



Development of a NIRS method to assess the digestive ability in growing pigs

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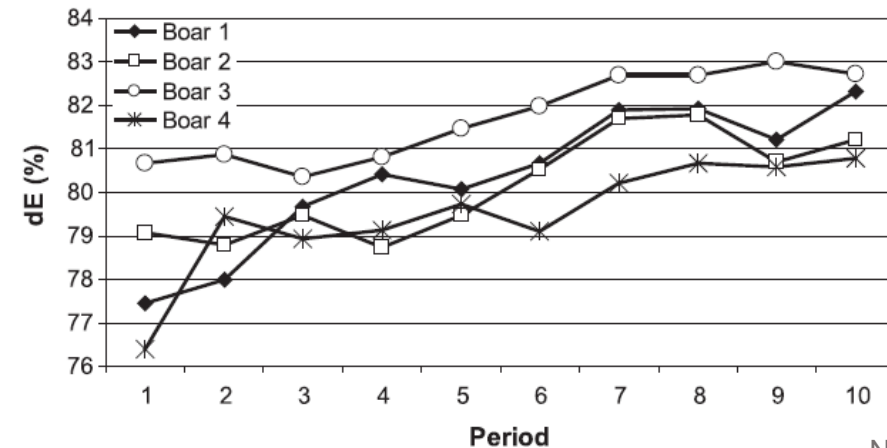
Pegase, INRA, Agrocampus Ouest, Saint-Gilles, France





Context

- ▶ Digestive efficiency is a component of feed efficiency
- ▶ Variability in digestive efficiency



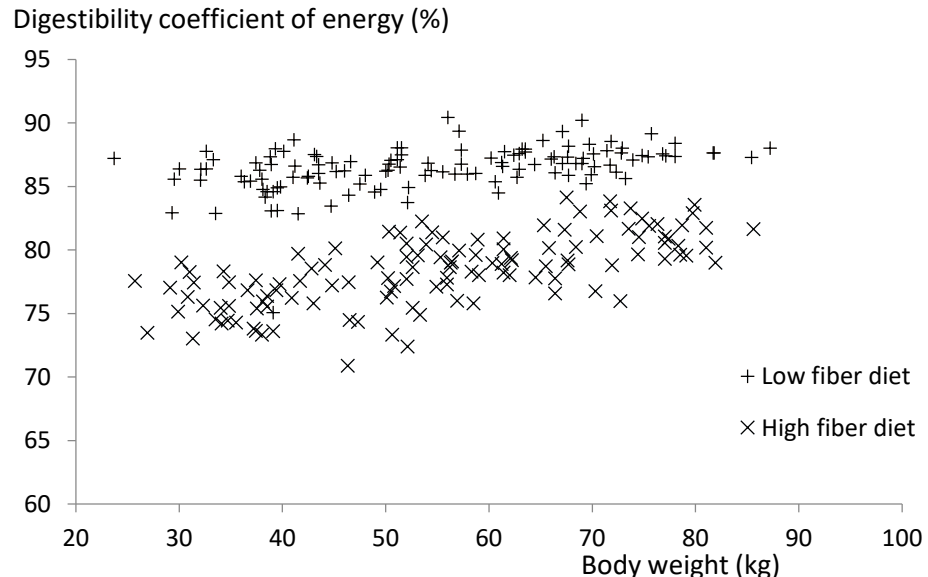
Noblet et al., 2013

- ▶ Objective: to develop a method to predict digestive ability in growing pigs
 - ▶ Spot sampling of feces
 - ▶ Rapid analysis by NIRS (Bruker MPA)



Experimental design to generate variability

- ▶ 246 samples of feces
 - ▶ 2 diets with low or high CF content
 - ▶ Indigestible markers
 - ▶ 63 Pietrain, Large White or Duroc pigs
 - ▶ 4 periods (30 to 80 kg)



	Low fiber diet	High fiber diet
Ingredients, %		
Cereals (maize, wheat, barley)	70.12	53.31
Rapeseed meal	-	1.97
Soyabean meal	15.74	9.18
Wheat bran	2.50	15.00
Soyabean hulls	-	10.00
Sugar beet pulp	-	5.00
Corn starch	4.25	-
Sunflower oil	1.00	-
Others	4.89	4.05
Silicone oil	0.50	0.50
Plastic resin Kynar®	0.50	0.50
Polyethylene glycol	0.50	0.50
Chemical composition, %DM		
Ash	5.52	6.31
Crude protein	16.17	16.18
Ether extract	4.27	3.06
Crude fiber	3.08	8.48
NDF	10.74	22.34
ADF	3.60	10.14
ADL	0.74	1.41
Gross energy (MJ/kg DM)	18.22	18.72



First step: utilization of indigestible markers to predict digestibility

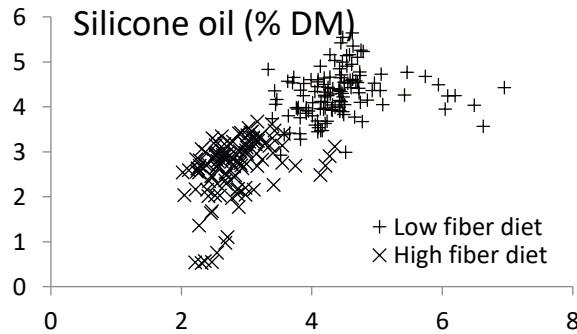
- Diets supplemented with silicone oil, plastic resin Kynar® and polyethylene glycol
- Ability of NIRS to predict marker concentration in feces

	Range (% DM)	Calibration dataset			Validation dataset				
		n	Standard deviation	R ²	n	Standard deviation	R ²	Intercept	Slope
Silicone oil	0-11.13	771	0.25	99.5	257	0.24	99.5	0.029	0.99
Plastic resin	0-11.33	771	0.30	99.2	254	0.28	99.2	0.025	0.98
Polyethylene glycol	0-11.15	771	0.19	99.7	271	0.19	99.7	0.014	1.00

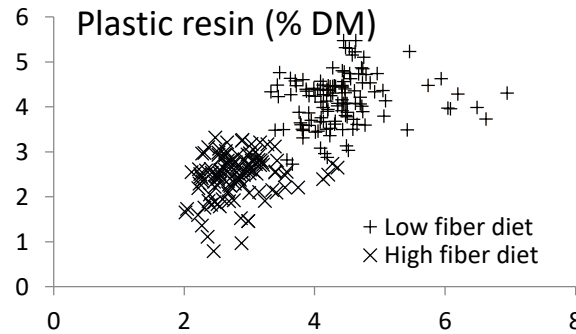


First step: utilization of indigestible markers to predict digestibility

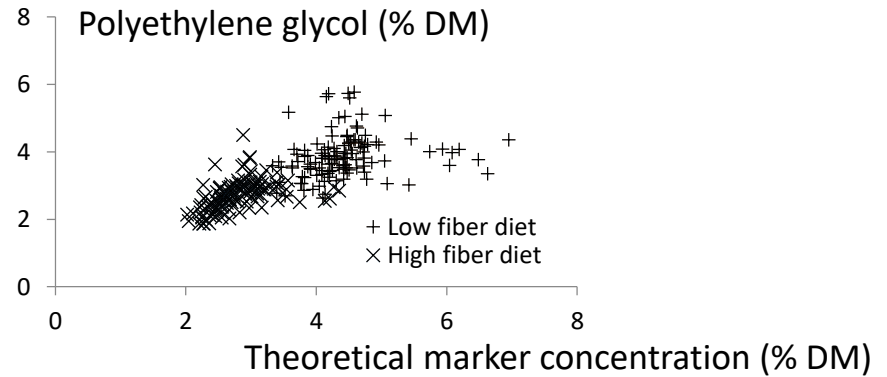
But inability to predict digestibility



Intercept: 0.68% DM (P<0.01)
 Slope: 0.77 (P<0.01)
 R²= 56.9 %



Intercept: 0.53% DM (P<0.01)
 Slope: 0.77 (P<0.01)
 R²= 56.8 %



Intercept: 1.22% DM (P<0.01)
 Slope: 0.58 (P<0.01)
 R²= 49.6 %

Recovery (%)	97 ± 20	92 ± 18	93 ± 16
Variability	Period	Diet, period, and interaction	Diet, period, and interaction with breeds



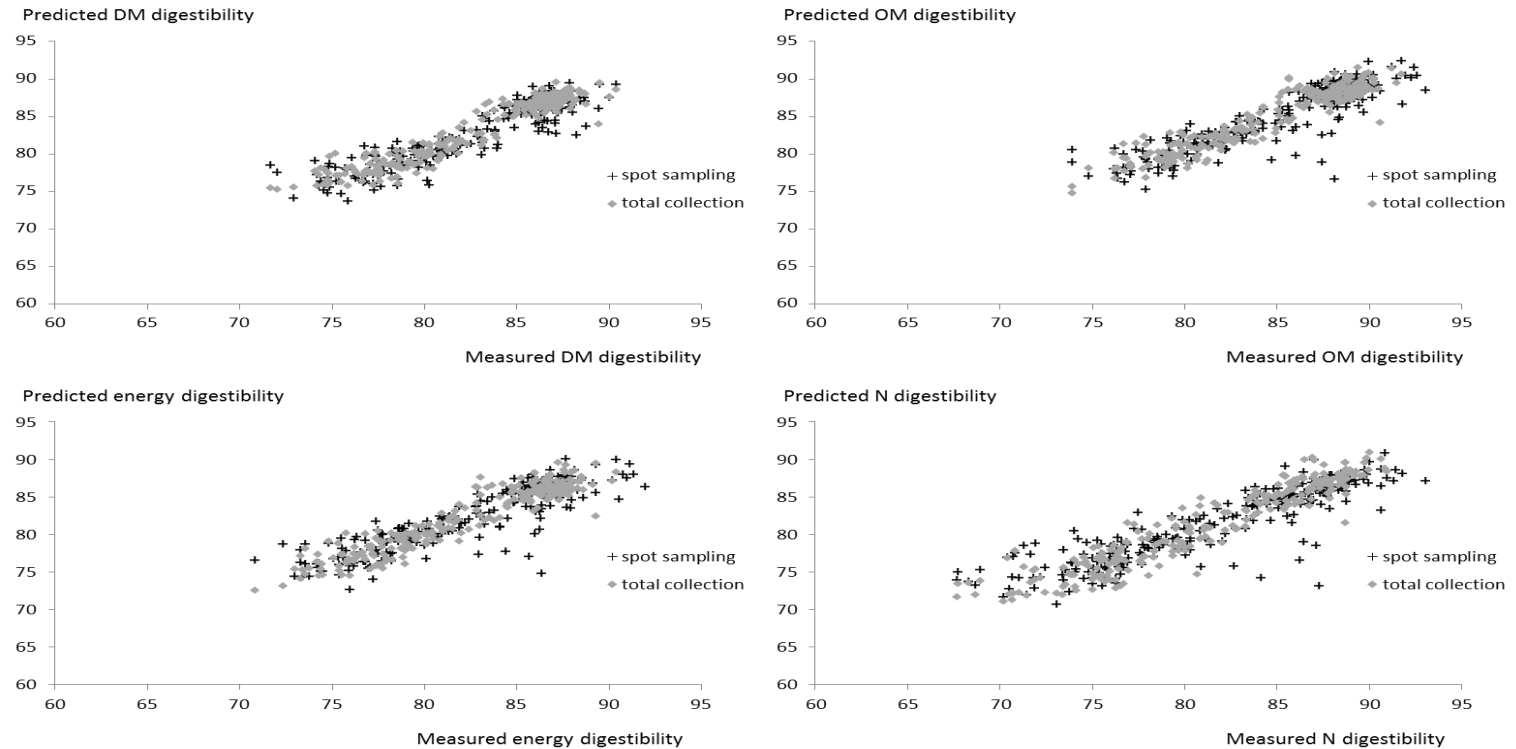
Second step: direct predictions of digestibility coefficients by NIRS

- ▶ New database with 830 samples from Inra experiments
 - ▶ 550 samples from total collection of feces over 6-10 days
 - ▶ 280 samples from direct collection in the rectum

	Range (%)	Calibration dataset			Validation dataset							
		n	Standard deviation	R ²	n	Standard deviation	R ²	RPD	r	Bias	Intercept	Slope
Dry matter	72.1-90.4	749	1.61	83.5	82	1.71	85.7	2.67	0.93	0.2	12.3	0.85
Organic matter	73.9-91.8	749	1.63	82.5	82	1.47	89.3	3.05	0.94	0.1	9.2	0.89
Energy	70.9-90.4	749	1.84	79.2	82	1.73	87.0	2.78	0.94	0.1	15.8	0.81
N	67.4-90.9	749	2.32	79.1	82	1.82	89.6	3.11	0.95	0.1	14.5	0.82
Crude fiber	24.0-73.7	497	6.75	61.4	82	6.64	66.4	1.74	0.82	0.8	18.8	0.59



Direct prediction from total collection or spot sampling

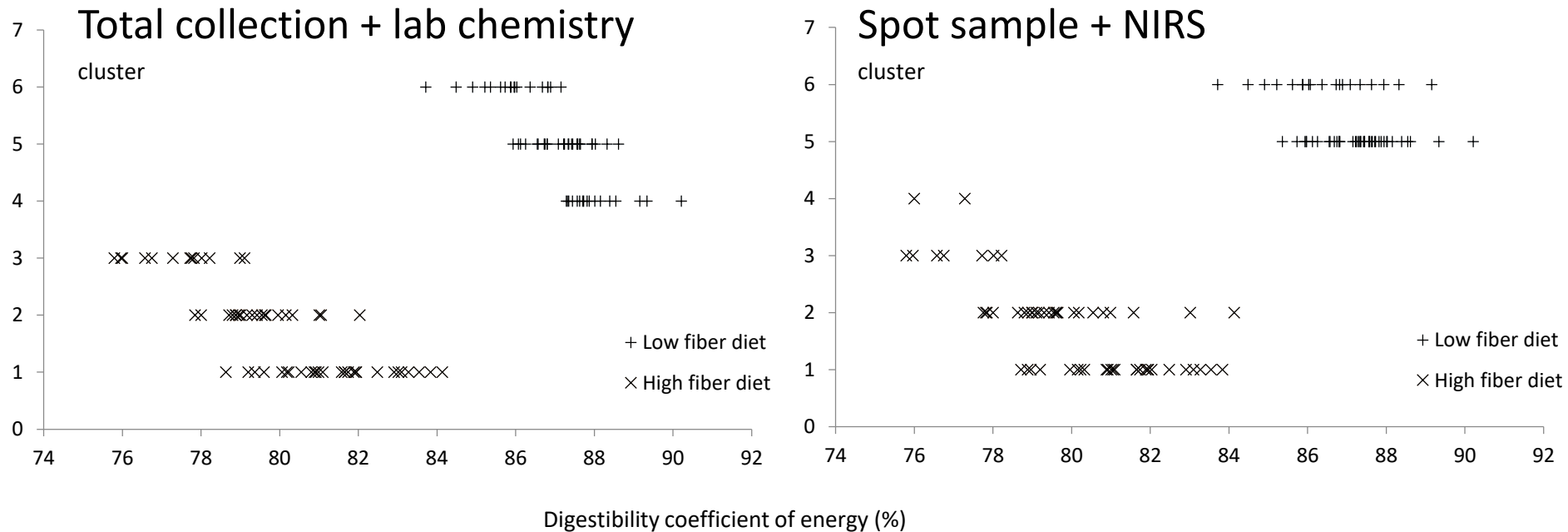


- ▶ Accuracy of prediction from 81 (spot sampling) to 89% (total collection)
- ▶ Lowest bias: with the high fiber diet and when animals get older



Clustering of pigs for their digestive ability

With animals during periods 3 and 4 (BW > 60 kg)



Strong agreement between methods



Conclusions

- ▶ Silicone oil, plastic resin Kynar® and polyethylene glycol inadequate as indigestible markers for digestibility
 - ▶ Silicone oil with heavy animals should be further investigated
- ▶ Ability of NIRS to predict digestive ability from a spot sample of feces in growing pigs
 - ▶ BW > 60 kg
 - ▶ High fiber diet



Thank you for your attention





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