

SLU

Analysing and Reporting Series of Variety Trials

International Symposium

Agricultural Field Trials – Today and Tomorrow

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Johannes Forkman

Swedish University of Agricultural Sciences

Objectives

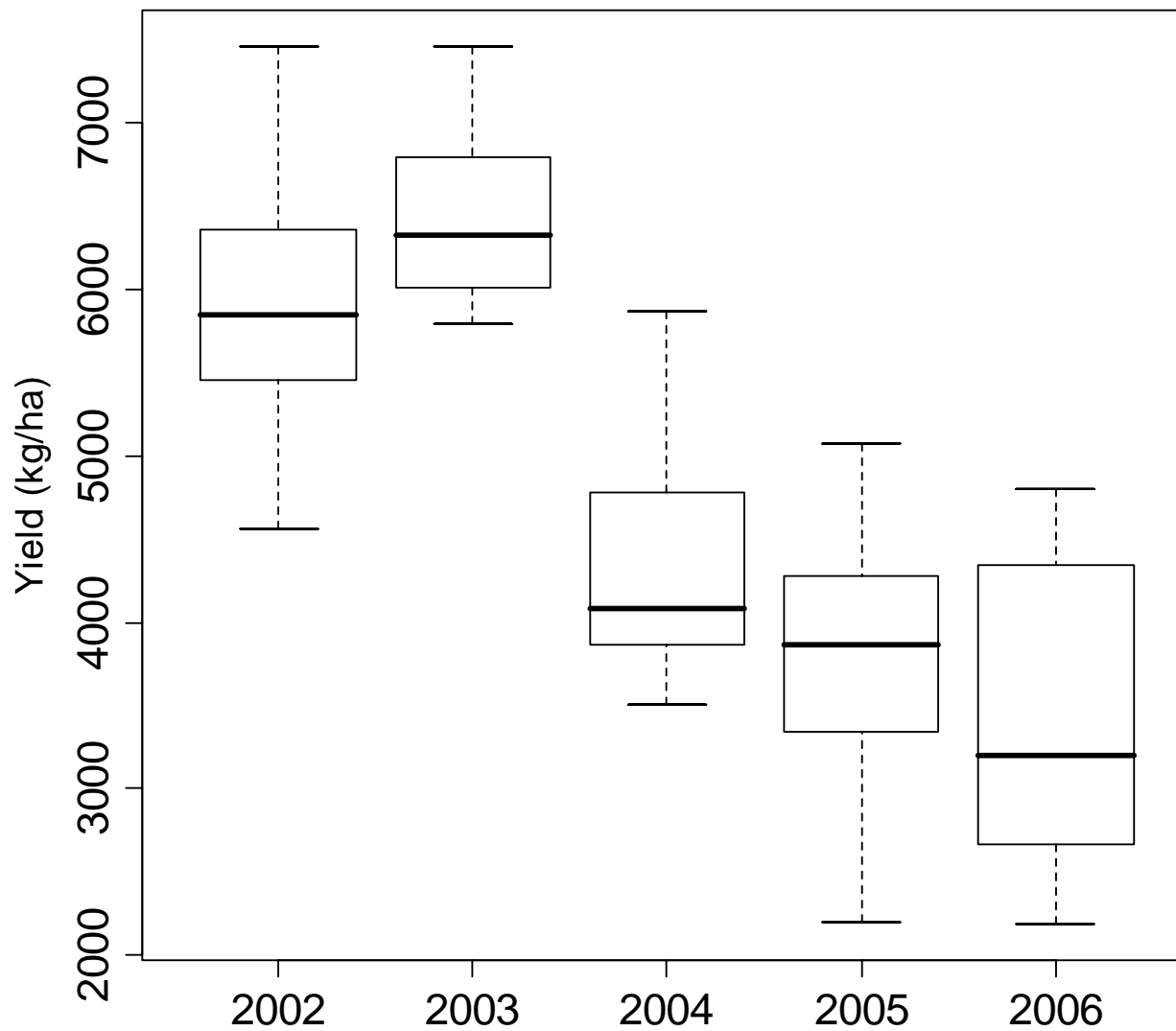
- Discuss experiences with mixed models
- Discuss routine analysis of small, unbalanced series
- Compare methods for statistical analysis

Case Study

Series of pea trials in Scania, Sweden

- 5 years (2002 – 2006)
- 11 varieties (control: Celine)
- 20 trials
- 119 observations
- 5 districts

Yield per year



Analysis per year

- Mixed model
- Fixed factor: Variety
- Random factor: Trial
- SAS[®], version 9, proc mixed
- REML
- Differences in fixed effects
- Kenward & Roger's method

Results per year

Variety	2002		2003		2004		2005		2006	
	N	Rel. ctrl (%)	N	Rel. ctrl (%)	N	Rel. ctrl (%)	N	Rel. ctrl (%)	N	Rel. ctrl (%)
Clara	6	95*	5	90*	4	96	2	100	3	89*
Faust	6	96	5	94	4	105	2	102	3	96
Stilo					4	97	2	113	3	101
Exclusive					4	104	2	106	3	95
Tinker							2	110	3	107*
Eden							2	113	3	96
Arthur							2	115	3	96
Rocket							2	113	3	102
1872							1		3	100
Brutus		95*		89*		104	2	82	2	101
Control (kg/ha)	6	6340	5	6820	4	4380	2	3530	3	3480

Analysis of the series

- Mixed model
- Pairwise calculations
- Fixed effects model
- Hybrid method

Mixed model

- Fixed factors: Variety,
District
- Random factors: Year,
Trial
- Random interactions: Variety x Year,
District x Year,
Variety x District x Year

SAS[®], proc mixed, REML, Kenward & Roger

Results with mixed model

Variety	N trials	Rel. control (%)	Conf. int. (%)	Control (kg/ha)
Clara	20	94	(88 , 100)	4829
Faust	20	98	(92 , 104)	4829
Stilo	9	99	(92 , 107)	4829
Exclusive	9	99	(92 , 107)	4829
Tinker	5	104	(96 , 113)	4829
Eden	5	101	(93 , 110)	4829
Arthur	5	102	(93 , 110)	4829
Rocket	5	104	(95 , 112)	4829
1872	4	102	(93 , 111)	4829
Brutus	17	94	(88 , 100)	4829

Pairwise calculations

- Each variety compared with the control, one at a time
- Student's t-test
- Independent differences

Results with pairwise calculations

Variety	N trials	Rel. control (%)	Conf. int. (%)	Control (kg/ha)
Clara	20	93	(89 , 97)	5313
Faust	20	97	(94 , 101)	5313
Stilo	9	102	(95 , 109)	3868
Exclusive	9	102	(94 , 110)	3868
Tinker	5	108	(102 , 114)	3503
Eden	5	103	(89 , 117)	3503
Arthur	5	103	(88 , 119)	3503
Rocket	5	107	(89 , 124)	3503
1872	4	101	(96 , 107)	3681
Brutus	17	94	(90 , 99)	5203

Fixed effects model

- Fixed factors: Variety, Trial
- SAS[®], proc glm

Results with fixed effects model

Variety	N trials	Rel. control (%)	Conf. int. (%)	Control (kg/ha)
Clara	20	93	(90 , 97)	5313
Faust	20	97	(94 , 101)	5313
Stilo	9	98	(94 , 103)	5313
Exclusive	9	99	(94 , 103)	5313
Tinker	5	104	(98 , 109)	5313
Eden	5	100	(94 , 106)	5313
Arthur	5	101	(95 , 106)	5313
Rocket	5	103	(97 , 109)	5313
1872	4	101	(95 , 107)	5313
Brutus	17	94	(91 , 98)	5313

Hybrid method

- Each variety compared with the control, one at a time
- Mixed model

Results with hybrid method

Variety	N trials	Rel. control (%)	Conf. int. (%)	Control (kg/ha)
Clara	20	94	(88 , 100)	4829
Faust	20	98	(92 , 104)	4829
Stilo	9	103	(91 , 115)	3783
Exclusive	9	103	(91 , 115)	3783
Tinker	5	108	(92 , 123)	3783
Eden	5	104	(89 , 119)	3783
Arthur	5	104	(89 , 119)	3783
Rocket	5	107	(92 , 122)	3783
1872	4	103	(86 , 119)	3996
Brutus	17	94	(87 , 101)	4679

Conclusions

- Unbalance → strange results
- Pairwise calculations → incorrect confidence intervals
- Hybrid method → too large confidence intervals

Conclusions

- Mixed model → appropriate estimates
- Mixed model → enables inclusion of Genotype by environment interactions
- Mixed model → appropriate confidence limits

Conclusion

We recommend mixed models
for routine analysis
of small unbalanced series of
variety trials