TC/49/11
ORIGINAL: English
DATE: January 28, 2013

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
Geneva

TECHNICAL COMMITTEE

Forty-Ninth Session
Geneva, March 18 to 20, 2013

METHOD OF CALCULATION OF COYU

Document prepared by the Office of the Union

1. The purpose of this document is to report on developments concerning the method of calculation of COYU.

Background

2. At its twenty-sixth session held in Jeju, Republic of Korea, from September 2 to 5, 2008, the Technical Working Party on Automation and Computer Programs (TWC) considered document TWC/26/17 "Some consequences of reducing the number of plants observed in the assessment of quantitative characteristics of reference varieties[1]" and a presentation by Mr. Kristian Kristensen (Denmark), a copy of which is reproduced as document TWC/26/17 Add.

3. Document TWC/26/17 states the following with regard to the current method of calculation of the Combined-Over-Years Uniformity Criterion (COYU):

> "Conclusions
>
> "18. From the above it can be concluded that the variances calculated in the present system do not reflect the expected value of the true variance as they are too small, partly because the expected value of RMS [residual mean square] from the ANOVA is less than the expected value of $Var(Y_v)$ and partly because only the number of varieties used in the local adjustment influence[s] this variance (and not the total number of reference varieties). However, the present method probably adjusts for this bias by using a large t-value (by using a small α-value). Also it can be concluded that the residual mean square (RMS) may depend significantly on the number of observations recorded as the component of RMS that depends on the number of observations (degrees of freedom) was not a negligible part."

4. The TWC noted the following possible actions to address the bias in the present method of calculation of COYU, as identified and commented on by Mr. Kristensen:

(i) Ignore the biases
(comment: the test will most probably be too liberal);

(ii) Correct only for the bias introduced by the smaller sample sizes
(comment: the test will be too liberal, but will be comparable to those in the past);

[1] The term "reference varieties" here refers to established varieties which have been included in the growing trial and which have comparable expression of the characteristics under investigation.

(iii) Correct only for the present bias
(comment: the test will be conservative, but not comparable to the past);

(iv) Correct for all biases
(comment: there will be no biases, but the tests will not be comparable to the past).

5. The TWC agreed that Denmark and the United Kingdom should prepare a new document, including a simulation using the smoothing spline method. It was noted that that would also allow experts further time to reflect on the situation and possible ways forward.

6. The Technical Committee, at its forty-fifth session, held in Geneva from March 30 to April 1, 2009, noted the discussions concerning the current method of calculation of COYU, as set out above, and agreed that the Technical Working Parties (TWPs) should be informed about those discussions at their sessions in 2009. The TC requested the TWC to make its recommendations to the TC concerning the proposals set out in paragraph 3 of this document.

Developments in 2009

7. At its twenty-seventh session, held in Alexandria, Virginia, United States of America, from June 16 to 19, 2009, the TWC considered document TWC/27/15 "Potential approaches to improving COYU" prepared by experts from Denmark and the United Kingdom on the basis of a presentation by Mr. Adrian Roberts (United Kingdom). The TWC agreed that it would be important to evaluate the range of circumstances that needed to be accommodated and that a new document should be prepared for its twenty-eighth session by experts from Denmark and the United Kingdom.

Developments in 2010

8. The Technical Committee (TC) at its forty-sixth session held in Geneva from March 22 to 24, 2010 considered document TC/46/11 "Method of Calculation of COYU". It noted the developments concerning the method of calculation of COYU as set out in document TC/46/11, paragraphs 7 to 11, and requested the TWC to make proposals to address the bias in the present method of calculation of COYU. The TC noted the observation at the twenty-seventh session of the TWC, that the way COYU made the calculations at the moment was acceptable, but that it was nevertheless desirable to find a solution.

9. The TWC, at its twenty-eighth session held in Angers, France, from June 29 to July 2, 2010, considered document TWC/28/27 "Alternative Methods to COYU for the Assessment of Uniformity", presented by Mr. Kristian Kristensen (Denmark). Mr. Kristensen proposed to carry out a survey to obtain data on the relationship between uniformity and expression of characteristics for different crops in order to determine if linear or quadratic adjustments would be suitable to correct the biases. He would then consider the implementation of the improved method. The TWC noted that experts from Germany, the Netherlands, Poland and United Kingdom would send information of averages and standard deviations to Mr. Kristensen for analysis and encouraged other experts to send such information to Mr. Kristensen (see document TWC/28/36 "Report" paragraphs 49 and 50).

Developments in 2011

10. The TC, at its forty-seventh session held in Geneva from April 4 to 6, 2011, noted the developments concerning the method of calculation of COYU as set out in this document, paragraphs 8 and 9, and requested the TWC to continue its work with the aim of developing recommendations to the TC (see document TC/47/26 "Report on the Conclusions", paragraph 88).

11. The TWC, at its twenty-ninth session held in Geneva, Switzerland, from June 7 to June 10, 2011, took note of the information contained in document TWC/29/10 "Method of Calculation of COYU" (see document TWC/29/31 "Report", paragraph 60).

12. The TWC also received a presentation by Mr. Kristian Kristensen (Denmark) based on document TWC/29/22 "Analysis of the Relation Between Log SD and Mean of Varieties", prepared by experts from Denmark and the United Kingdom. Document TWC/29/22 states as follows:

"Introduction

"1. At the twenty-eighth session on the Technical Working Party on Automation and Computer Programs, held in Angers, France, from June 29 to July 2, 2010, the bias in the present COYU method was discussed (document TWC/28/27; also previously documents TWC/26/17 and TWC/27/15). One of the possible approaches to overcome the bias in the present method was to use a linear and quadratic adjustment instead of the moving average method. However, it was questioned whether such an adjustment would be appropriate in all cases. It was decided to carry out a survey on the relationship between log SD and the mean of varieties in order to see if this could be modelled sufficiently well using a linear or quadratic regression. In such case it would be appropriate to introduce a new method for COYU based on a linear and quadratic effect adjustment of the log SD.

"2. *The following data were received:*

- Data on *Lolium perenne* (perennial ryegrass) from Germany, the Netherlands and the United Kingdom through the years 1993-2002. Part of the data has previous been used in TWC/28/31 "A study on Grass Reference Collections in Different Locations"
- Data on *Brassica napus* L. *oleifera* (spring oil seed rape) from Denmark through the years 1997-2005
- Data on *Pisum sativum* (field pea) from Denmark through the years 1997-2005"

[…]

"Discussion and conclusions

"18. For most cases a model with a linear and quadratic effect described the relation between Log SD and the mean sufficiently well. In many of the cases where the preferred model included a significant cubic term, this seemed to be caused by a few unusual varieties. The 3rd degree polynomial fit seemed to be strongly influenced by extreme standard deviations particularly for varieties with either low or high means. In such cases it might be questioned whether a model that displaying such sensitivity should be used or whether such extreme varieties should be left out of the model fitting. The cubic spline applied seemed to be less influenced by extreme observations and seemed to describe the relationship at least as well as the 2nd and 3rd degree polynomial. In most cases the cubic spline (with 4 degrees of freedom set) was in most cases located between the 2nd and 3rd degree polynomial. However the cubic spline would be a little more difficult to implement than the polynomial regressions and some technical challenges remain."

13. The TWC agreed that a new document based on the cubic spline model should be prepared for the next session of the TWC.

Developments in 2012

14. The Technical Committee (TC) at its forty-eighth session held in Geneva from March 26 to 28, 2012 noted the latest developments concerning the method of calculation of COYU, as set out in paragraphs 10 to 13 of this document.

15. The TC agreed to request the TWC to continue its work with the aim of developing recommendations to the TC concerning the proposals to address the bias in the present method of calculation of COYU (see document TC/48/22 "Report on the Conclusions", paragraphs 126 to 127).

16. In that regard, the Office of the Union was informed by Mr. Adrian Roberts (United Kingdom) that a document on possible proposals for improvements to COYU could not be prepared for consideration by the TWC at its thirtieth session to be held in Chisinau, Republic of Moldova, from June 26 to 29, 2012, and could be prepared for the TWC session in 2013.

17. The TWC, at its thirtieth session, held in Chisinau, Republic of Moldova, from June 26 to 29, 2012, took note of the information contained in document TWC/30/10 "Method of Calculation of COYU" and requested experts from Denmark and the United Kingdom to prepare a document on possible proposals for the improvement of COYU for consideration by the TWC at its next session (see document TWC/30/41 "Report", paragraph 86).

18. The TC is invited to request the TWC continue its work with the aim of developing recommendations to the TC concerning the proposals to address the bias in the present method of calculation of COYU, as set out in paragraphs 16 and 17.

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