

# Towards a handheld **NIR spectrometer** to evaluate the fruit organoleptic and nutritional quality in the context of **Organic fruit breeding**

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## Use of NIRS to analyze fruits

2004



- **XDS (Foss)**  
(400 - 2500 nm)



- **Phazir (Polychromix)**  
(1000 - 1800 nm)



- **Da Meter (Turoni srl)**  
( $I_{AD}$  Index : Abs 670 – Abs 720)



- **MicroNir (VIAVI)**  
(1100 - 1600 nm)



- **SCIO**



- **F-750 FELIX Instrument**  
(400 - 1000 nm)



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Agriculture



Research Article

### Non-destructive measurement of vitamin C, total polyphenol and sugar content in apples using near-infrared spectroscopy

Audrey Pissard, Juan A Fernández Pierna, Vincent Baeten, Georges Sinnaeve, Georges Lognay, Anne Mouteau, Pascal Dupont, Alain Rondia, Marc Lateur

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Postharvest Biology and Technology

Volume 172, February 2021, 111375



### Evaluation of a handheld ultra-compact NIR spectrometer for rapid and non-destructive determination of apple fruit quality

Audrey Pissard, Emanuel José Nascimento Marques, Pierre Dardenne, Marc Lateur, Celio Pasquini, Maria Fernanda Pimentel, Juan Antonio Fernández Pierna, Vincent Baeten



## InnOBreed

### ‘Innovative Organic fruit Breeding and uses’ (2022-2026)



European research project dedicated to **innovative solutions** for **collaborative organic fruit breeding**

### Task : Nondestructive fruit quality screening

- Deliver a tool based on NIRS for a rapid and non-destructive phenotyping of fruits

Experiments done by partners : CRA-W, SERIDA, IRTA, BOKU, VSUO, CTIFL, CIHEAM, CREA and INRAE





## F-750

(Felix Instruments, Camas, USA)

- Carl Zeiss MMS-1 Spectrometer
- Spectra from 400 to 1100 nm
- Interactance mode

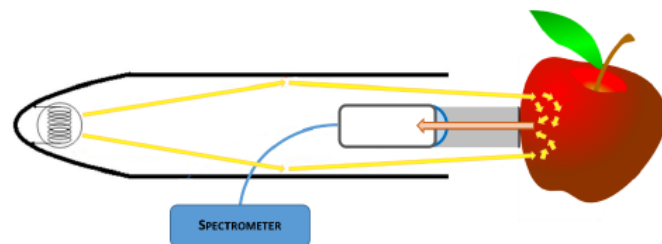
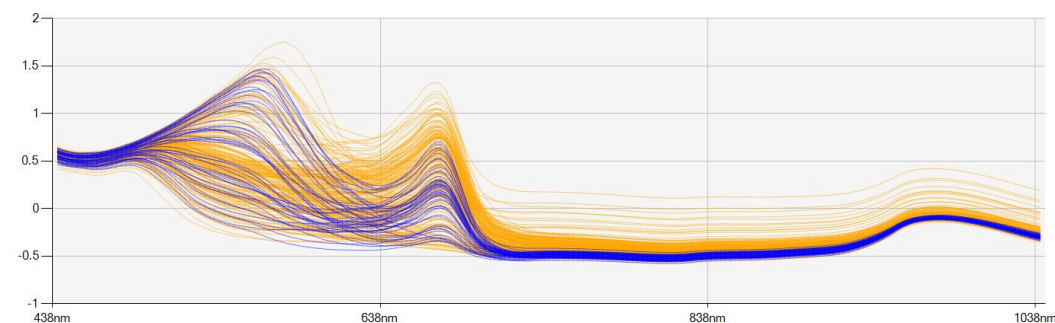


Figure 1: Interactance optical design; light rays illuminate an annulus on the sample. The light then interacts with the sample by internally scattering through the tissue. Light that undergoes remission normal to the collimating lens is collected and focused onto the fiber.

(Source: Felix)

## Vis-NIR spectra

- 3 years data
- 4 sides/fruit
- 25 varieties



(AppBuilder software)



## Fruit quality evaluation

- Organoleptic quality
  - Dry matter content
  - Firmness
  - Sugar content (°Brix)
  - Titrable acidity
  - Starch index
  
- Nutritional traits
  - Fibers
  - Starch
  - Polyphenols



## Calibration models for Dry matter, Brix, Acidity

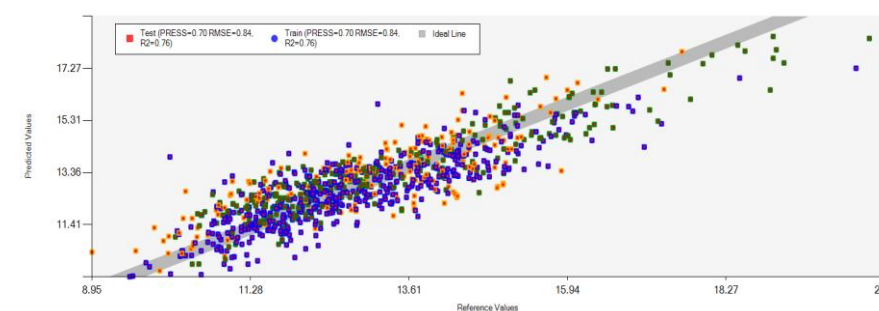
(2nd derivative of the 729–975 nm - PLSR models with LOOCV)



F-750

	n	Mean	RMSECV	R <sup>2</sup> cv	RPD
Dry matter (%)	699	16.99	0.9	0.83	2.4
Brix (°)	976	13.03	0.84	0.76	2.1
Acidity (g ac. malic/L)	976	7.46	1.3	0.64	1.7

(AppBuilder software)



Scatter plot of cross-validation for Brix



Custom models  
integrated into the  
device

## Calibration models for Dry matter, Brix, Acidity

(2nd derivative of the 729–975 nm - PLSR models with LOOCV)



F-750

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(AppBuilder software)



XDS

	n	Mean	RMSECV	R <sup>2</sup> cv	RPD
<b>Dry matter (%)</b>	699	16.99	0.94	0.81	2.3
<b>Brix (°)</b>	976	13.03	0.68	0.84	2.5
<b>Acidity (g ac. malic/L)</b>	976	7.46	1.01	0.78	2.1

(Winisi software)

## *Perspectives 2025-2026...*



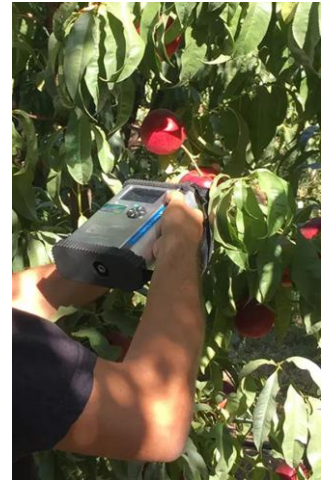
**Validation** directly in field conditions by fruit growers “*case studies*”



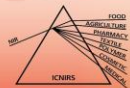
**Nutritional traits** : polyphenols, vitamin C, starch, fibers



**European InnOBreed NIRS network**: build a common database to develop robust models







Auditorium della Tecnica (Rome), 8-12 June 2025

[www.nir2025.sisnir.org](http://www.nir2025.sisnir.org)

#### DATES

From Monday 29 September PM  
to Friday 3 October AM

#### REGISTRATION FEE

2500 €

50% discount for students (1250 €)  
including attendance to the training, training material,  
coffee breaks, lunches and participation to a social  
event

#### REGISTRATION

<https://gqr.sh/bbn2>



#### CRA-W

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## XVII<sup>th</sup> Vibrational Spectroscopy and Chemometrics Training Course

29 September to 3 October 2025

Walloon Agricultural  
Research Center (CRA-W)  
Gembloux, Belgium

Thanks for your attention!



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