

Technical Working Party on Testing Methods and Techniques**TWM/4/15****Fourth Session****Cambridge, United Kingdom, June 2 to 5, 2026****Original:** English**Date:** May 28, 2026

COMPARISON OF COY U METHOD*Document prepared by an expert from France**Disclaimer: this document does not represent UPOV policies or guidance***COMPARISON TO THE RESULTS OF THE SPLINE METHOD IN COYU**

1. Our aim was to compare COYU results obtained with the current moving average method and with a spline method for assessing uniformity in plant variety trials, using GEVES (France) data.
2. We successfully implemented the COYU R package on real experimental (French) datasets and developed scripts to systematically compare the results from both methods. Tables and graphical outputs were produced, and an R Shiny application was developed to facilitate test execution.
3. The comparison was conducted on several forage and turf species, including Cocksfoot, Tall Fescue (forage and turf), Lucerne/Alfalfa, and Festulolium, over two- and three-year periods. Identical decision thresholds were applied for both methods. Results were compiled in structured Excel files containing raw data, adjusted values, decisions, extrapolation indicators, and comparative visualizations.
4. Results for candidate and reference varieties were analysed, and potential differences were examined in detail.
5. The annex to this document contains a presentation “Comparison of COY U method”, to be made by an expert from France, at the fourth session of the TWM.

[Annex follows]



Comparison of COY U method

Spline vs Moving average

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Moving average vs spline

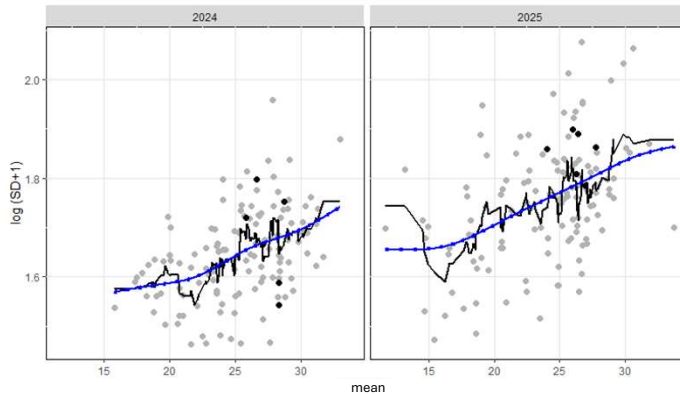
- COY U moving average method is now used with R code in Geves (previously in SAS)
- We wanted to compare results with spline method proposed by BioSS
 - As the coyu package is in R, easy to implement
 - Extrapolation coefficient is a very useful tool to detect « extreme » cases



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Moving average vs spline

- **Moving Average**
 - Smooths year-to-year variability using a moving window
 - Simple and transparent; historically used in COYU
- **Spline**
 - Uses smooth spline curves to model trends over years
 - Handles non-linear temporal patterns



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Comparison with our data (GEVES)

- Exchanges with BioSS team and developers, AFBI, NIAB and also BSA (thanks !)
- Implementation of coyu R package with our data
- R script to compare results between moving average and spline
 - Definition of tables and graphs
- Tests ran:
 - Cocksfoot (*Dactylis glomerata L.*)
 - Tall Fescue (*Festuca arundinacea Schreb*) forage
 - Tall Fescue (*Festuca arundinacea Schreb*) turf
 - Lucerne/Alfalfa (*Medicago sativa*)
 - **Festulolium* Aschers. et Graebn. / Festulolium
- Analyze of results

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Comparison with our data (GEVES)

- **coyu R package :**
 - Easy to use and understandable
 - Feedback was sent to the developers to improve the package (small adjustments)

- **For two methods, comparison of :**
 - decision of uniformity for each variety/characteristic
 - adjusted means
 - p values
 - graphical representation of moving average and spline lines with dotted lines when extrapolation

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Thresholds

- We tested same thresholds at first

- **Moving average :**
 - acceptance threshold (2 years) : 0.01
 - rejection threshold (2 years) : 0.001
 - rejection threshold (3 years) : 0.001

- **Spline :**
 - acceptance threshold (2 years) : 0.01
 - rejection threshold (2 years) : 0.001
 - rejection threshold (3 years) : 0.001

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Two-year analyses: results

- No difference in uniformity results
- 9 extrapolation cases for cocksfoot 2024-2025, below 4 otherwise

		Nb cand	Nb ref	Nb cara	extrapolation	diff in uniform result
Cocksfoot	2024-2025	15	127	17	9	0
	2025-2026	3	137	2	1	0
Tall fescue forage	2023-2024	5	100	14	0	0
	2024-2025	7	101	14	2	0
Tall fescue turf	2025-2026	11	112	1	0	0
	2023-2024	8	166	15	0	0
Tall fescue turf	2024-2025	1	160	15	0	0
	2025-2026	10	156	4	2	0
Lucerne	2024-2025	8	49	9	4	0
	2025-2026	12	90	2	0	0
Festulolium	2024-2025	1	20	14	0	0

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Three-year analyses: results

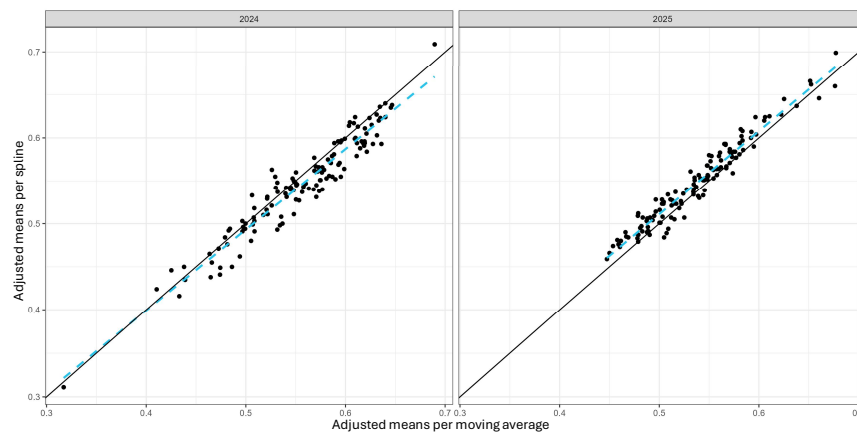
- No difference in uniformity results
- Below 4 extrapolation cases

		Nb cand	Nb ref	Nb cara	extrapolation	diff in uniform result
Cocksfoot	2024-2025-2026	12	124	2	0	0
Tall fescue forage	2023-2024-2025	5	94	14	0	0
	2024-2025-2026	7	99	1	0	0
Tall fescue turf	2023-2024-2025	7	147	15	2	0
	2024-2025-2026	1	155	4	0	0
Lucerne	2024-2025-2026	8	42	2	4	0
Festulolium	2024-2025-2026	1	20	2	0	0

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Adjusted means

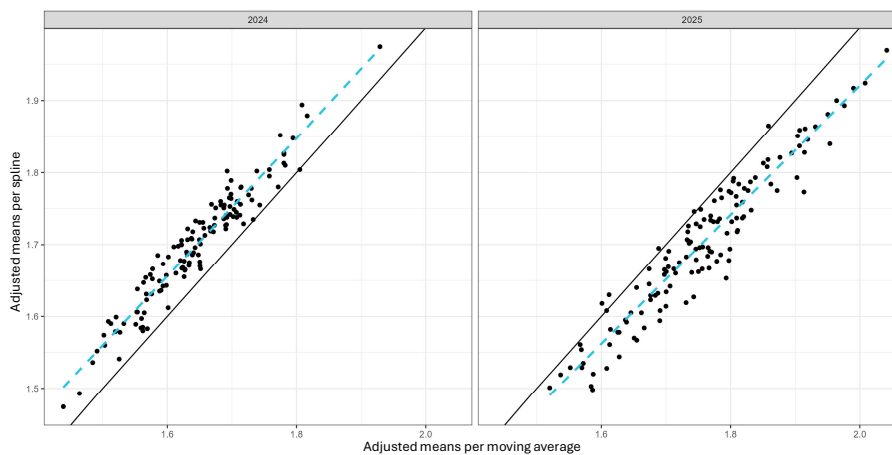
- (Cocksfoot) UPOV n°7 Plant: growth habit after vernalization (TG/31/9)
- Strong correlation between adjusted means for the majority of characters



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Adjusted means

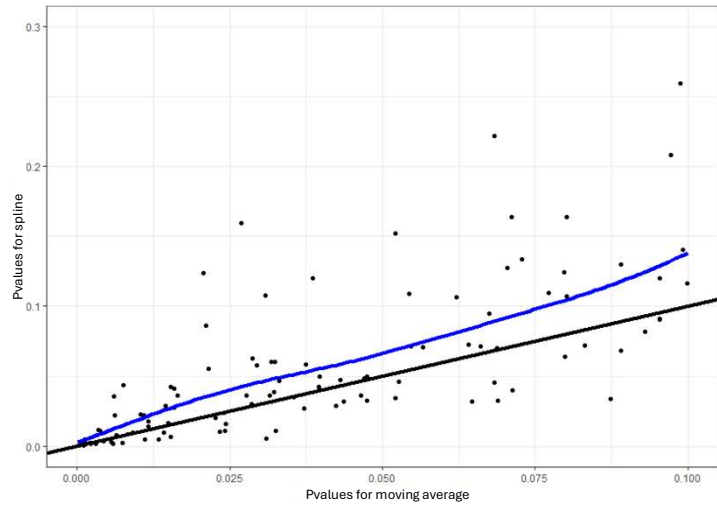
- (Cocksfoot) UPOV n°5 Plant: natural height without vernalization (TG/39/1)
- For some characteristics, the relation needs to be studied more carefully



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p values

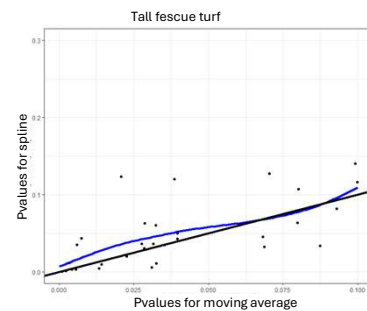
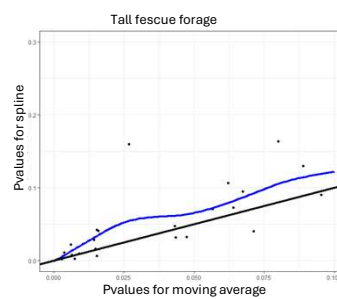
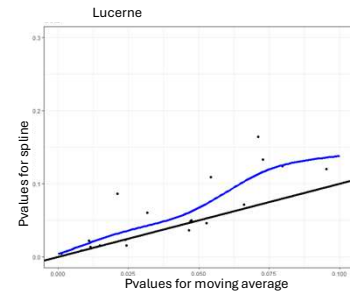
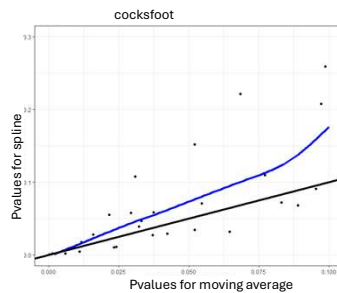
- P values were studied by focusing on p values < 10% for moving average
- Keeping all species studied at first
- Extrapolation cases were set aside
- For a moving average pvalue of 0.001 the prediction with spline is 0.004



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pvalues

- Same work by species was made
- Predicted pvalues are between 0.001 to 0.005 (for a pvalue of 0.001 for moving average)



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To be continued

- We started looking at the uniformity of the reference varieties
- Implementation of spline is now working
- We plan to systematically launch the spline method in parallel with moving averages and to establish (by species) the appropriate thresholds.
- We will look carefully at every difference that will appear

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Thank you for your attention !



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