UPOV

# INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
Geneva

# TECHNICAL WORKING PARTY ON AUTOMATION AND COMPUTER PROGRAMS

## Thirty-Third Session
## Natal, Brazil, June 30 to July 3, 2015

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

*Document prepared by experts from the United Kingdom*

*Disclaimer: this document does not represent UPOV policies or guidance*

The Annex to this document contains a copy of a presentation on Method of calculation of COYU that will be made at the Technical Working Party on Automation and Computer Programs (TWC), at its thirty-third session.

[Annex follows]

# Method of calculation of COYU

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*BioSS*

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# 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

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## Activities in 2015-6

- Development and improvement of software

- Practical Exercise

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## 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

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## Practical Exercise
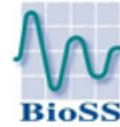
| Country | Participant | Software | Crops |
|---|---|---|---|
| Finland | Sami Markannen | DUST | Timothy, meadow fescue, tall fescue, Canarian reed grass, red clover, white clover, turnip rape |
| France | Christophe Chevalier | R | Fescue |
| Kenya | Abraham Lagat | R | Wheat |
| United Kingdom | 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

# 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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Fit of splines
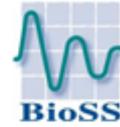
New software produces clear plots

Fits of splines seemed okay overall
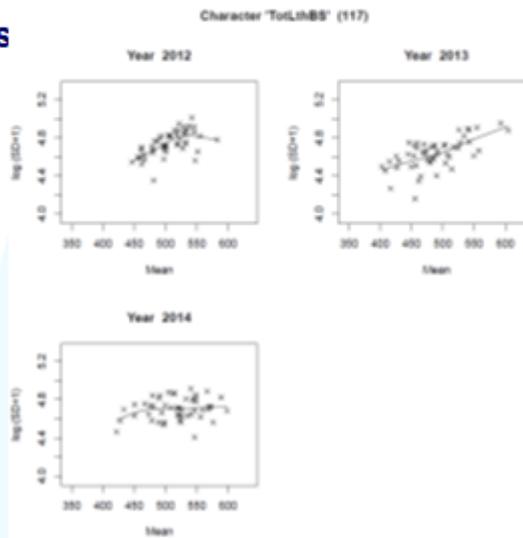


Probability level

Example: UK field pea semi-leafless group
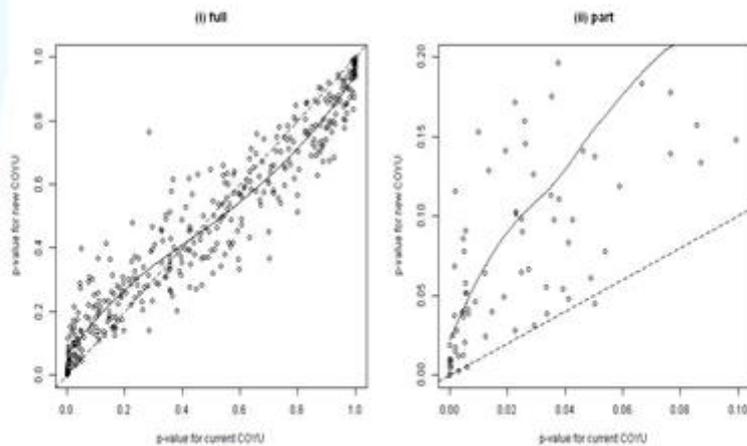
# Probability level
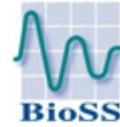
**Approx equivalent probability levels to current COYU at 0.1%**

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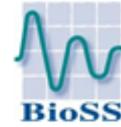
**Extrapolation is when the candidate has a mean value outside those of the reference varieties**

- 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
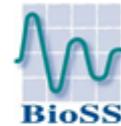
| Country | Data set | Frequency of extrapolation | Cases > 10% extrapolation | Cases > 20% extrapolation |
|---|---|---|---|---|
| France | Fescue | 0% | n/a | n/a |
| Kenya | Wheat | 50% | n/a | n/a |
| Finland | Various | 19% | n/a | n/a |
| GB | PRG amenity | 9% | 2% | <1% |
| GB | PRG tetraploid† | 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

**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

**Improvement to software**

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

**Discuss/agree plan for extrapolation**

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[End of Annex and of document]