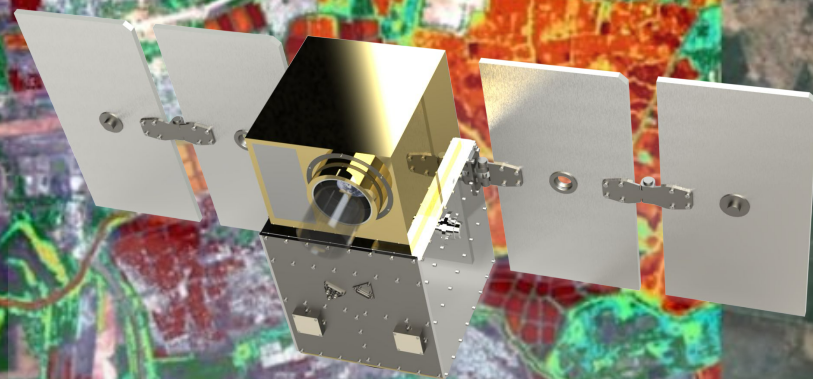




# Agricultural Possibilities



●●RESTRICTED CONFIDENTIAL●● Orus property. Disclosure outside the Group prohibited unless authorized.



## Who are we?

We are a **startup** dedicated to the exploitation of a hyperspectral constellation.

**Hyp4U Constellations** will start launching end of 2026, first images 2027.

Version 1 will have 4 satellites.

Version 2 will start launching after 2028 (4+ satellites).

We are part of the **New Space Generation** launching hyperspectral satellites.

We integrated the **Copernicus Contributing Mission** Cohorte in spring 2025.

## Where?

Sophia-Antipolis (Nice area, FR).

online: <https://orus.space/>



# HYP4Uses

## End-to-end high resolution hyperspectral geodata service

### Space Infrastructure > Data Acquisition

#### HIGH QUALITY & PRECISION

#### > MICROSAT OPTICAL PAYLOAD

hyperspectral **VNIR-SWIR** high res  
**Native & Dual Use**  
GSD<10m Res\_spec<10nm SNR~100

#### Own IP

18 years space inheritance

#### Adaptability

on demand :  
In-Flight control of imagery  
acquisition parameters



#### DAILY REVISIT

#### > 5 MICROSAT CONSTELLATION

Global

#### Opérability

Roll adhoc control

#### Sovereign

Industrial branch  
FR & european

### Ground Segment > Data Processing & Insights

#### RAPID AND PRECISE HIERARCHICAL CLASSIFICATION OF CHEMICAL COMPONENTS

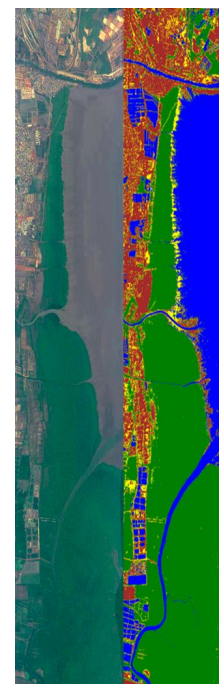
#### > RT IA

Classification on reception  
with automatic warning

#### 100% scalable solution

Big data mining  
Large area analytics

**High precision image correction**  
in-house L0-L2



# Hyperspectral Advocacy/Adaptation

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Hyperspectral applications require some expertise

Regular multispectral/temporal remote sensing analysts find it hard to adapt

Advocacy is needed

Adaptation too

JRC already has this expertise for several years, I worked with that team!


# 1. Main field crop identification



0 125 250 500 Meters


## Legend


### Class\_name

 *Acer negundo*


 *Amygdalus*

 Background

 *Fraxinus chinensis*


 *Oryza sativa*

 *Populus*

 Post-harvest field

 *Pyrus*

 *Salix*

 *Sophra japonica*

 Water

 Weeds

 *Zea mays*

The literature is now rich in main field crop identification  
Methods vary, ML being the most common.

Spectral libraries are now getting developed in this matter and  
provide direct unsupervised classifications.

<https://ieeexplore.ieee.org/abstract/document/9497323>

<https://www.sciencedirect.com/science/article/abs/pii/B9780444639776000183>

# Agricultural possibilities

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For today, I decided to take three subjects relating to :

1. main field crop identification
2. main field crop health
3. fodder production precise assessment

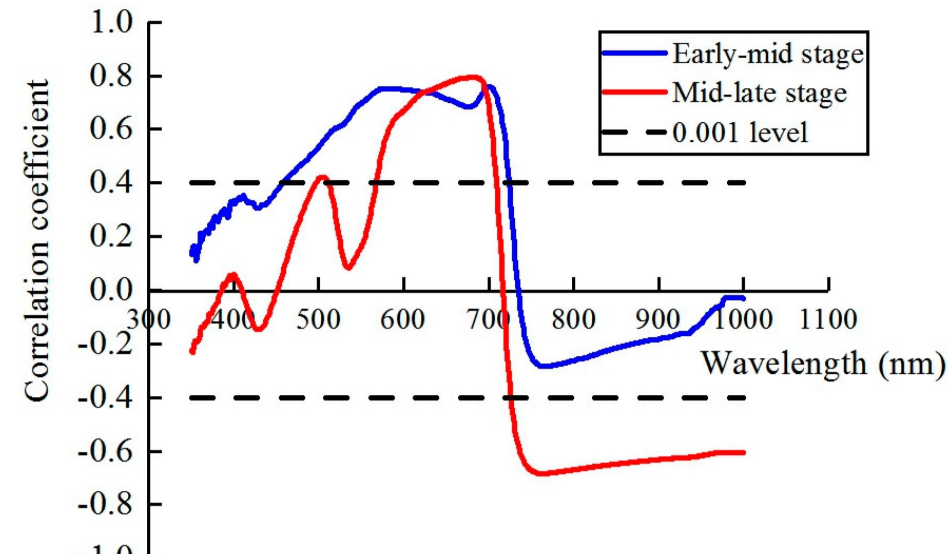
The idea is simple, give concrete possibilities of hyperspectral applications in our context of crop analysts.

## 2. Cereal diseases detection

- Stem Rust Disease in Wheat (Abdulridha J, et al., **2023**)
- Scab/Fusarium head blight (FHB) => wheat, rye, barley and oat
  - Fusarium Disease Index (FDI for wheat ; Zhang et al., **2020**)
- Wheat yellow rust (YR ; Zhang et al., **2019**)

*Identification of Wheat Yellow Rust  
Using Optimal Three-Band Spectral  
Indices in Different Growth Stages*  
Zhang et al., 2019

**Correlation values =>**



# Cereal diseases detection

## Wheat yellow rust (YR)

Index (abbreviation)	Band specification (nm)	Growth stage	Performance/Notes	Main Reference
PRI (Photochemical Reflectance Index)	570, 525, 705	Early–mid growth	<b>Classification accuracy:</b> 84.1%, <b>Kappa:</b> 0.61; sensitive to photosynthetic changes due to YR infection	<a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC6339203/">https://pmc.ncbi.nlm.nih.gov/articles/PMC6339203/</a>
ARI (Anthocyanin Reflectance Index)	860, 790, 750	Mid–late growth	<b>Classification accuracy:</b> 93.2%, <b>Kappa:</b> 0.75; sensitive to canopy/structural changes from YR	<a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC6339203/">https://pmc.ncbi.nlm.nih.gov/articles/PMC6339203/</a>
YROI (Yellow Rust Optimal Index)	(constructed via best sensitive bands)	All stages	Spectrally optimized for YR discrimination; high quantitative performance	<a href="https://www.tandfonline.com/doi/full/10.1080/20964471.2021.1907933">https://www.tandfonline.com/doi/full/10.1080/20964471.2021.1907933</a>



# Cereal diseases detection references

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- Abdulridha J, et al., **2023**. *Evaluation of Stem Rust Disease in Wheat Fields by Drone Hyperspectral Imaging*. Frontiers in Plant Science, 14:1186847. doi:10.3389/fpls.2023.1186847
- Terentev A., Dolzhenko V., Fedotov A., Eremenko D., **2022**. *Current State of Hyperspectral Remote Sensing for Early Plant Disease Detection: A Review*. Sensors, 22:757. <https://doi.org/10.3390/s22030757> <https://www.mdpi.com/1424-8220/22/3/757>
- Zhang, D., Wang, Q., Lin, F., Yin, X., Gu, C., & Qiao, H. **2020**. Development and Evaluation of a New Spectral Disease Index to Detect Wheat Fusarium Head Blight Using Hyperspectral Imaging. Sensors, 20(8), 2260. <https://doi.org/10.3390/s20082260>
- Zheng, Q., Huang, W., Cui, X., Dong, Y., Shi, Y., Ma, H., & Liu, L. **2019**. Identification of Wheat Yellow Rust Using Optimal Three-Band Spectral Indices in Different Growth Stages. Sensors, 19(1), 35. <https://doi.org/10.3390/s19010035>

# 3. Counting Fodder Harvested

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Grass fodder is harvested 1 to 5 times per year in EU fields

Very often now, it is stored in **round balers** wrapped in **plastic (PE)**

at a weight of 270-290 Kg per round baler





Plumergat, Bretagne, FR  
July 2025





# Round baler

polyethylene (PE) stretch film



## Caractéristiques techniques du filet round baller :

- ✓ **Largeur du filet** : 123 cm
- ✓ **Longueur du rouleau** : 3600 m
- ✓ **Témoin de fin de rouleau** : 50 m
- ✓ **Longueur maximum du mandrin** : 124,7 - 125 cm
- ✓ **Diamètre maximum du rouleau** : 27 - 28 cm
- ✓ **Grammage** : 10 g/m
- ✓ **Nombre de chaînes** : 42
- ✓ **Résistance linéaire** : 260 - 280 kgf
- ✓ **Poids** : 38 kg
- ✓ **Couleur de la nappe** : Blanc avec 2 bandes de couleur pour un positionnement simplifié
- ✓ **Conditionnement** : 28 rouleaux/palette

Filet round baller - REFERENCE -  
123cmx3600m | FilMax

10 avis clients ★★★★★ 4.9/5

Référence : 450831 Expédié par Agryco

PRIX DEGRESSIF

Le filet **FilMax Round Baler** est la solution idéale pour le **liage efficace et durable des balles rondes**. Grâce à sa conception soignée, il garantit un maintien optimal tout en s'adaptant parfaitement à **toutes les presses du marché**. Avec un **rapport qualité/prix exceptionnel**, il répond aux attentes des agriculteurs en quête de fiabilité et d'économie.

Ce modèle offre une **longueur impressionnante de 3600 mètres par rouleau**, ainsi qu'un témoin de fin de rouleau de 50 mètres, pour des opérations pratiques et sans interruption. Ses **42 chaînes** assurent une couverture uniforme et robuste, tandis que ses bandes colorées permettent un alignement facile lors du liage.



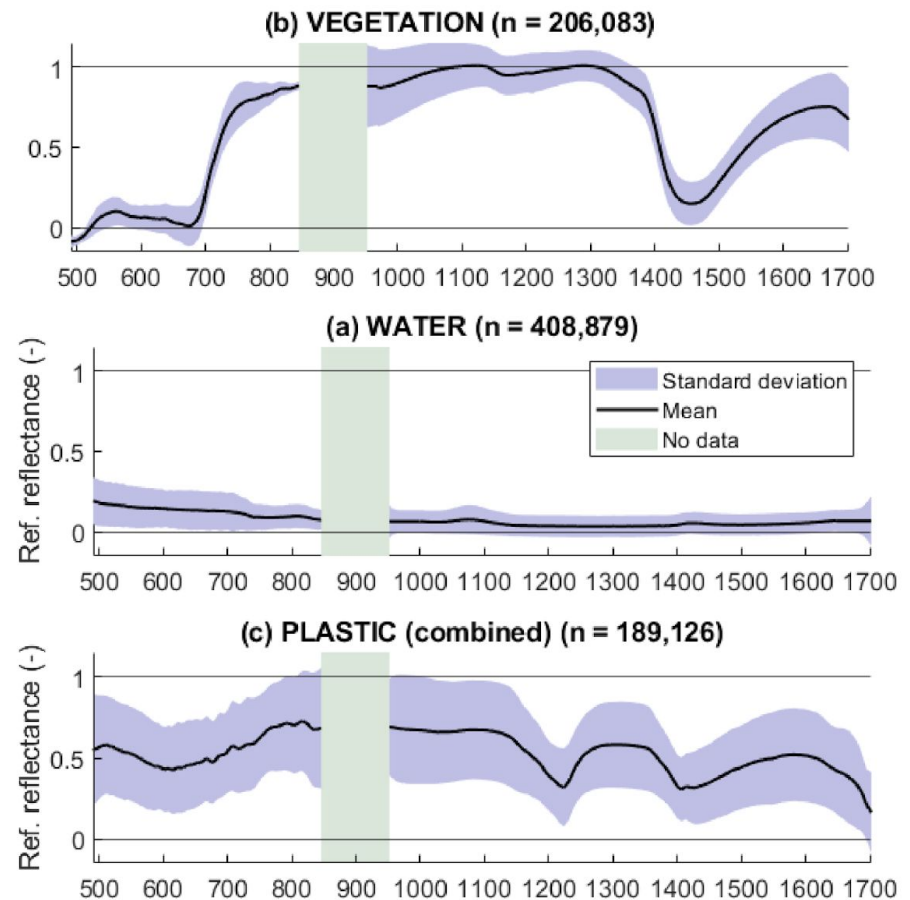
# Polyethylene (PE) stretch film

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- **Strong & broad absorption bands:**
  - 1200, 1400, and 1720 nm
  - Clear, polymer-specific patterns in the NIR-SWIR
- **Why?**
  - C–H overtone
  - PE specific molecular structure combination bands

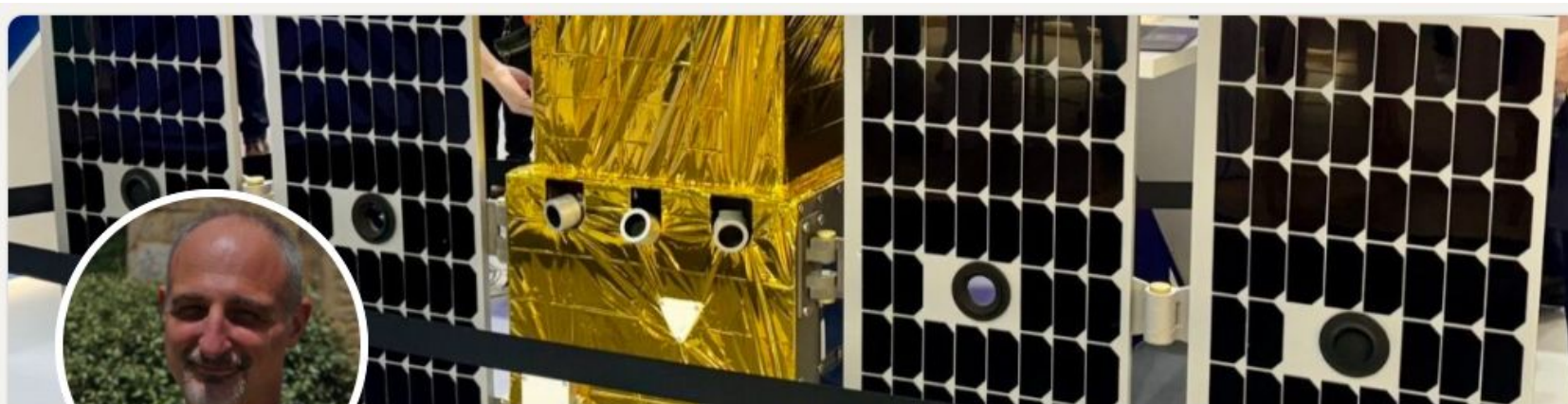
# Detecting round balers in the field

Looks like a **plastic duck on water**:  
Anomaly detection is easy with hyperspectral



<https://www.mdpi.com/2072-4292/13/12/2335>

# THANK YOU



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<https://orus.space>



ORUS



IAE Nice (Graduate School of Management)

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