# INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

Geneva

# TECHNICAL COMMITTEE

## Fifty-Second Session
## Geneva, March 14 to 16, 2016

REVISION OF DOCUMENT TGP/8: PART II: SELECTED TECHNIQUES USED IN DUS EXAMINATION, SECTION 9: THE COMBINED-OVER-YEARS UNIFORMITY CRITERION (COYU)

*Document prepared by the Office of the Union*

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EXECUTIVE SUMMARY

1.      The purpose of this document is to report on developments concerning the method of calculation of the Combined-Over-Years Uniformity Criterion (COYU).

2.      The TC is invited to note that:

(a)      experts from Finland, France, Germany, Kenya and the United Kingdom participated in the exercise to test the software module on the new method for calculation of COYU;

(b)      the TWC agreed that the new method for calculation of COYU worked well in practice and agreed to request the expert from the United Kingdom to provide guidance on extrapolation when the candidate had a level of expression outside that seen in the reference varieties;

(c)      the TWC noted the need for larger data sets to be tested in order to develop probability levels for the new method.  Such data sets should include at least 100 candidate varieties, with a possibility that data for those 100 varieties could be derived from several years;

(d)      the TWC agreed to invite experts from China and France to join in the next steps of the practical exercise and to provide their data sets for use in the testing; and

(e)      the TWC proposed to invite the TWA to provide large data sets from field crops in order to identify suitable probability levels on the new method for calculation of COYU.

3.      The following abbreviations are used in this document:

TC:            Technical Committee
TC-EDC:      Enlarged Editorial Committee
TWA:          Technical Working Party for Agricultural Crops
TWC:          Technical Working Party on Automation and Computer Programs
TWF:          Technical Working Party for Fruit Crops
TWO:          Technical Working Party for Ornamental Plants and Forest Trees
TWPs:        Technical Working Parties
TWV:          Technical Working Party for Vegetables

4.    The structure of this document is as follows:

ANNEX :    New Statistical Method for Visually Observed Characteristics with Multinomial Distributed Data (English only)

BACKGROUND

5.    The background to this matter is provided in document TC/51/17 "Revision of document TGP/8: Part II: Selected Techniques Used in DUS Examination, Section 9: The Combined-Over-Years Uniformity Criterion (COYU)".

DEVELOPMENTS IN 2015

Technical Committee

6.    The TC, at its fifty-first session, held in Geneva, from March 23 to 25, 2015, considered document TC/51/17 "Revision of document TGP/8: Part II: Selected Techniques Used in DUS Examination, Section 9: The Combined-Over-Years Uniformity Criterion (COYU)" and a practical exercise using real data to compare decisions made using the current and the proposed improved method of calculation of COYU (see document TC/51/39 "Report", paragraphs 134 to 138).

7.    The TC noted that participants of the exercise to test the software on the new method for the calculation of COYU should:

     (i)     seek to define probability levels to match decisions using the previous COYU method;
     (ii)    run the test for rejection probabilities of 1, 2 and 5% levels; and
     (iii)   assess whether the results are consistent in all crops.

8.    The TC noted that the expert from the United Kingdom had distributed the software module for calculation of COYU and the guidance document to participants of the exercise.

9.    The TC noted that the experts from Czech Republic, France, Finland, Germany, Kenya, Poland and United Kingdom would participate in the exercise to test the new software on COYU.

10.    The TC noted that a report on the practical exercise and the development of the DUST module would be presented at the thirty-third session of the TWC.

Technical Working Parties

11.    At their sessions in 2015, the TWV, TWC, TWA, TWF and TWO considered documents TWV/49/16, TWC/33/16 and TWC/33/16 Add., TWA/44/16, TWF/46/16 and TWO/48/16 "Revision of document TGP/8: Part II: Selected Techniques Used in DUS Examination, Section 9: The Combined-Over-Years Uniformity Criterion (COYU)", respectively.

12.    The TWV, TWA, TWF and TWO noted that the participants of the exercise to test the software on the new method for the calculation of should  (see documents TWV/49/32 "Report", paragraph 45, TWA/44/23 "Report", paragraph 38, TWF/46/29 Rev. "Revised Report", paragraph 41 and TWO/48/26 "Report", paragraph 34, respectively):

     (i)     seek to define probability levels to match decisions using the previous COYU method;
     (ii)    run the test for rejection probabilities of 1, 2 and 5% levels; and
     (iii)   assess whether the results are consistent in all crops

13. The TWV, TWA, TWF and TWO noted that the expert from the United Kingdom had distributed the new software on COYU and the guidance document to the participants of the exercise (see documents TWV/49/32, paragraph 46, TWA/44/23, paragraph 39, TWF/46/29 Rev., paragraph 42 and TWO/48/26, paragraph 35, respectively).

14. The TWV, TWA, TWF and TWO noted that the experts from Czech Republic, France, Finland, Germany, Kenya, Poland and United Kingdom would participate in the exercise to test the new software on COYU (see documents TWV/49/32, paragraph 47, TWA/44/23, paragraph 40, TWF/46/29 Rev., paragraph 43 and TWO/48/26, paragraph 36, respectively).

15. The TWV noted that a report on the practical exercise and the development of DUST module would be presented at the thirty-third session of the TWC by an expert from the United Kingdom (see document TWV/49/32, paragraph 48)

16. The TWC noted that the experts from Finland, France, Germany, Kenya and the United Kingdom had participated in the exercise to test the new software on COYU (see document TWC/33/30 "Report", paragraph 23).

17. The TWC considered the report on the practical exercise as presented by an expert from the United Kingdom in the Annex to document TWC/33/16 (see document TWC/33/30 "Report", paragraph 24).

18. The TWC received a presentation on the "Method of calculation of COYU" from an expert from the United Kingdom, a copy of which was provided in an addendum to document TWC/33/16, reproduced as Annex to this document (in English only). The TWC agreed that the new method worked well in practice and requested the expert from the United Kingdom to provide guidance on extrapolation when the candidate had a level of expression outside that seen in the reference varieties (see document TWC/33/30 "Report", paragraph 25).

19. The TWC noted the need for larger data sets to be tested in order to develop probability levels for the new method. Such data sets should include at least 100 candidate varieties, with a possibility that data for those 100 varieties could be derived from several years (see document TWC/33/30 "Report", paragraph 26).

20. The TWC agreed to invite the experts from China and France to join in the next steps of the practical exercise and to provide their data sets for use in the testing. The TWC also agreed to invite the TWA to provide large data sets from field crops (see document TWC/33/30 "Report", paragraph 27).

21. The TWA, TWF and TWO noted that a report on the practical exercise and the development of a DUST module was presented at the thirty-third session of the TWC by an expert from the United Kingdom (see documents TWA/44/23, paragraph 41, TWF/46/29 Rev., paragraph 44 and TWO/48/26, paragraph 37, respectively).

*22.   The TC is invited to note that:*

*(a)   experts from Finland, France, Germany, Kenya and the United Kingdom participated in the exercise to test the software module on the new method for calculation of COYU;*

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(e)    the TWC proposed to invite the TWA to provide large data sets from field crops in order to identify suitable probability levels on the new method for calculation of COYU.

[Annex follows]

METHOD OF CALCULATION OF COYU
(ENGLISH ONLY)

# Method of calculation of COYU

**Adrian Roberts and David Nutter**
*BioSS*

TWC/33/16

# Background

**Previous papers:**

- Found that current COYU method tends to find more varieties non-uniform than desirable
    - Compensated by small probability values
    - Due to moving average method of adjustment

- New method proposed and tested
    - Uses spline method instead of moving average
    - Prototype software developed in R and DUST

TWC/33/16

## Activities in 2015-6

- **Development and improvement of software**

- **Practical Exercise**

TWC/33/16

## Software development 2015-6

- **R: package –source code also available on GitHub**

- **DUST module – accesses R package (new)**

- **Problems identified:**
  - Installation issues with DUST module (part dealt with)
  - Order issues when missing data present

- **Extra functionality planned**

TWC/33/16

## Practical Exercise 2015-6

- To evaluate method and software

- What probability levels to use

- Review the extrapolation issue

TWC/33/16

## Practical Exercise

| Country | Participant | Software | Crops |
|---|---|---|---|
| Finland | Sami Markennen | DUST | Timothy, meadow fescue, tall fescue, Canarian reed grass, red clover, white clover, turnip rape |
| France | Christophe Chevalier | R | Fescue |
| Kenya | Abraham Legat | R | Wheat |
| United Kingdom | Sally Watson | DUST | Perennial ryegrass |
| United Kingdom | Haidee Philpott | DUST | Oilseed rape |
| United Kingdom | Tom Christie | DUST | Field pea |

Germany – currently use SAS for COYD and COYU

TWC/33/16

## Practical Exercise

| Country | Participant | Software | Crops |
|---|---|---|---|
| Finland | Sami Markkanen | DUST | Timothy, meadow fescue, tall fescue, Canarian reed grass, red clover, white clover, turnip rape |
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| Kenya | Abraham Lagat | R | Wheat |
| United Kingdom | Sally Watson | DUST | Perennial ryegrass |
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| United Kingdom | Tom Christie | DUST | Field pea |

Germany – currently use SAS for COYD and COYU

# THANKS !

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## Data sets

| Country | Crop | Number of data sets | Number of years for each data set | Probability level for COYU | Number of characters | Number of candidates | Number of reference varieties |
|---|---|---|---|---|---|---|---|
| Finland | Timothy | 1 | 2 | 0.001 | 6 | 3 | ~60 |
| Finland | Timothy | 2 | 3 | 0.001 | 1-7 | 2-4 | 63 |
| Finland | Meadow fescue | 1 | 2 | 0.001 | 6 | 2 | 35 |
| Finland | Meadow fescue | 1 | 3 | 0.001 | 6 | 2 | 35 |
| Finland | Tall fescue | 1 | 2 | 0.001 | 6 | 1 | 20 |
| Finland | Canarian reed grass | 1 | 3 | 0.001 | 8 | 1 | 10 |
| Finland | Red clover | 2 | 2 | 0.001 | 6 | 1 | 27 |
| Finland | Red clover | 2 | 3 | 0.001 | 7 | 1 | 15 |
| Finland | White clover | 1 | 2 | 0.001 | 9 | 1 | 22 |
| Finland | White clover | 1 | 3 | 0.001 | 9 | 1 | 23 |
| Finland | Turnip rape | 1 | 2 | 0.001 | 8 | 3 | 13 |
| Finland | Turnip rape | 1 | 3 | 0.001 | 8 | 1 | 13 |
| France | Fescue | 1 | 2 | 0.001 | 11 | 4 | 126 |
| Kenya | Wheat | 1 | 2 | ? | 3 | 2 | ? |
| GB | Perennial ryegrass | 2 | 3 | 0.001 | 30 | 30/16 | 102/74(cyclic) |
| GB | Oilseed rape | 4 (by type) | 2 | 0.001 | 12 | 64/15/1/48 | 444/136/272/217 |
| GB | Field pea (conventional) | 5 | 2 | 0.001 | 17-19 | 6/5/3/1/1 | 18/39/31/10/21 |
| GB | Field pea (semi-leafless) | 5 | 2 | 0.001 | 13-14 | 4/14/7/2/4 | 49/67/77/61/72 |

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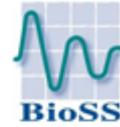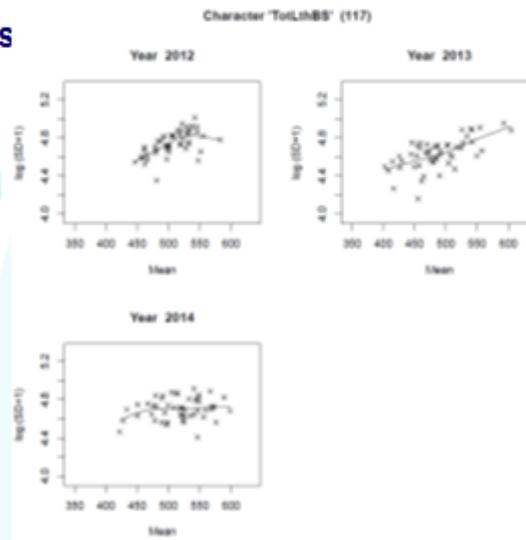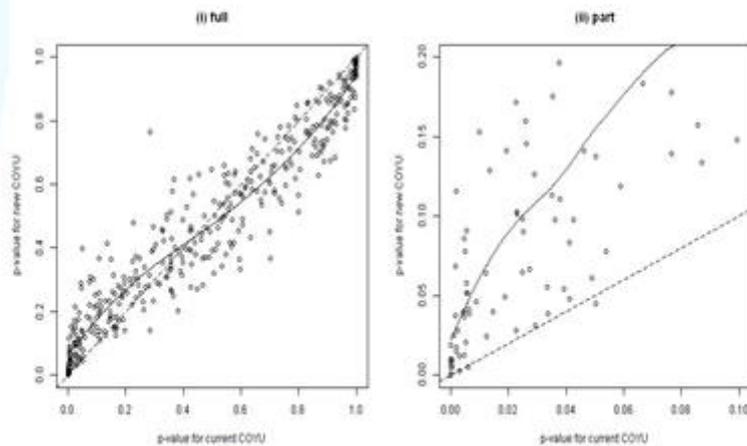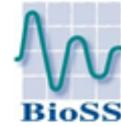
## Probability level

**Approx equivalent probability levels to current COYU at 0.1%**

- Data sets with > 20 candidates with current method p-value < 0.1

| Country | Data set | Approximate equivalent p-value |
|---------|----------|-------------------------------|
| GB | PRG amenity | 0.005 |
| GB | PRG tetraploid | 0.009 |
| GB | OSR lines | 0.013 |
| GB | OSR restored hybrids | 0.009 |
| GB | Field pea conventional | 0.020 |
| GB | Field pea semi-leafless | 0.026 |

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## Extrapolation
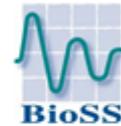
**Extrapolation is when the candidate has a mean value outside those of the reference varieties**

- In any cycle
- Important because of the estimation of the relationship between mean and variability (uniformity)
  - For both current and proposed methods of COYU
- Need to agree what to do in cases of extrapolation

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# Extrapolation

**BioSS**

**Extrapolation is when the candidate has a mean value outside those of the reference varieties**

- In any cycle
- Important because of the estimation of the relationship between mean and variability (uniformity)
  - For both current and proposed methods of COYU
- Need to agree what to do in cases of extrapolation

**Degree of extrapolation:**

- Extent of extrapolation divided by range of reference varieties

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# Extrapolation

**BioSS**

| Country | Data set | Frequency of extrapolation | Cases > 10% extrapolation | Cases > 20% extrapolation |
|---------|----------|----------------------------|---------------------------|---------------------------|
| France | Fescue | 0% | n/a | n/a |
| Kenya | Wheat | 50% | n/a | n/a |
| Finland | Various | 19% | n/a | n/a |
| GB | PRG amenity | 9% | 2% | <1% |
| GB | PRG tetraploid† | 20% | 13% | 9% |
| GB | OSR lines | <1% | <1% | 0% |
| GB | OSR restored hybrids | 2% | <1% | 0% |
| GB | OSR hybrids | 8% | <1% | 0% |
| GB | OSR composite | 3% | 0% | 0% |
| GB | Field pea conventional | 10% | 5% | 3% |
| GB | Field pea semi-leafless | 7% | 3% | 1% |

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## Conclusions

**BioSS**
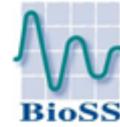
**New method works well in practice**

**Higher probability levels likely to be required than for current COYU**
- Practical exercise: probability levels 0.005 to 0.026 to match 0.001 for current COYU
- More data sets are required to examine this more fully

**Need to discuss action when the candidate has a level of expression outside that seen the reference varieties.**
- Suggest that cases of minor extrapolation can safely be ignored
- Cases of major extrapolation should be considered by crop expert

**Software worked**
- some areas for improvement and development identified
- To be pursued during 2015-6

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## Future work

**BioSS**

**Improvement to software**

**More data sets to help identify probability levels required**

**Discuss/agree plan for extrapolation**

TWC/33/16

[End of Annex and of document]