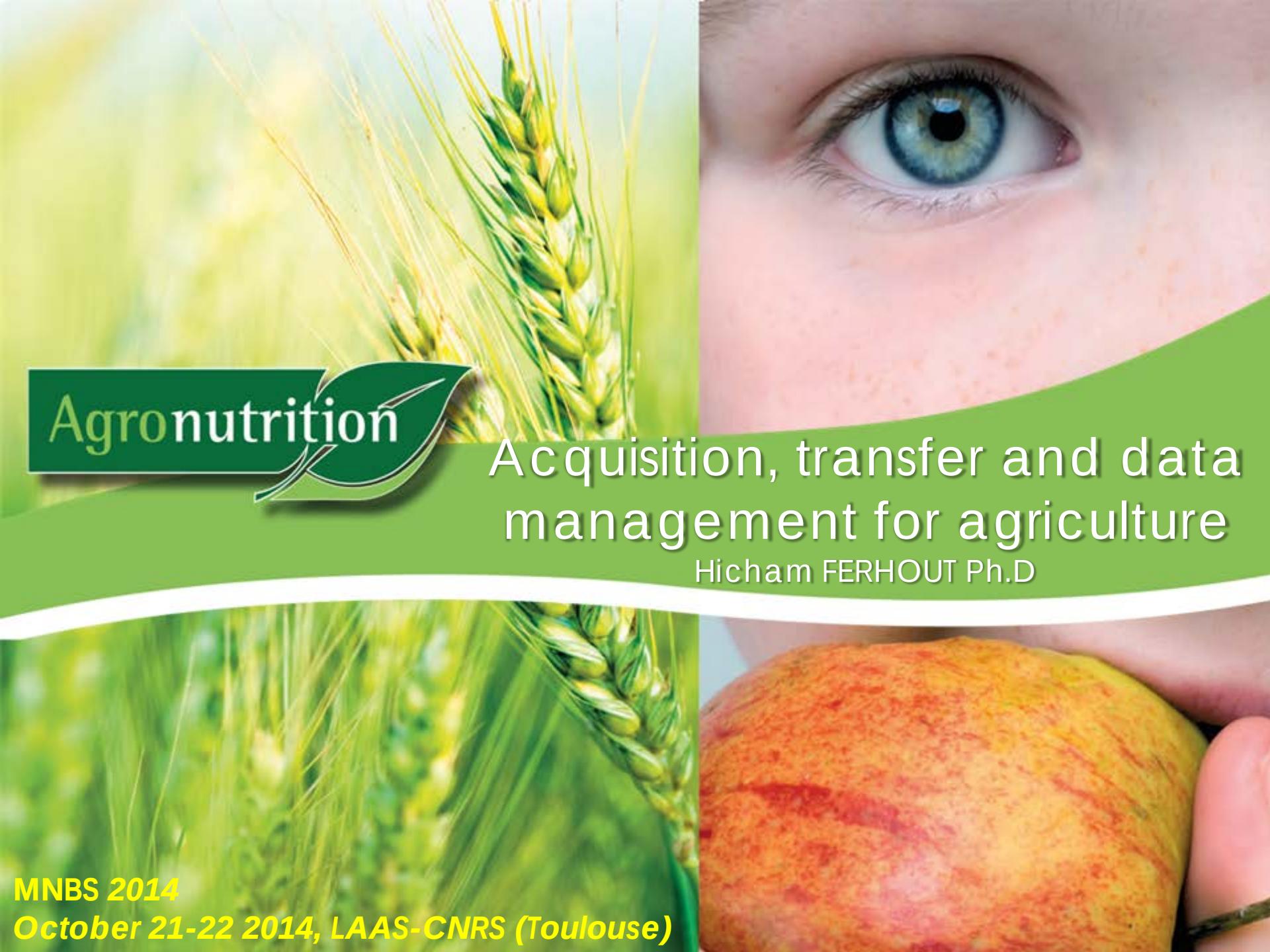

Acquisition, transfer and data management for agriculture

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Agriculture : new challenges

- New challenges for modern agriculture :
  - Less land and increasing needs
    - Demographic growth / Animal proteins diets
  - New uses for crop biomass
    - Ethanol / Energy / Green chemistry / Textile fibers
  - Environnemental issues : soil / water / crops
    - Larger urban zones / health issues / Soil / Ressources

Producing more with less

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Farmer's constraints

- Cost reduction and Labor requirements
- More efficient use of inputs (nutrients, pesticides, irrigation water)
- Yield
- Crop quality improvement
- Production tracking for food safety and environmental benefits

Main goal : economic return on investment

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Precision agriculture

A Management System that is information and technology based, is site specific and uses one or more of the following sources of data: *soils, crops, nutrients, pests, moisture, or yield*, for optimum **profitability**, **sustainability**, and protection of the **environment**

(Precision Ag. 2003)

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The Soil : culture substrate ?

A finite ressource

No intensive agriculture or productivity without soil

Soil FERTILITY = Completing biogeochemical cycles (C; N; P)

Soil HEALTH = physico-chemical / biological parameters

Heterogeneity

Water
Nutrients
Biological engine
Soil structure

Inputs efficiency:
Nutrients
Pesticides
Irrigation water

Itinerary of culture and parcel history

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The Soil : culture substrate ?

Heterogeneity

Soil FERTILITY

Soil HEALTH

Inputs efficiency

Itinerary of culture
Parcel history

Water
Nutrients
Biological engine
Soil structure

Too many variables

Need to monitor

What and how to monitor?
For what Purpose?

Economic and production considerations

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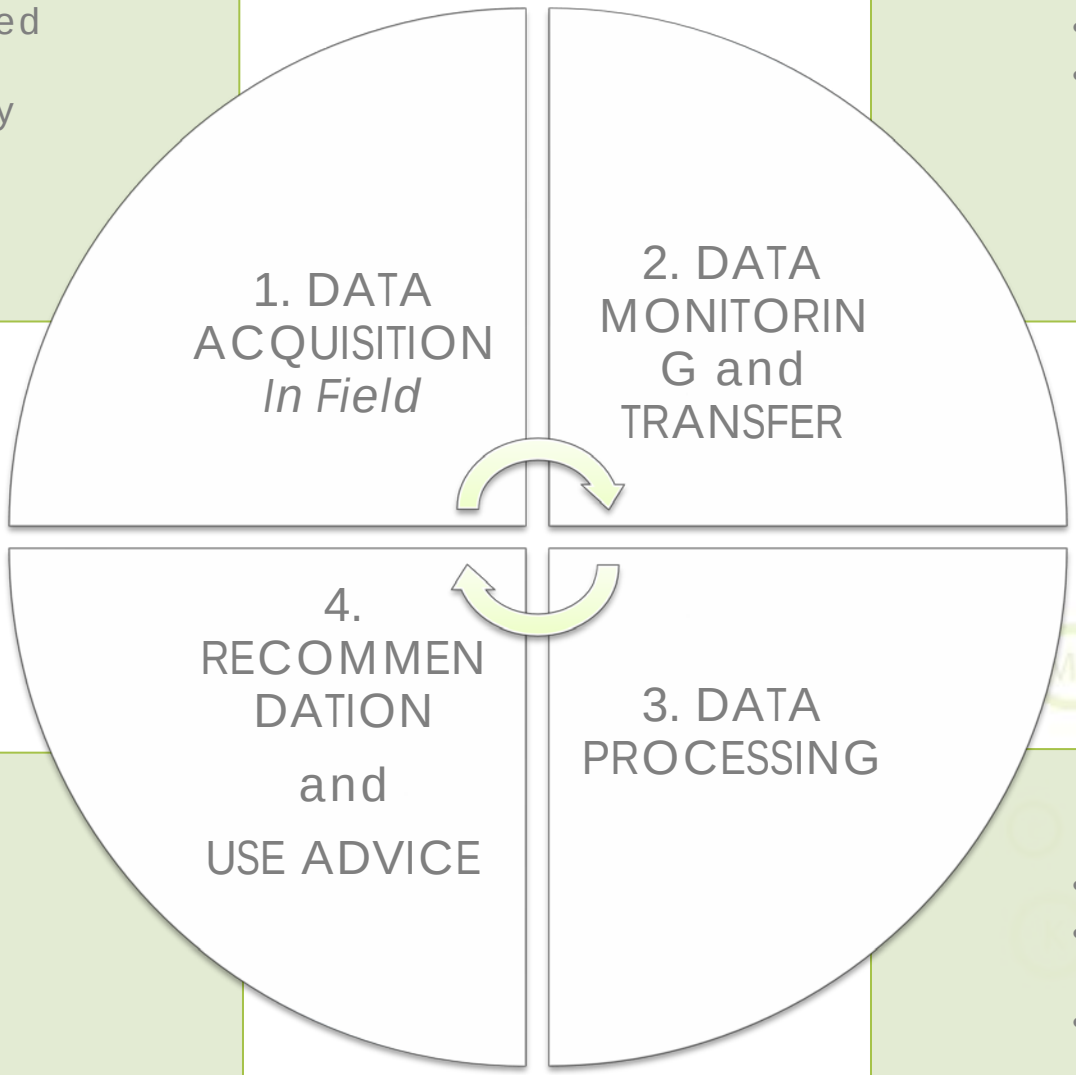
Decision tools for a better end-user economic performance

- Grid of sensors and probes for directed sampling
- Sensors specificity and sensitivity
- Autonomy
- How deep?

- Linking the sensors
- Data readings
- Data transfer : real time?



- Specialized implementation equipement
- Evaluation and revision

- Background data
- recordkeeping system
- analysis and decision making process

Technological barriers

1. *Sensors and probes*: not **specific** and not **sensitive** enough;

   integration of different sensors in the same probes; …

   - Nutrients : Nitrogen ≠ Phosphate
   - Pesticides and pesticide residues
   - Water (Agralis probes)
   - Soil life / plant health

2. *Sensors and probes*:

cost and industrial mass production

⇒ how many sensors / Ha

⇒ how precise is the data acquisition and monitoring

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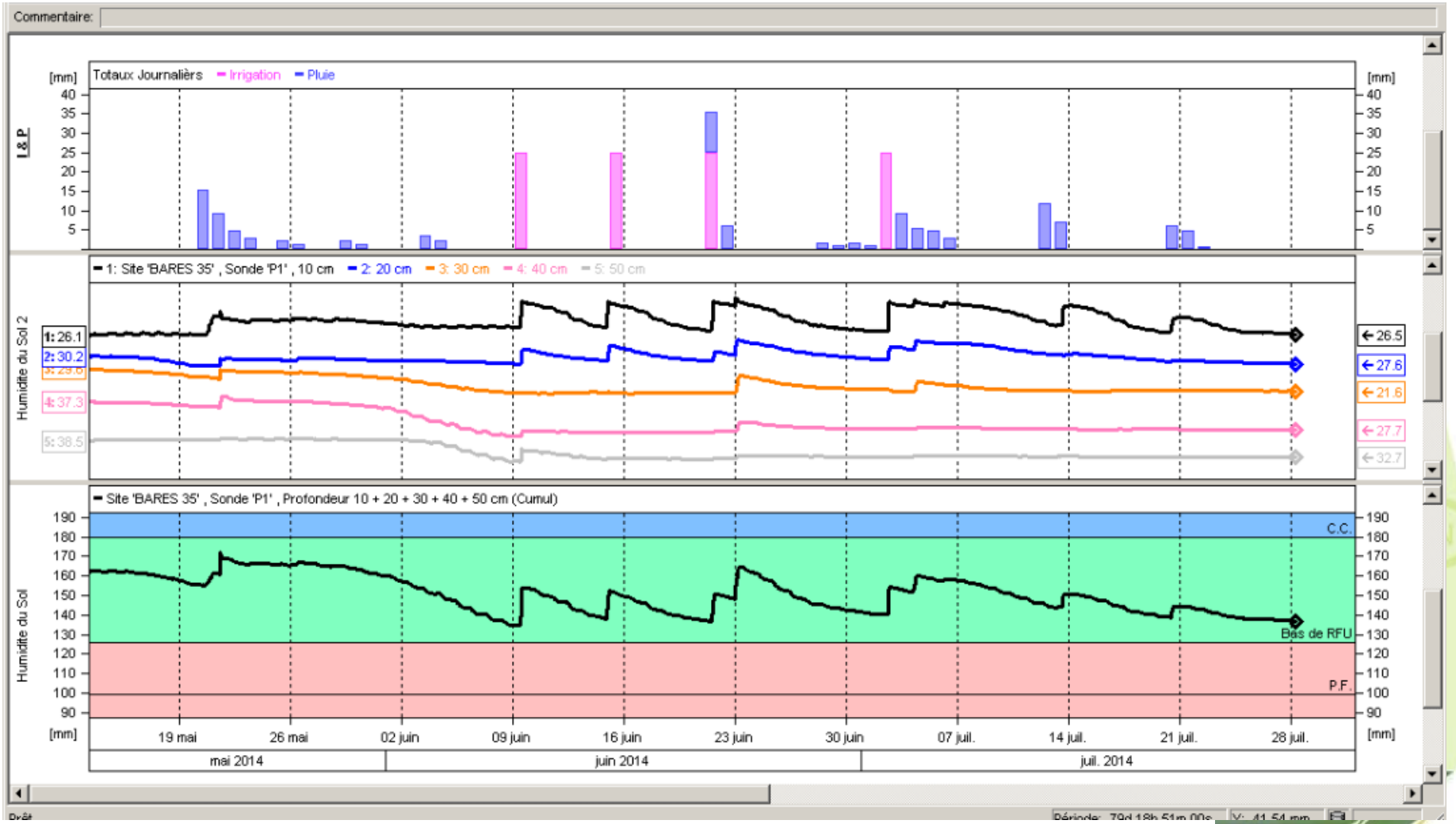
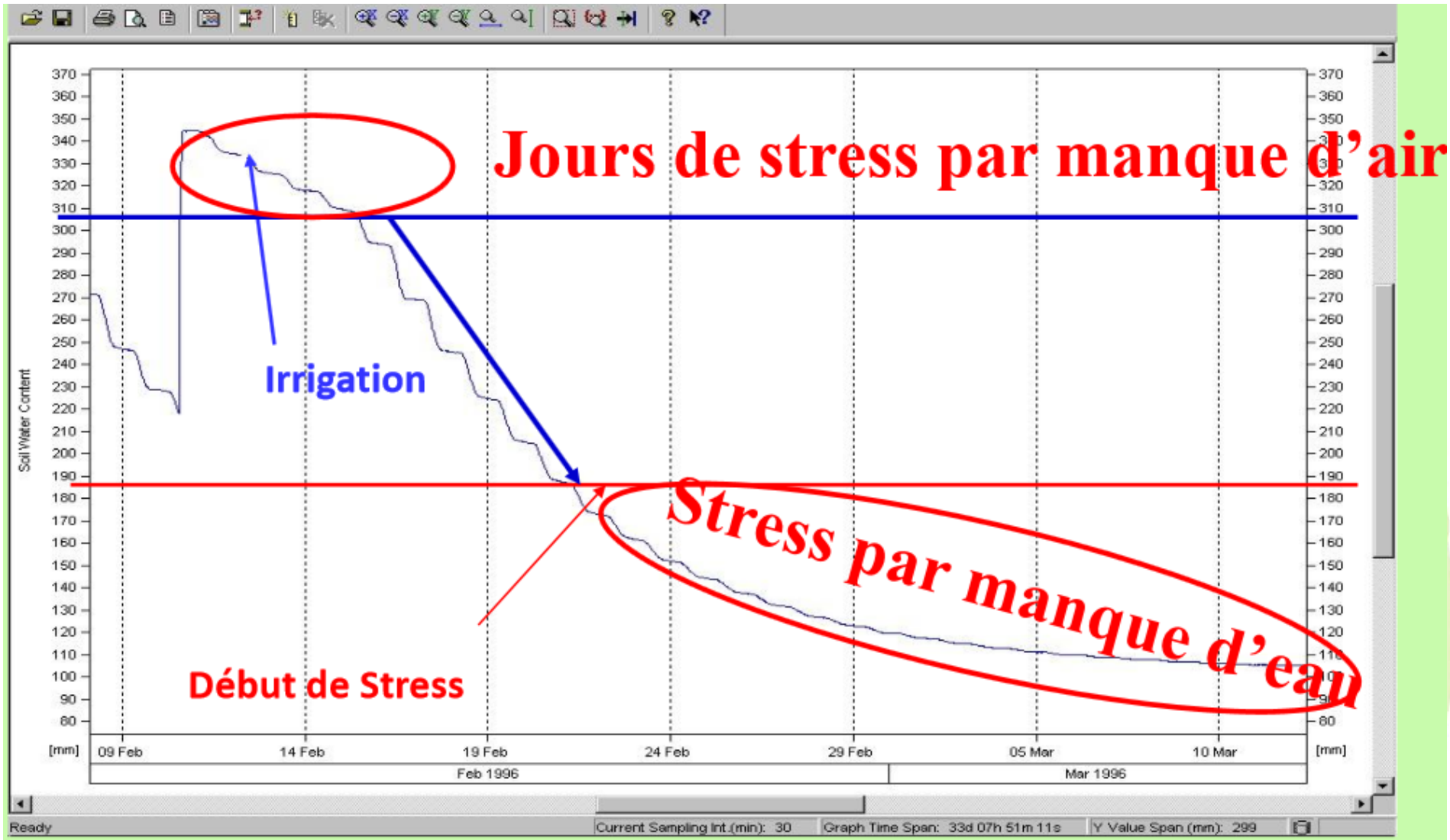
Water monitoring (Agralis)

Capacitive sensors : 1 to 5 / probe; 10 to 50 cm / capacitors



Water monitoring (Agralis)



Technological barriers

3. *Data processing and use recommendation*:
    - uge ammount of data can be collected / Ha => how to process / compare / learn / interact / model / predict
    - and of course **delive**r a simple specific **accurate** and usable **information** to the **farmer**

- Work in progress for the physico-chemical aspects, but very little for the **biological interactions and parameters**.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Thank you