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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

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TECHNICAL WORKING PARTY ON AUTOMATION AND COMPUTER PROGRAMS

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ADDENDUM TO

CALCULATED THRESHOLDS FOR EXCLUDING VARIETIES OF COMMON KNOWLEDGE FROM THE SECOND GROWING CYCLE WHEN COYD IS USED, FIRST YEAR THRESHOLDS

Document prepared by experts from the United Kingdom

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The Annex to this document contains a copy of a presentation on "Calculated Thresholds for Excluding Varieties of Common Knowledge from the Second Growing Cycle when COYD is used, First Year Thresholds" that was made at the thirty-third session of the Technical Working Party on Automation and Computer Programs (TWC).

[Annex follows]

First Year Thresholds

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Paper submitted to the Journal of Agricultural Science

Introduction

After first growing cycle:

- May review results
- Identify reference varieties that are clearly distinct from candidate
- TGP/9; GAIA

For quantitative characteristics where COYD is used

- Difficult to do this effectively based on experience
- New method proposed in TWC/25/14
- Shown in TWC/28/30 that needs improvement
- Here improved method developed and tested

Basis

Calculate probability that a candidate will be distinct from a reference variety on 2-cycle COYD criterion,

- A prediction based on only first year results
- High probability → enough evidence that reference variety is distinct from candidate
- Reverse to get a threshold for a set probability
- Method requires first year results plus historical data (>10 years)

Problem with the original method

In TWC/25/14, method straightforward but based on key assumptions:

- Normality
  - okay in general
  - for problem characteristics, easy to deal with
- Consistent variability
  - Over cycles, over varieties
  - In example data, problem with heterogeneous variance between cycles
    - COYD criterion varies

In TWC/33/20, method extended to cope with heterogeneity

Example data

- Field pea
- UK
- 1995 to 2013
- Semi-leafless group
- 13 quantitative characteristics
- 222 varieties
- COYD at 2%

Characteristic (UPOV number)	Mean	Standard deviation	Minimum	Maximum	Over-cycle heterogeneity index
(5) Stem: number of nodes up to and including first fertile node	16.0	1.59	9.6	20.9	13.0
(15) Stipule: length (mm)	82.3	13.48	47.2	121.5	4.4
(16) Stipule: width (mm)	46.3	8.80	23.7	79.0	4.1
(21) Stipule: density of flecking (1-9)	5.3	0.90	2.5	8.0	4.3
(22) Petiole: length from axil to first leaflet or tendril (mm)	83.2	13.34	34.8	128.6	5.8
(28) Flower: width of standard (mm)	31.8	2.64	23.3	41.1	9.1
(29) Flower: shape of base of standard (1-9)	6.8	1.02	4.0	9.0	3.8
(34) Peduncle: length from stem to first pod (mm)	72.9	24.41	12.0	145.7	4.6
(37) Pod: length (mm)	79.1	6.24	63.3	105.6	4.3
(38) Pod: width (mm)	13.9	1.22	10.5	18.6	3.4
(42) Pod: curvature (1-9)	2.4	0.58	1.0	5.5	2.5
(46) Pod: number of ovules	8.2	0.54	6.0	10.0	7.5
(57) Seed: weight	28.1	5.19	12.2	49.1	5.7

Characteristic	Long-term COYD criterion	Threshold with p_D=0.99	Thresholds with p_D=0.9	Current UK tolerance	Proposed new tolerance	Change
5	0.93	3.99	1.39	3	4.0	↑
15	10.80	22.76	15.63	25	22.8	↓
16	6.95	13.81	9.82	20	13.8	↓
21*	0.95	1.96	1.37	3	3	–
22	12.61	27.63	18.49	30	27.63	↓
28	2.39	5.83	3.55	12	5.8	↓
29*	0.93	1.91	1.36	2	2	–
34	19.61	44.40	28.82	40	44.4	↑
37	5.84	12.23	8.60	20	12.2	↓
38	0.97	1.95	1.41	2	2.0	–
42*	0.83	1.61	1.15	2	2	–
46	0.47	1.00	0.66	2	1.0	↓
57	4.03	9.44	6.01	8	9.4	↑

Software

BioSS

- **Basic formulae can be implemented in many software packages, e.g. Excel, R, SAS, GenStat**
- **Requires estimation of residual variance in each growing cycle**
  - Best approach uses linear mixed model with appropriate variance structure for the residual term
  - Can be done in GenStat or ASREML (optionally in R)
  - Might be possible in SAS?
- **Also necessary to estimate parameters of a gamma distribution**
  - Directly in many stats packages, e.g. R, SAS, GenStat
  - Or by an approximation

Conclusions & Next steps

- Method developed to calculate first year threshold
  - Deals with cycle-to-cycle heterogeneity
- Could be incorporated in wider system for distinctness plus e.g. GAIA
- Works well on field pea example → change to UK tolerances
- Method could be adapted:
  - Give early indication to applicants
  - Identify closest reference varieties
- Other example data sets to evaluate method?
  - At least 10 cycles of past trials

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[End of Annex and of document]