Monitoring potatoes from space: from "iPot" to "WatchITgrow®"

Isabelle Piccard – VITO Remote Sensing

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➤ Potatoes remain a major staple food product in most of the EU countries

➤ Global demand for fresh potatoes and processed potato products is increasing
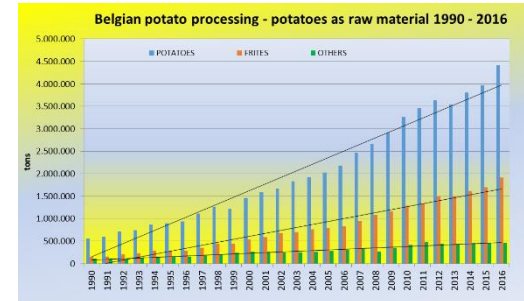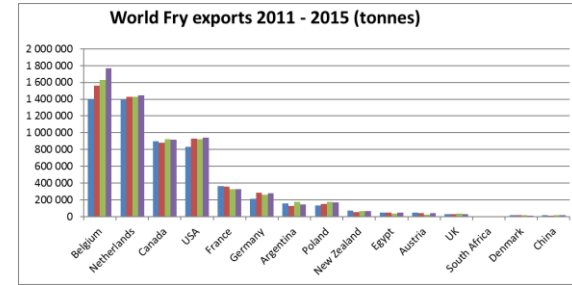
Need for more potatoes!

- Need for more arable land and efficient land use
- Potato yields have capacity to increase!

Need for new instruments! *"to measure is to know"*
"if you can measure it, you can improve it"

- Potatoes have evolved from a 'side crop' to a 'main crop': need for professionalization and R&D
- Potato market = volatile and speculative market
- Nature product = risks! Soil, weather, disease & pests,…

World Fry exports 2011 - 2015 (tonnes)

Belgian potato processing - potatoes as raw material 1990 - 2016

iPot project

- **2014-2017: iPot - "industrial Potato monitoring" -> R&D**
  - Set-up of a potato monitoring system for the Belgian potato sector
  - Application project financed by BELSPO's Stereo-III programme, +/- 300k€
  - Partners: Belgapom, CRA-W, VITO, ULg

- **2017-present: WatchITgrow® -> web based platform**
  - Launched on 14 March 2017
  - www.watchitgrow.be
  - Free of charge in 2017-18

Monitoring potatoes from space!
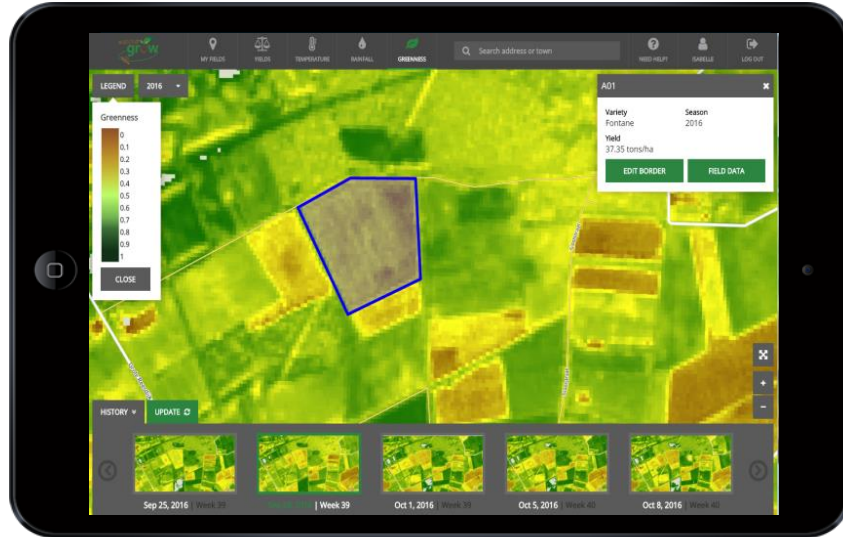
- Satellite info
  - Crop development
  - Field heterogeneity

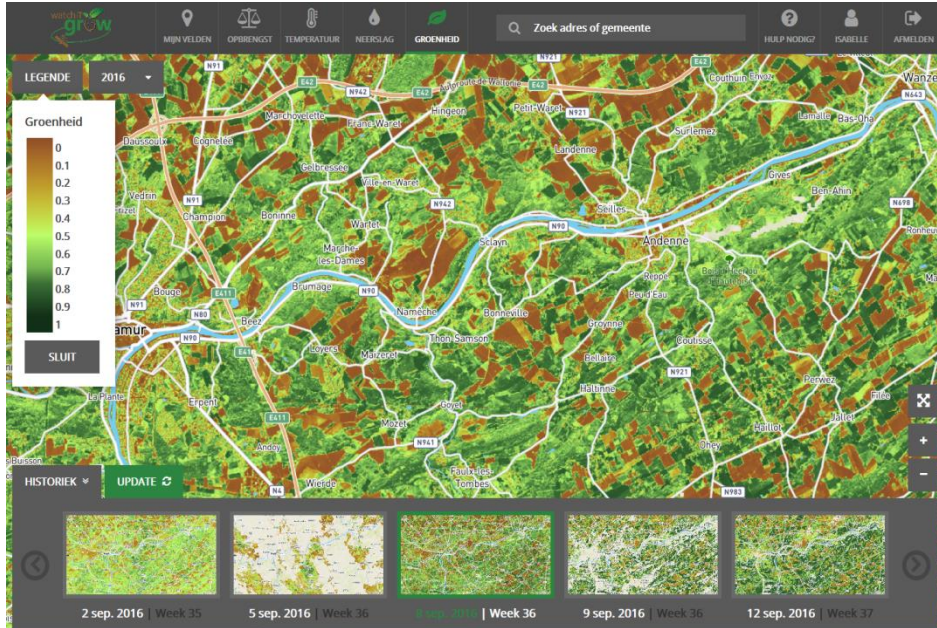- Weather info: risk at production & quality losses

- Yield forecasts

For all actors in the potato chain:
- Get access to satellite images, weather data, yield forecasts
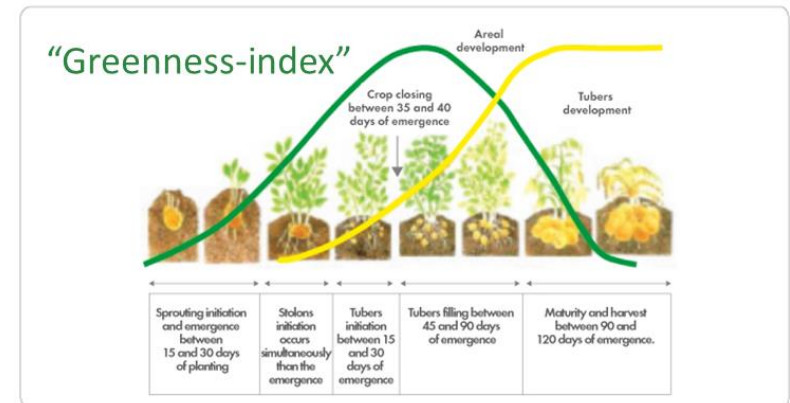- Store your own field data (e.g. treatments, yield samples,…)
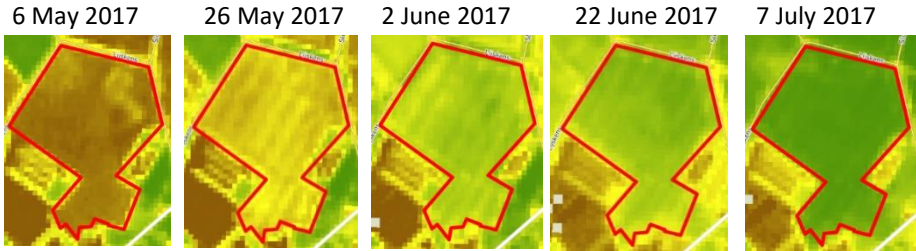
Satellite images

→ **monitor & compare fields**

- **Sentinel-2:**
  - 10m pixels
  - August 2015-present
  - Every 5 days

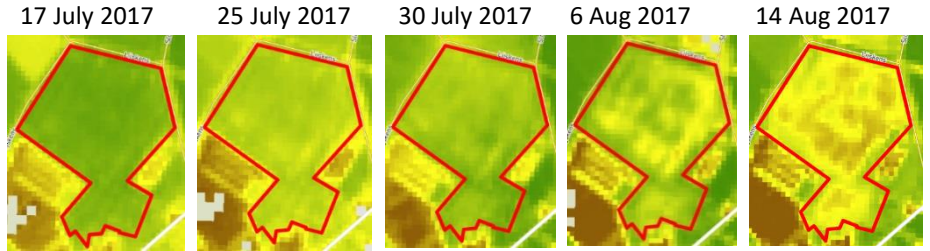- **DMC/Deimos:**
  - 22m pixels
  - 2009-2016
  - Every 2 days

Crop growth monitoring

Harvest: 20 Aug 2017

| 6 May 2017 | 26 May 2017 | 2 June 2017 | 22 June 2017 | 7 July 2017 | 17 July 2017 | 25 July 2017 | 30 July 2017 | 6 Aug 2017 | 14 Aug 2017 |

Greenness
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

- **Normal crop growth & development?**
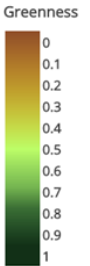
- **Heterogeneity?**

    → improved sampling (per zone)

    → evolution towards "smart farming": variable rate application of fertilizers, irrigation, haulm killing,…

   → useful for field selection (historical data)

- **Comparison of fields:**

    → optimize field visits

    → input for planning / logistics (harvest)

iPot
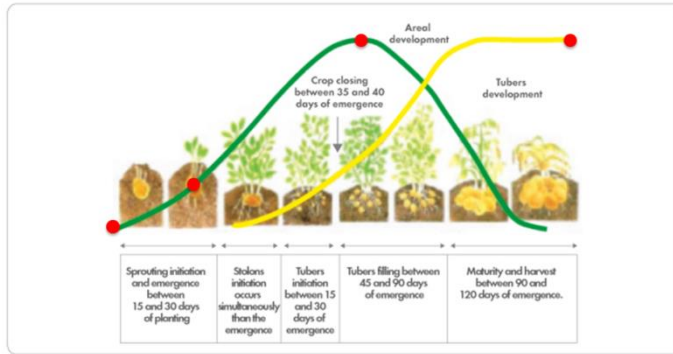industrial potato monitoring

Validation of satellite indices

- **fCover & fAPAR** from S2 and DMC computed with BV-NET
- Validation of fCover & fAPAR (2014-2016) with
  - UAV
  - Field measurements (DHP: hemispherical pictures, collected by CRA-w)
- Check
  - absolute values
  - temporal evolution (growth curve)
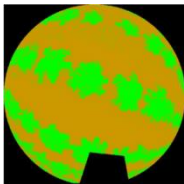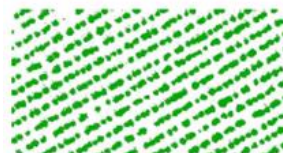
Phenology detection

9*: Senescence

8*: Ripening of fruit and seed

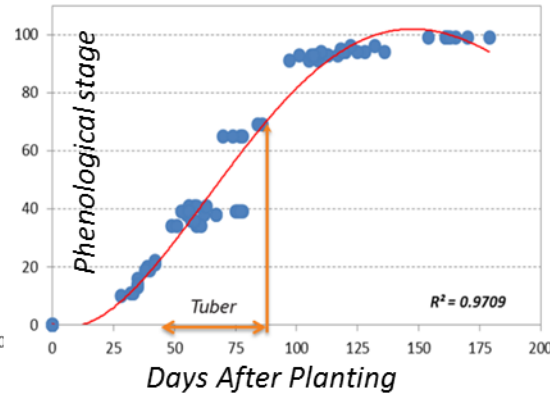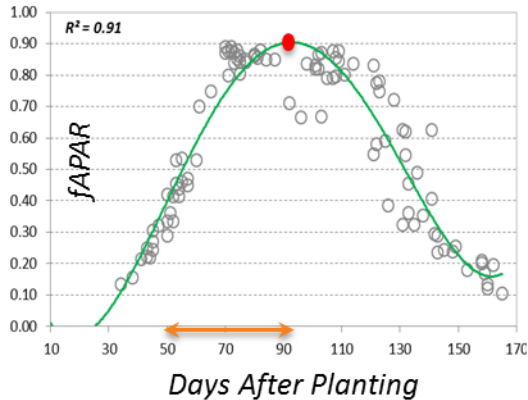7*: Development of fruit

6*: Flowering

5*: Inflorescence emergence

4*: Tuber formation

3*: Main stem elongation (crop cover)
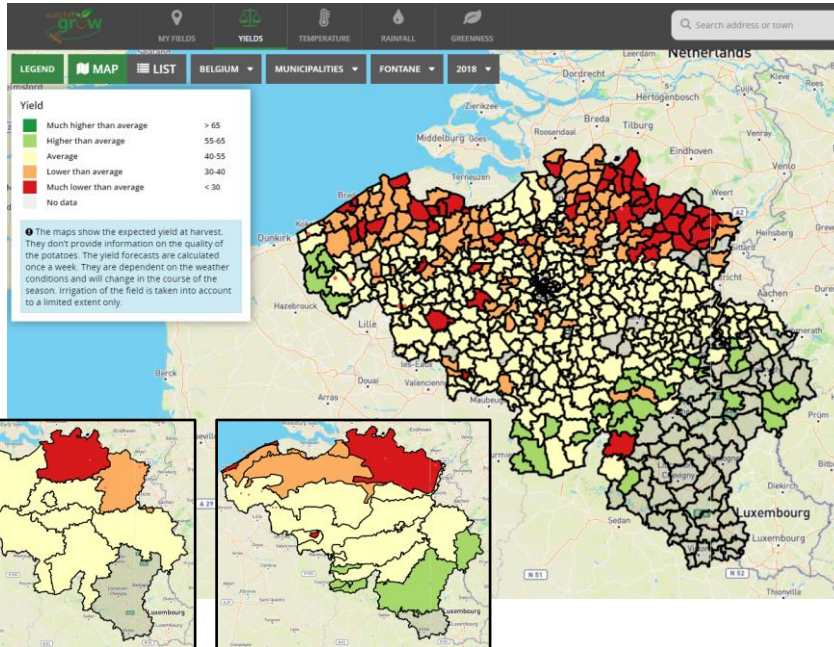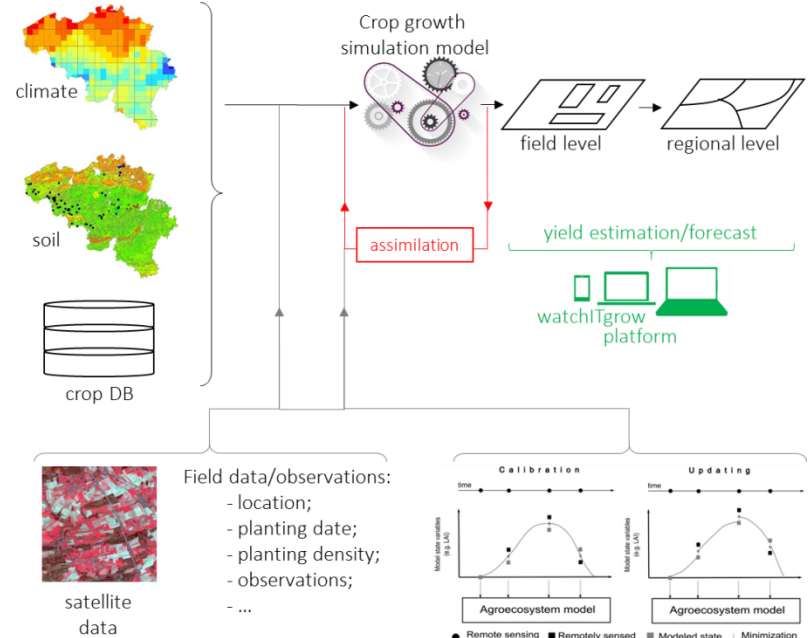
2*: Formation of main stem

1*: Leaf development

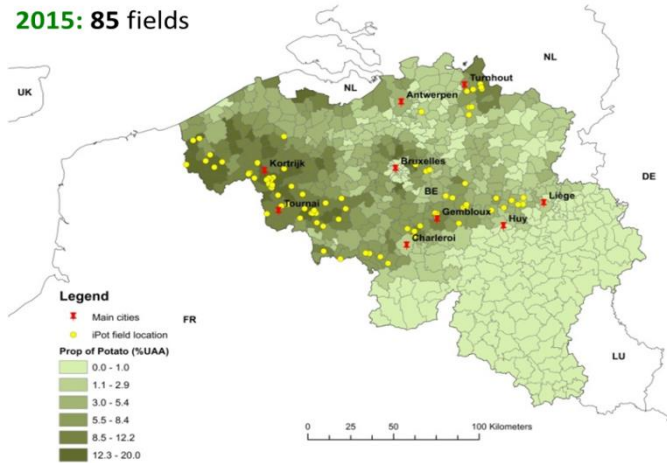0*: Sprouting/Germination

Yield forecast

- Based on combination of yield models
- For 3 varieties: Fontane, Bintje, Nicola
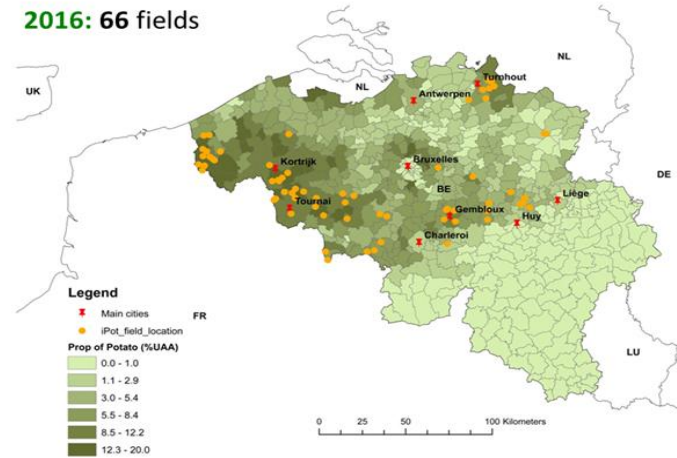- Per field, municipality, agricultural region

Training of yield models

- Field campaigns organised by CRA-W in collaboration with potato processing industry
- Agronomic variables measured related to phenology, physiology and yield
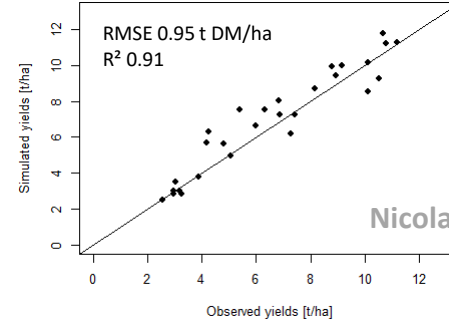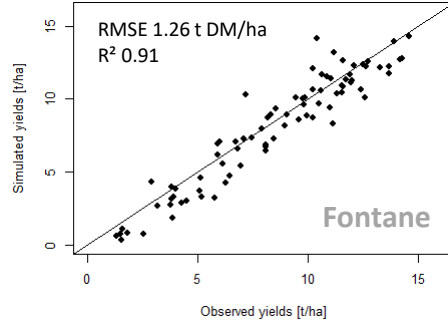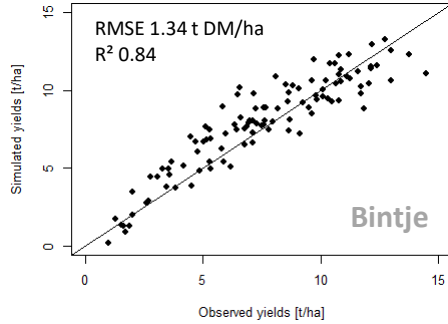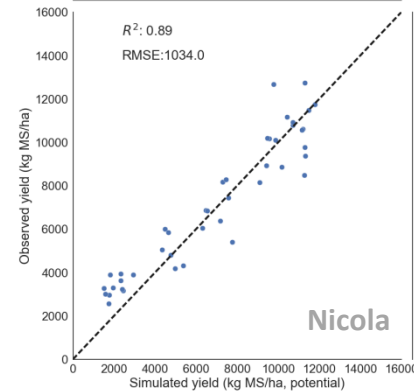

2015: 85 fields

2016: 66 fields

Yield model performance

- Aquacrop

RMSE 1.34 t DM/ha
R² 0.84
Bintje

RMSE 1.26 t DM/ha
R² 0.91
Fontane

RMSE 0.95 t DM/ha
R² 0.91
Nicola

- Wofost

R^2: 0.76
RMSE:1496.0
Bintje

R^2: 0.76
RMSE:1409.0
Fontane

R^2: 0.89
RMSE:1034.0
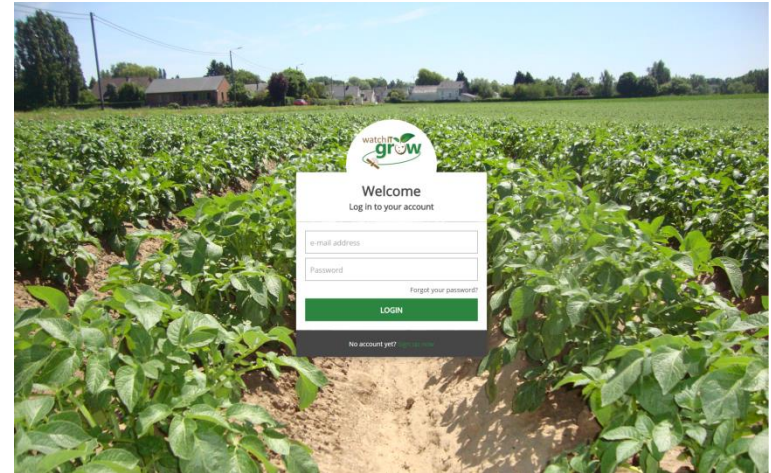Nicola
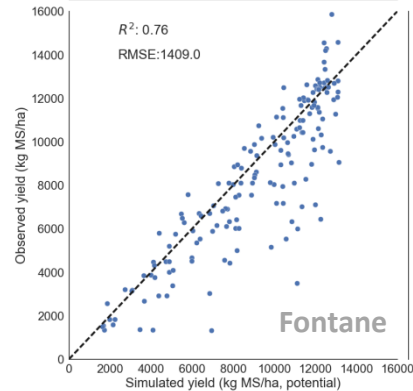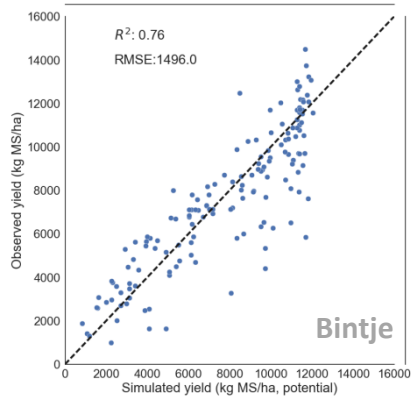
WatchITgrow®

- WatchITgrow® today:
  - +600 users
  - +25% of the BE potato production area monitored

- New developments 2018 (after iPot):
  - Shadow maps
  - Parcel history
  - Parcel ranking based on greenness curve
  - Extension to other crops

- Plans 2019 season:
  - Integration of Sentinel-1
  - Link with external applications (Vegaplan,…)
  - Collected data -> advise on variable rate fertilization, irrigation, haulm killing,…
    in close collaboration with the potato sector

Thanks!