (or three) years based on the total number of plants examined and the total number of off-types recorded. (A combined test).
- "(b) Use the result of the first year to see if the data suggests a clear decision (reject or accept). If the decision is not clear then proceed with the second year and decide after the second year. (A two-stage test).

"8.1.7.1.2 However, there are some alternatives (e.g. a decision may be made in each year and a final decision may be reached by rejecting the candidate variety if it shows too many off-types in both (or two out of three years)). Also there are complications when more than one single year test is done. It is therefore suggested that a statistician should be consulted when two (or more) year tests have to be used.

"8.1.7.2 Combined test

"The sample size in test i is n_i . So after the last test we have the total sample size $n = \sum n_i$. A decision scheme is set in exactly the same way as if this total sample size had been obtained in a single test. Thus, the total number of off-types recorded through the tests is compared with the maximum number of off-types allowed by the chosen decision scheme.

"8.1.7.3 Two-stage test

"8.1.7.3.1 The method for a two-year test may be described as follows: In the first year take a sample of size n . Reject the candidate variety if more than r_1 off-types are recorded and accept the candidate variety if less than a_1 off-types are recorded. Otherwise, proceed to the second year and take a sample of size n (as in the first year) and reject the candidate variety if the total number of off-types recorded in the two years' test is greater than r . Otherwise, accept the candidate variety. The final risks and the expected sample size in such a procedure may be calculated as follows:

$$\begin{aligned}\alpha &= P(K_1 > r_1) + P(K_1 + K_2 > r \mid K_1) \\ &= P(K_1 > r_1) + P(K_2 > r - K_1 \mid K_1) \\ &= \sum_{i=r_1+1}^n \binom{n}{i} P^i (1-P)^{n-i} + \sum_{i=\alpha_1}^{r_1} \binom{n}{i} P^i (1-P)^{n-i} \sum_{j=r-i+1}^n \binom{n}{i} P^j (1-P)^{n-j} \quad (3)\end{aligned}$$

$$\begin{aligned}\beta_q &= P(K_1 < \alpha_1) + P(K_1 + K_2 \leq r \mid K_1) \\ &= P(K_1 < \alpha_1) + P(K_2 \leq r - K_1 \mid K_1) \\ &= \sum_{i=0}^{\alpha_1-1} \binom{n}{i} P_q^i (1-P_q)^{n-i} + \sum_{i=\alpha_1}^{r_1} \binom{n}{i} P_q^i (1-P_q)^{n-i} \sum_{j=0}^{r-i} \binom{n}{i} P_q^j (1-P_q)^{n-j} \quad (4)\end{aligned}$$

$$n_e = n \left(1 + \sum_{i=\alpha_1}^{r_1} \binom{n}{i} P^i (1-P)^{n-i} \right) \quad (5)$$

‘where

- ‘P = population standard
- ‘ α = probability of actual Type I error for P
- ‘ β_q = probability of actual Type II error for q P
- ‘ n_e = expected sample size
- ‘ r_1, α_1 and r are decision-parameters
- ‘ P_q = q times population standard = q P
- ‘ K_1 and K_2 are the numbers of off-types found in years 1 and 2 respectively.

‘The decision parameters, α_1, r_1 and r, may be chosen according to the following criteria:

- (a) α must be less than α_0 , where α_0 is the maximum Type I error, i.e. α_0 is 100 minus the required acceptance probability
- (b) β_q (for q=5) should be as small as possible but not smaller than α_0
- (c) if β_q (for q=5) < $\alpha_0 n_e$ should be as small as possible.

‘8.1.7.3.2 However, other strategies are available. No tables/figures are produced here as there may be several different decision schemes that satisfy a certain set of risks. It is suggested that a statistician should be consulted if a 2-stage test (or any other sequential tests) is required.

‘8.1.7.4 Sequential tests

‘The two-stage test mentioned above is a type of sequential test where the result of the first stage determines whether the test needs to be continued for a second stage. Other types of sequential tests may also be applicable. It may be relevant to consider such tests when the practical work allows analyses of off-types to be carried out at certain stages of the examination. The decision schemes for such methods can be set up in many different ways and it is suggested that a statistician should be consulted when sequential methods are to be used.’

[End of Annex I, Annex II follows]

DRAFT PROPOSAL FOR THE REVISION OF DOCUMENT TGP/8: PART II: SECTION 8: "THE METHOD OF UNIFORMITY ASSESSMENT ON THE BASIS OF OFF-TYPES"

8.1.7 *Method for more than one single growing cycle*

8.1.7.1. Often a candidate variety is assessed in two growing cycles. The question then arises of how to combine the information from the individual cycles in order to make a decision on uniformity. Three approaches are described:

(a) The uniformity for a variety is considered separately in each cycle. If the verdicts are the same, then the overall decision is based on this common result. However, if the variety is within the uniformity standard in one growing cycle but is not within the uniformity standard in the other growing cycle, then uniformity is assessed in a third growing cycle. In this case, the overall decision is based on the uniformity assessment for the third cycle.

(b) The uniformity for a variety is considered separately in each cycle. If the verdicts are the same, then the overall decision is based on this common result. However, if the variety is within the uniformity standard in one growing cycle but is not within the uniformity standard in the other growing cycle, then the information from the two cycles is combined. In this case, if the total number of off-types at the end of the two growing cycles does not exceed the number of allowed off-types for the combined sample size then the variety is considered uniform.

(c) The information on uniformity for a variety is combined over the two cycles. If the total number of off types at the end of the two growing cycles does not exceed the number of allowed off-types for the combined sample size then the variety is considered uniform.

For all three approaches, if in the first growing cycle a variety exceeds a predefined upper limit of off-types the variety may be rejected after a single growing cycle.

8.1.7.2 These three approaches are described in greater detail in document TGP/10 "Examining Uniformity". The risks associated with different approaches can be calculated according to the principles described in this Section. Calculations of risks can be complex and it is advisable to consult a statistician.

8.1.8 *Assessing uniformity on the basis of subsamples within a single test or trial*

8.1.8.1 Sometimes it may be possible to reduce the costs of off-type assessment by carrying it out in two stages. First a sub-sample of plants is examined. Based on the number of off-types in the sub-sample, either a verdict on uniformity is reached or (secondly) the whole sample of plants is examined.

8.1.8.2 A variety is considered uniform if the number of off-types does not exceed a predefined lower limit in the sub sample.

8.1.8.3 A variety is considered non-uniform if the number of off-types exceeds a predefined upper limit in the sub sample.

8.1.8.4 If the number of off-types is between the predefined lower and upper limits, the whole sample is assessed.

8.1.8.5 The predefined lower upper limits should be set considering comparable Type I and Type II errors in the sub sample and the whole sample. Setting up such two-stage tests is complex, and it is advisable to consult a statistician.

[End of Annex II and of document]