

Predicting pasture nutritive parameters using low-cost NIRS on fresh and dried samples

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Introduction

- Performances of grazing animal depends on the quantity and quality of available pasture
- Available quantity may be estimated with different methods implemented by the farmer himself
- Determination of quality requires the shipment to a lab and even with NIR that may take several days with quick changes in the actual grass quality



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PascoLove

**Technological and managerial innovations to support the profitability of
pasture-based livestock farms**



https://eu-cap-network.ec.europa.eu/projects/pascolove-technological-and-managerial-innovations-support-profitability-pasture-based_en

Objective

Develop a NIR application for on-farm pasture analysis to allow farmer to estimate grass quality in real time or a very short (<1 day) time

Provide farmers with a ration balancing software to determine the best concentrate (if any) supplementation that complements grass quality

Materials and Methods

Farms and Samples

- Agroscope



Materials and Methods

Farms and Samples

- Pasture sample (1st year):
 - Total 125
 - 6 commercial farms x 4 sampling time (April, June, July, September/October) x 4 fields
 - University farm x 3 sampling time x 4 fields (June July, September)
 - 17 samples “donated” by Agroscope (July)
 - 1 square meter clipped and collected in plastic bags in the morning
 - Processed the same afternoon in the lab





Materials and Methods

Sample processing

- Sample weighing
- Chopped with a garden shredder for homogenization
- NIR spectra collection (wet sample)
- Drying at 60 ° C for 48h
- Grinded through a 1mm screen
- NIR spectra collection (Dried and Ground)
- Reference analysis: CP. Fat. Ash. aNDF. ADF. ADL. WSC. UFL(calculated)

Materials and Methods – NIR collection

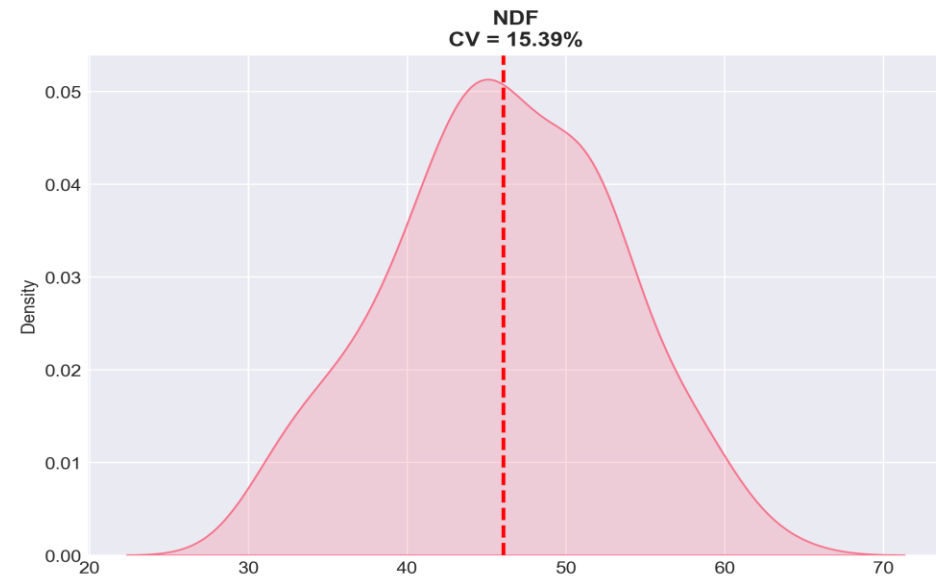
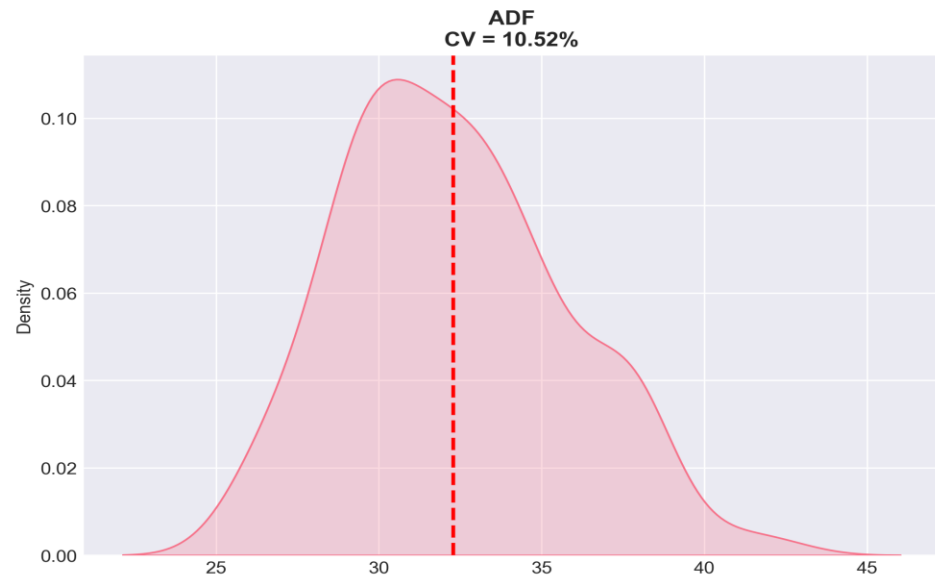
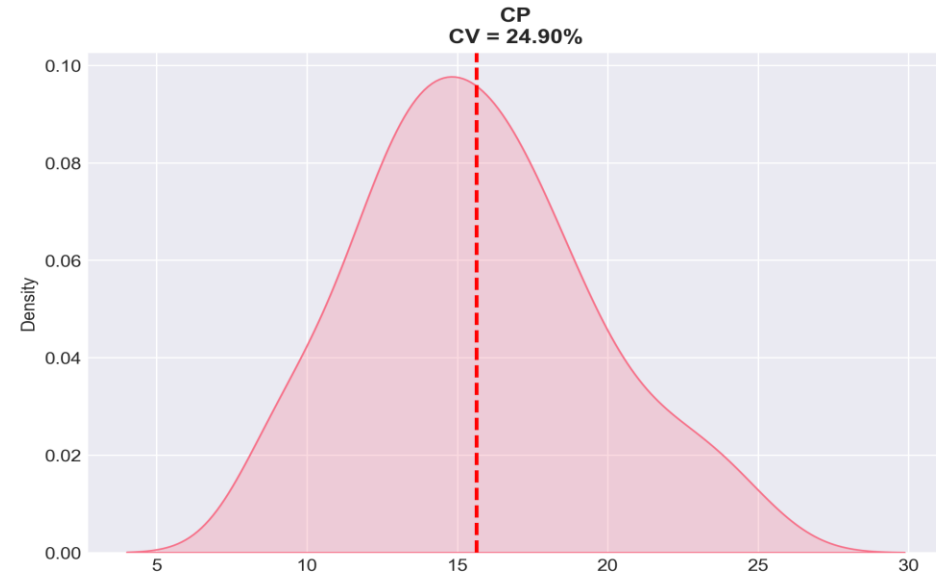
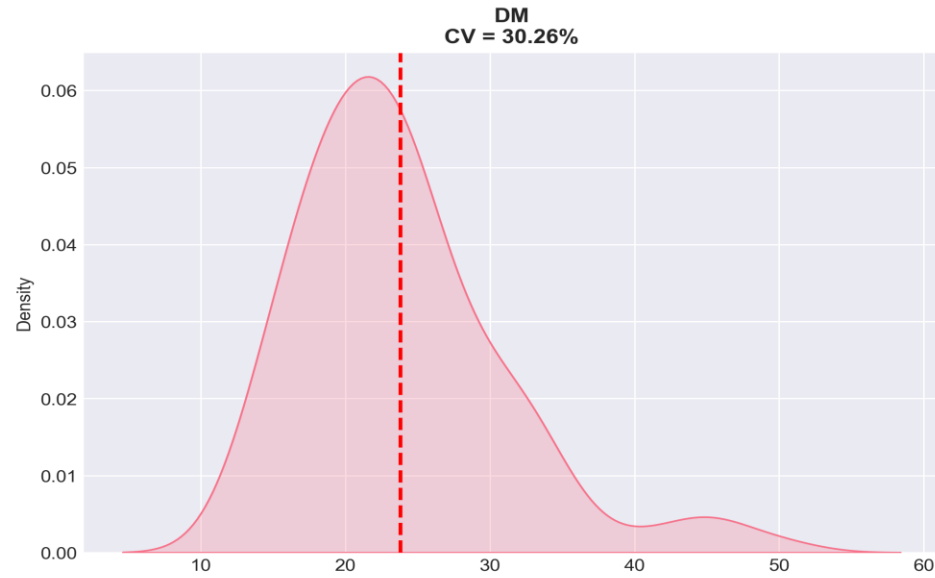
- Corona Extreme (Zeiss Spectroscopy, DE) diode array(DA) 950-1650 nm
 - Scan of two large cups (20cm diameter) – Green material
 - Scan of one large cup – dried and ground material
- DS2500 (Foss, DK) scanning monochromator (Mono) 850-2498nm
 - Duplicate scan in a round cup (12cm diameter)



Results – Chemical Composition

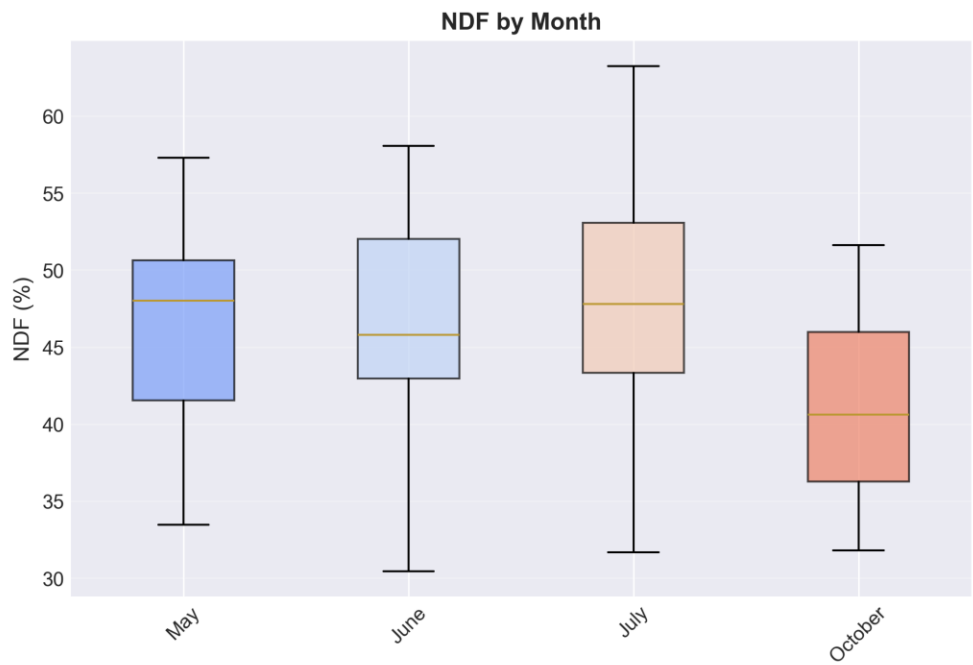
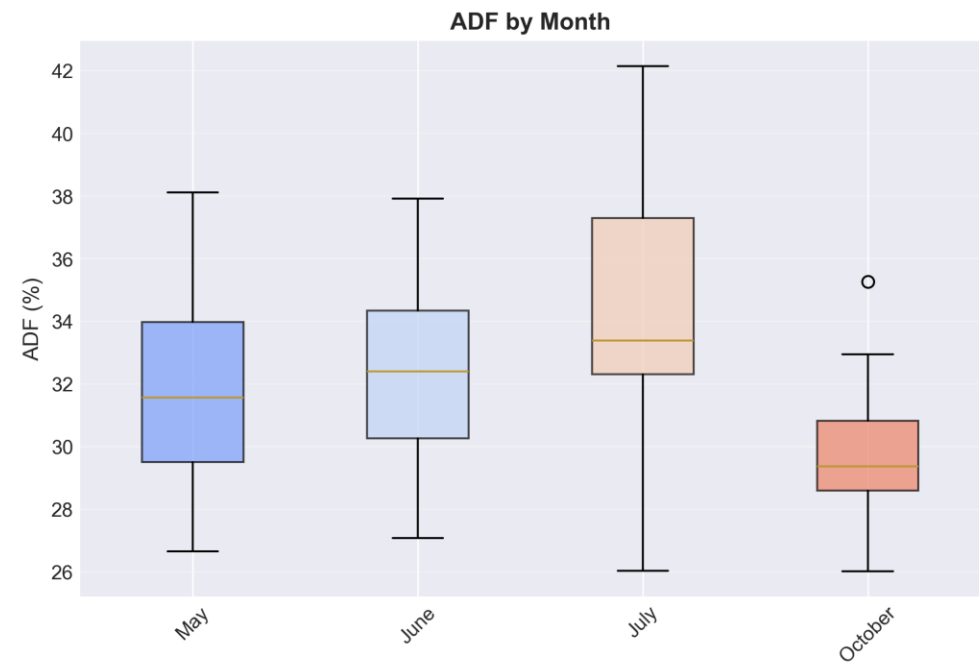
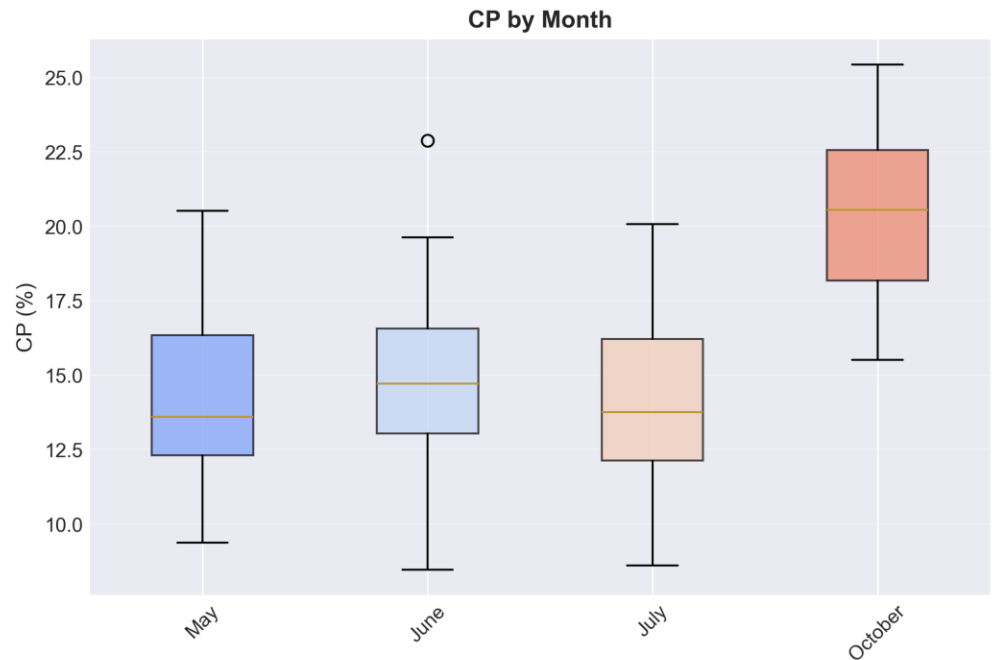
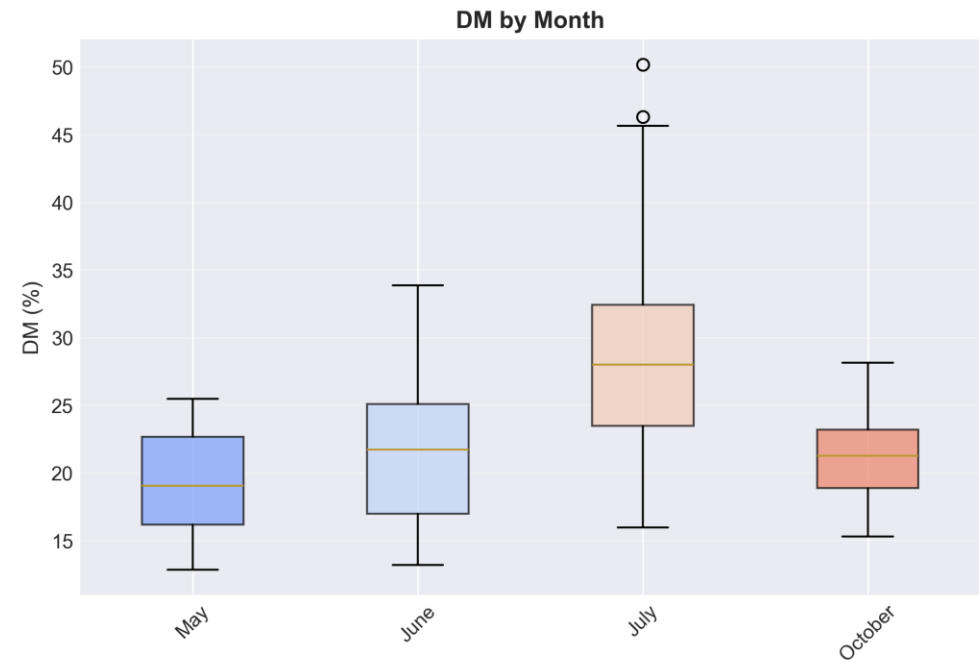
	Mean	Std.	Min	50%	Max	CV%
DM	23.8	7.2	12.8	22.8	50.2	30.3
CP	15.6	3.9	8.5	15.5	25.4	24.9
ADF	32.3	3.4	26.0	32.1	42.1	10.5
NDF	46.1	7.1	30.5	45.8	63.2	15.4
Lignin_ADL	6.2	1.0	4.1	6.0	8.9	16.4
WSC	11.4	2.2	7.6	11.1	17.7	19.5
Ash	10.8	2.9	5.7	10.3	21.2	26.6
Fat	2.2	0.4	1.3	2.2	3.1	17.5
UFL	72.3	4.8	58.8	72.4	82.2	6.6

Results – Chemical Composition



By
month

Seasonal Variation - Part 1



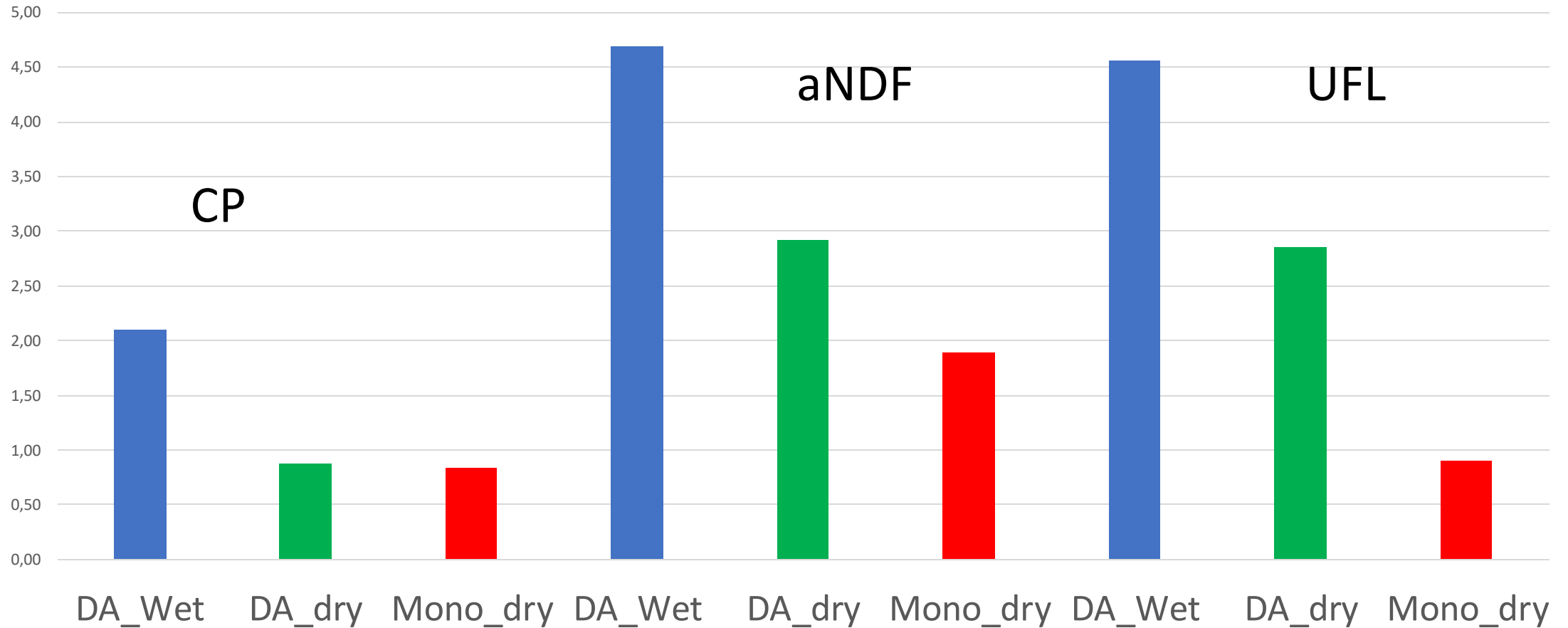
Results – NIR performance

	DA_Wet	DA_Wet	DA_dry	Mono_dry	DA_Wet	DA_dry	Mono_dry	DA_Wet	DA_dry	Mono_dry
Parameter	DM	CP	CP	CP	aNDF	aNDF	aNDF	UFL	UFL	UFL
Number of factors	4	8	11	9	7	8	13	7	8	13
SEC	1.68	1.65	0.63	0.59	3.65	2.32	1.20	3.89	2.29	0.53
RSQ	0.95	0.73	0.96	0.97	0.67	0.85	0.97	0.63	0.87	0.99
SECV	1.82	2.10	0.88	0.84	4.70	2.92	1.90	4.56	2.85	0.91
RSQV	0.92	0.54	0.92	0.93	0.37	0.74	0.91	0.43	0.79	0.98

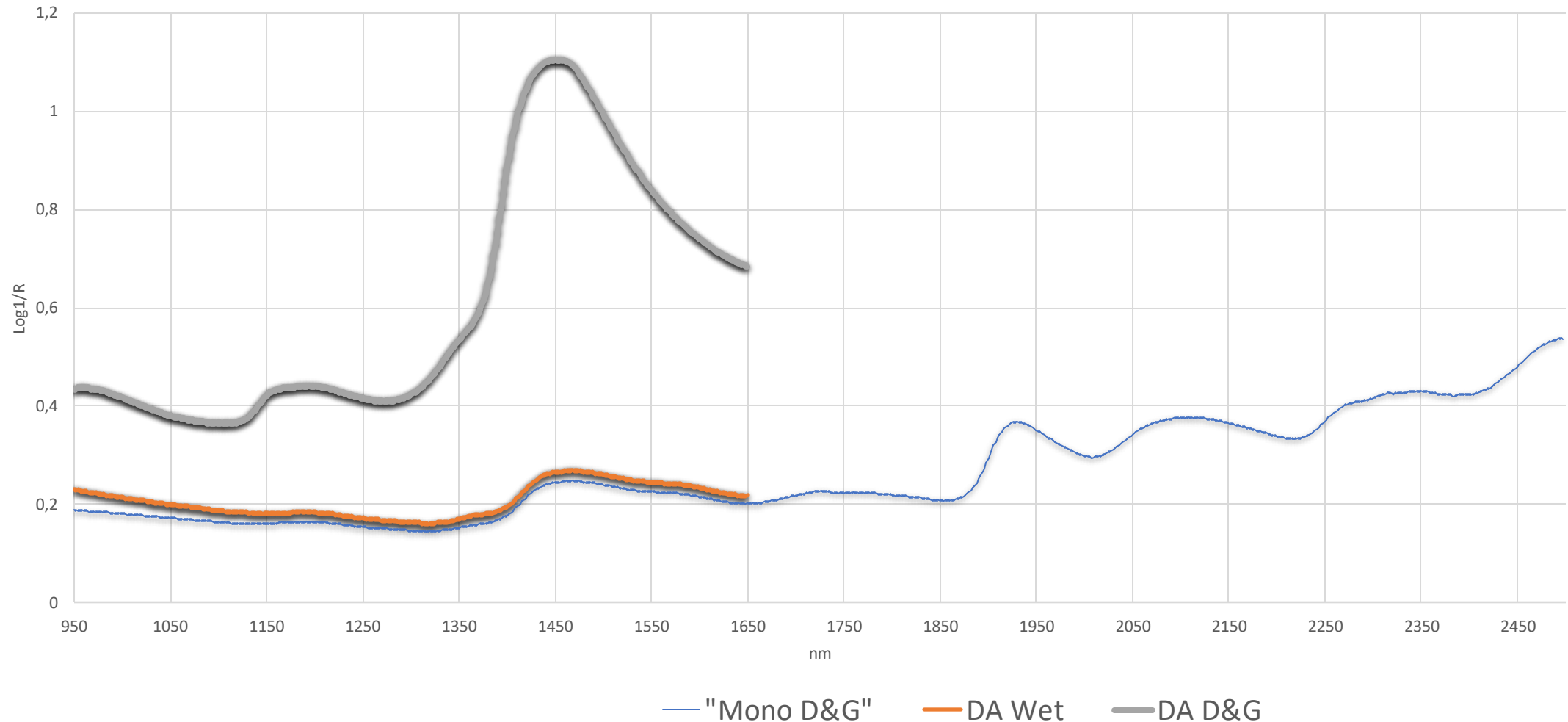
SECV: standard Error of cross validation; RSQV: R square of cross validation

Calibrations developed with PLS regression, SNV e Detrend pretreatment and Derivative 1st order

Standard error of Cross validation, % DM



Spectra of the same sample as wet or dry and ground and different instruments



Water is the problem!!!!

- What to do....our first attempt (method under development)



Air frier

80 °C x 30min



Blade mill

3min



Conclusion

- Forage quality prediction by NIR is not easy on wet samples, DM assessment is OK, but accuracy of nutrient profile may be limited with wet samples
- Removing water (drying) and grinding, greatly improves NIR predictions that reach best performances with lab type of instrument (expensive)
- Possible solution to use lower cost instrument is drying and grinding with consumer appliance which could make near on time quality assessment of pasture



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