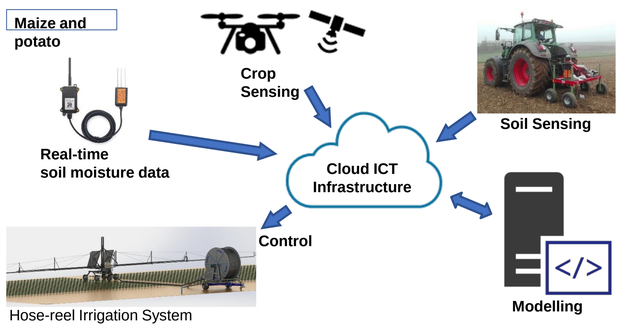
A Data Driven Platform for Site-Specific Fertigation

ADD Ferti
Harvest More for Less Water & Nutrients

Summary

Aim of the project is to design and develop a fully-automated ICT-based data-driven platform for **variable rate fertigation** (**VRFI**). The solution will attempt to account for all nutrients and water related limiting factors on crop yield by implementing advanced data fusion tools to derive VRFI recommendations.



Research question

Can N and water be combined during a VRFI to maximize yield and reduce cost, environmental impact and water use in maize and potato?

Main objectives

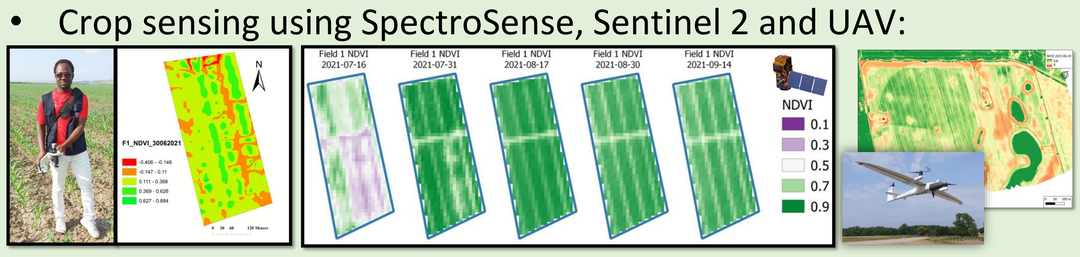
- Develop a Hose-Reel-Irrigation System for VRFI, with 4-section spray boom control.
- Acquire spatial data on soil and crop with IoT-based sensor technologies.
- Develop ICT based algorithms for data fusion and decision making for fully automated VRFI.
- Evaluate economic and environmental effects.

Results

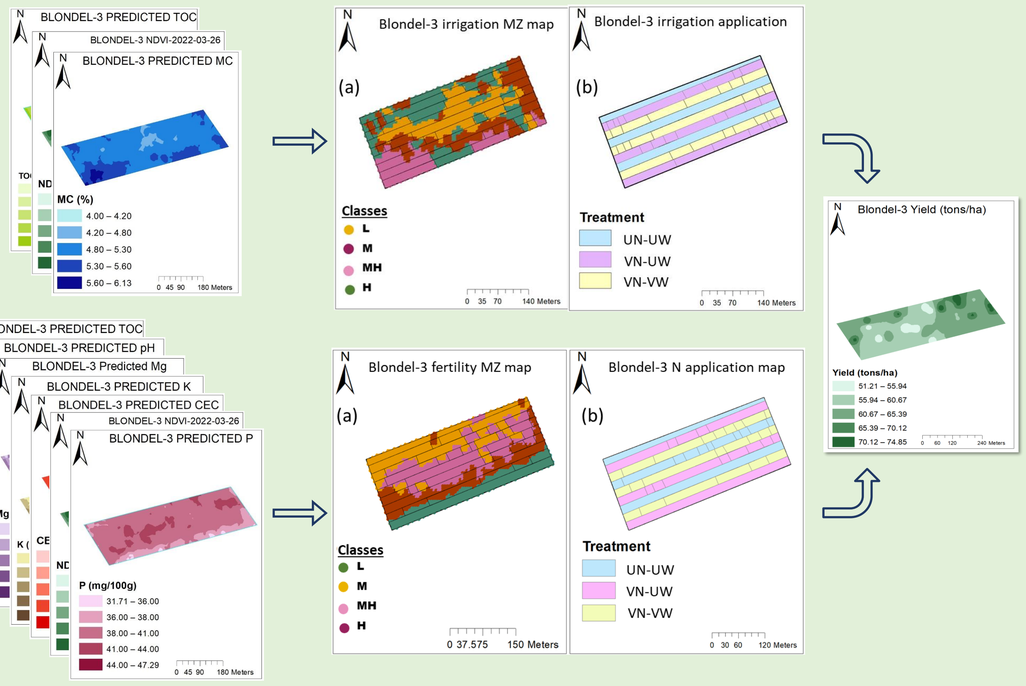
Development of fertigation recommendation maps

- Soil sensing with the UGent on-line VIS-NIR multi sensor platform:

- Crop sensing using SpectroSense, Sentinel 2 and UAV:

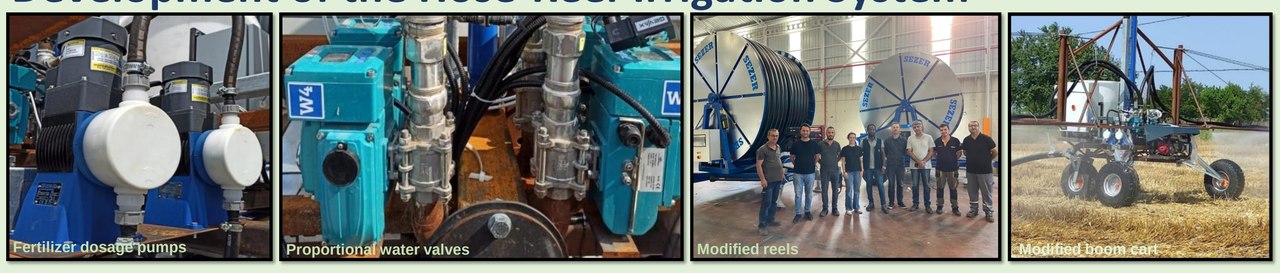


- Irrigation & fertilization recommendation maps in potato:



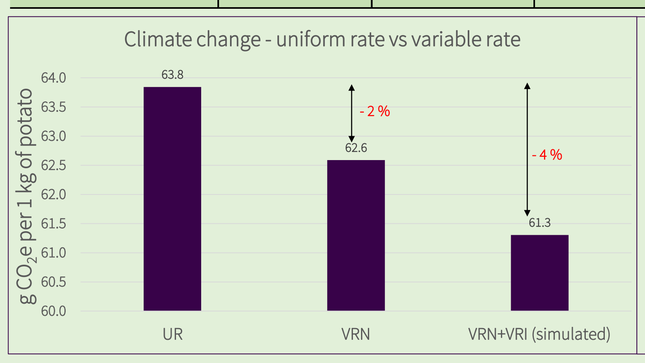
Development of a wireless soil moisture sensor network

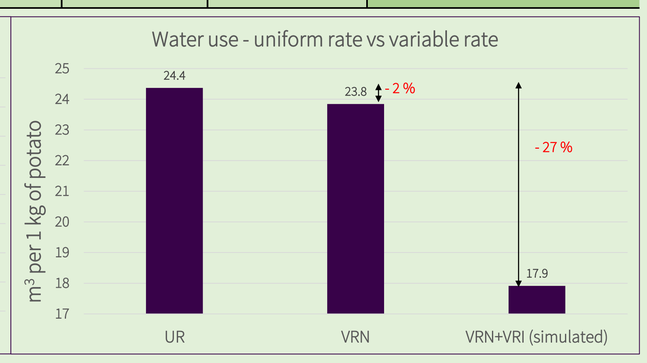
Development of the Hose-Reel-Irrigation System



Cost benefit analysis and life cycle analyses in potato

	Fertilizer rate (Kg/ha)	Fertilizer cost (€/ha)	Irrigation cost (€/ha)	Average yield (ton/ha)	gross margin (€/ha)	Relative gross margin (€/ha)
Uniform rate	39	52.72	135.82	58.67	11545.46	-
VRN+URI	40.28	54.45	135.82	**60.82**	11972.76	**427**
VRN+VRI	40.28	54.45	**90.55**	**60.82**	12018.04	**473**





Conclusions and impacts

Economic impacts:

- Increased profitability by increased potato yield while using almost same N fertilizer and less water:
  VRN: ≈ **430 €/ha** gross margin (≈ **3%**), compared to URN.
  VRN+VRI (Simulated): ≈ **470 €/ha** profit (≈ **4%**), compared to URN.

Visit of Hilde Crevits, the Flemish minister of Agriculture at the test site in Belgium.

Societal impacts:

- Conserving the available water resources by introducing a more sustainable irrigation technique.

Environmental impacts:

- Simulated VRN+VRI showed a reduction of CO_2eq (**-4 %**) and water use (**-27 %**) in comparison to the applied uniform rate.
- VRN showed a reduction of CO_2eq (**-2 %**) and water use (**-2 %**) in comparison to the applied uniform rate.

Scientific impacts:

- The integrated hardware and software infrastructure can be used for future research projects in PA & water management.

Future research activities

- Validate the fully-automated ICT platform for VRFI in commercial fields in Belgium, Germany in the 2024 season.
- Expand the use of IoT for better monitoring of the irrigation system.

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