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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

TECHNICAL WORKING PARTY ON AUTOMATION AND COMPUTER PROGRAMS

Twenty-Seventh Session
Alexandria, Virginia, United States of America
June 16 to 19, 2009

ADDENDUM

AN ADJUSTMENT TO THE COYD METHOD WHEN VARIETIES ARE GROUPED WITHIN THE DUS TRIAL

Document prepared by the Office of the Union

At the twenty-seventh session of the Technical Working Party for Automation and Computer Programs (TWC), Mr. Adrian Roberts (United Kingdom) made a presentation based on document TWC/27/18. A copy of that presentation follows:

An adjustment to the COYD method when varieties are grouped within the DUS trial

Adrian Roberts & Vincent Gensollen

Background

AR proposed a method of adjusting COYD when varieties are grouped – 2005 Canada

Developed for use in pea, where

- grouping characteristics used to divide varieties in distinct groups
- No need to compare varieties in different groups
- many groups are too small

Demonstrated that worked well for pea, a self-pollinated crop

- 10 years of trials

Background

- Pea is a self pollinating crop
- Since COYD is more commonly used in cross-pollinating crops, last year TWC suggested that we look at a cross-pollinated example
- GEVES offered to supply an example on cross pollinating crop: Tall fescue

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Group on Tall Fescue Turf / Fodder

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Group on Tall Fescue
Fodder / Festulolium

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Group on Tall Fescue

Turf (2nd generation)

Turf (1st generation)

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Group on Tall Fescue
Fodder (Millenium) / Fodder (Barelite)

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Recap on adjusted COYD COYDG

- COYD based on ANOVA of variety means by cycle (year)
- COYDG adjusts this by adding a term in the ANOVA for group-by-year interaction

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Recap on COYDG

Standard COYD
Block structure: Year
Treatment structure: Variety

Group-adjusted COYD
Block structure: Year+Year.Group
Treatment structure: Group/Variety

$$SED_{COYD} = \sqrt{\frac{2}{n} RSS_{COYD}} \qquad SED_{adj} = \sqrt{\frac{2}{n} RSS_{adj}}$$

n is the number of years

Note

- COYD criterion is based on variety-by-year interaction
- Adjusted analysis assume same variety-by-year interaction for all groups – so does COYD on all varieties

Application to a cross-pollinated crop

Tall fescue data 2003-8 from spaced plants trials

- 9 characters considered
- 2 sets of grouping
- Normally COYD applied over 3 years
- 115-151 varieties per set of 3 years

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No	Characteristic
CA982	Plant: length (at the end of growing period before vernalisation).
CA809	Plant: natural height after vernalisation
CA910	Plant: time of inflorescence emergence (in 2nd year)
CA880	Plant: natural height at inflorescence emergence
CA817	Flag leaf: width (same flag leaf as that used for 7)
CA819	Flag leaf: length (flag leaf on representative stem, within 2 weeks after inflorescence emergence)
CA813	Stem: length of longest stem (inflorescence included; when fully expanded)
CA870	Stem: length of upper internode
CA844	Inflorescence: length (when fully expanded)

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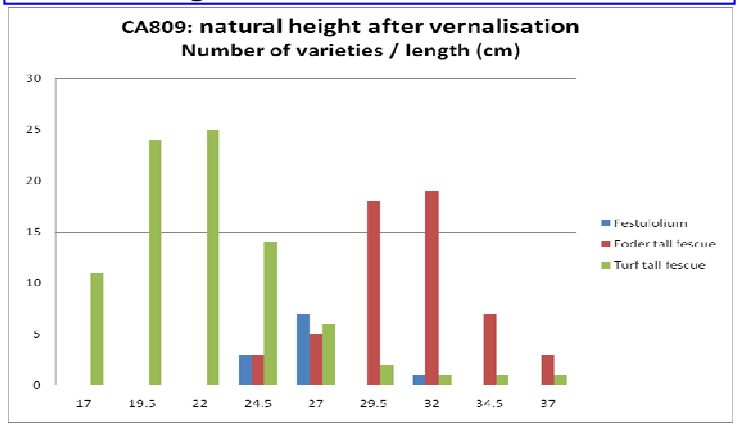
Number of varieties

	2003-5	2004-6	2005-7	2006-8
Group 1				
Festulolium	6	8	10	11
Fodder tall fescue	*45	48	55	55
Turf tall fescue	**64	68	76	85
Group 2				
Festulolium (*F.arundinacea* X *L.multiflorum*)	1	3	4	5
Festulolium (*F.pratensis* X *L.multiflorum*)	5	5	6	6
Fodder tall fescue	*43	46	53	53
Fodder tall fescue amphiploid	2	2	2	2
Turf tall fescue	**64	68	76	85

Reduction in criteria with COYDG Grouping 1

Characteristic	2003-5	2004-6	2005-7	2006-8
CA982	25.3%	30.7%	32.9%	10.3%
CA809	7.8%	15.1%	15.5%	**24.8%**
CA910	3.7%	9.8%	13.4%	**5.6%**
CA880	21.7%	23.7%	20.8%	12.7%
CA817	2.4%	2.7%	14.8%	11.3%
CA819	2.5%	4.9%	18.8%	18.0%
CA813	8.7%	18.5%	21.3%	26.8%
CA870	8.2%	19.8%	6.8%	5.8%
CA844	10.4%	6.8%	9.9%	8.1%

Distribution of grouping 1 for **CA809**: natural height after vernalisation Years 2006-8



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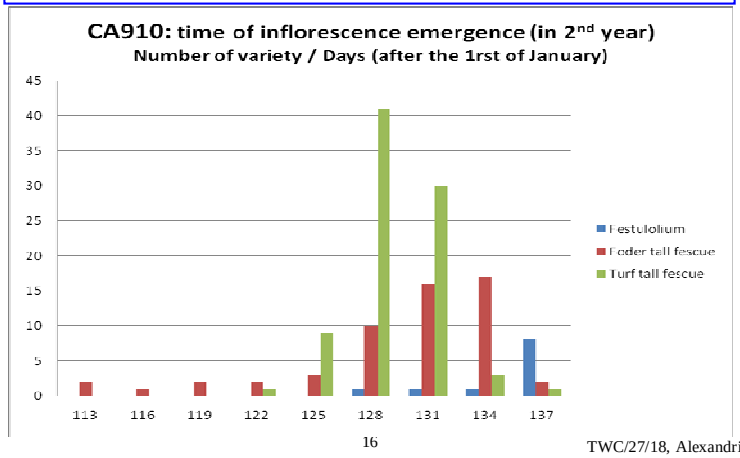
Distribution of grouping 1 for CA910: Time of inflorescence emergence (in 2nd year) Years 2006-8



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Reduction in criteria with COYDG Grouping 2

Characteristic	2003-5	2004-6	2005-7	2006-8
CA982	25.4%	32.3%	34.2%	11.2%
CA809	17.8%	17.4%	18.0%	25.6%
CA910	5.8%	11.3%	14.6%	6.3%
CA880	22.0%	24.6%	22.3%	14.2%
CA817	3.3%	3.3%	15.6%	11.9%
CA819	5.8%	9.4%	18.8%	17.9%
CA813	13.1%	19.3%	22.5%	27.7%
CA870	9.5%	19.4%	6.8%	5.6%
CA844	10.5%	8.9%	10.5%	9.8%

Reduction in criteria Grouping 1 to Grouping 2

Characteristic	2003-5	2004-6	2005-7	2006-8
CA982	0.1%	2.4%	1.8%	1.0%
CA809	10.9%	2.7%	2.9%	1.1%
CA910	2.2%	1.6%	1.4%	0.7%
CA880	0.3%	1.2%	1.9%	1.7%
CA817	1.0%	0.6%	0.9%	0.7%
CA819	3.5%	4.7%	-0.1%	-0.2%
CA813	4.9%	1.0%	1.6%	1.3%
CA870	1.4%	-0.5%	0.0%	-0.3%
CA844	0.0%	2.2%	0.7%	1.9%

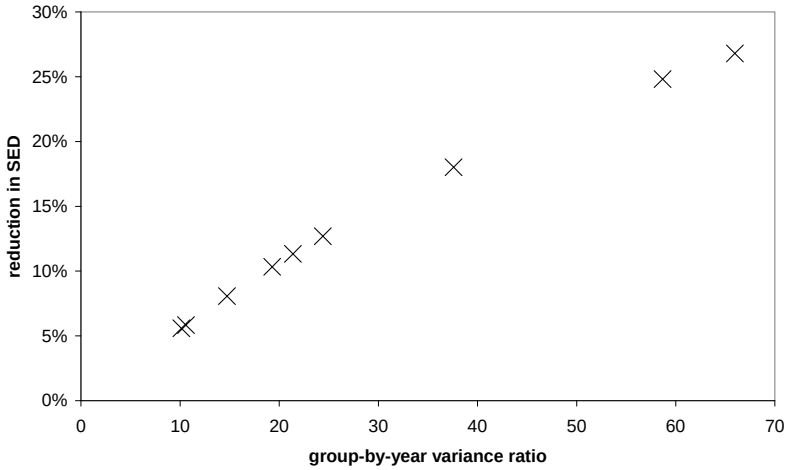
CA910, 2006-8, grouping 1

Source	d.f.	s.s.	m.s.	v.r.	F pr.
Year	2	15435	7717	489.9	
Group	2	1332	666	42.3	0.002
Residual (Year.Group)	4	63	16	**10.1**	
Group.Variety	148	6419	43	27.9	<0.001
Residual	296	460	2		
Total	452	23709			

CA809, 2006-8, grouping 1

Source	d.f.	s.s.	m.s.	v.r.	F pr.
Year	2	3717	1859	9.0	
Group	2	8444	4222	20.4	0.008
Residual (Year.Group)	4	829	207	**58.7**	
Group.Variety	148	5679	38	10.9	<0.001
Residual	296	1045	3.53		
Total	452	19714			

2006-8, grouping 1



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Modified joint regression? 2006-8 Grouping 1

Characteristic	Reduction in SED – COYDG over MJRA
CA982	-0.4%
CA809	-11.2%
CA910	-3.7%
CA880	7.6%
CA817	1.3%
CA819	11.8%
CA813	14.9%
CA870	2.8%
CA844	1.2%

Conclusions

- Adjusted COYDG method demonstrated on cross-pollinating crop – Tall fescue
- Seems to be beneficial for all characters
- Assigning group membership may be difficult – in practice –wider issue?
- Need to do fuller comparison with MJRA

Other issues

A future development in forage species, may permit to:

- Use COYD for varieties of new species or new types of the same species (when there is no or few reference collection, but closed species);
- A possible non distinction between varieties belonging to different groups

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