Monitoring potatoes from space: from “iPot” to “WatchITgrow®”

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Background

- 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,...
• **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](http://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

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

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

→ monitor & compare fields
Crop growth monitoring

Emergence →
6 May 2017  26 May 2017  2 June 2017  22 June 2017  7 July 2017

Senescence →

Harvest: 20 Aug 2017

- 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)
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
Yield model performance

- **Aquacrop**

  - **Bintje**
    - RMSE 1.34 t DM/ha
    - $R^2$ 0.84
  - **Fontane**
    - RMSE 1.26 t DM/ha
    - $R^2$ 0.91
  - **Nicola**
    - RMSE 0.95 t DM/ha
    - $R^2$ 0.91

- **Wofost**

  - **Bintje**
    - $R^2$ 0.78
    - RMSE: 1496.0
  - **Fontane**
    - $R^2$ 0.76
    - RMSE: 1409.0
  - **Nicola**
    - $R^2$ 0.89
    - RMSE: 1034.0
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!

James Bint says, “EAT BELGIAN FRIES”