VegCast: Modelling Broccoli Data for Forecasting

Adrian Salazar Gomez & Elizabeth Sklar

Lincoln Institute for Agri-food Technology (LIAT) – University of Lincoln

8 December 2020

Overview: the VegCast project

- VegCast is funded by Ceres and is a collaboration between University of Lincoln (led by Simon Pearson) and University of Reading (led by Paul Hadley)
- **Problem:** An accurate model is needed to provide yield forecasting for broccoli, in order to match supply with demand.
- **Solution:** VegCast will provide a user-friendly digital forecasting system that predicts timing and yield estimates, and associated uncertainties.
- **Status:** Project just completed first quarter

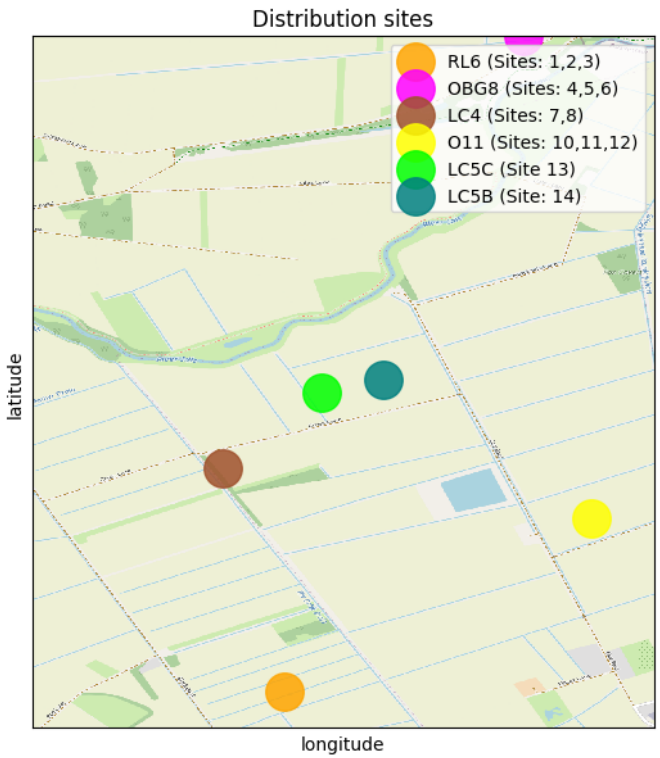


Data & Project focus

- Data sets to be considered in VegCast:
  - Manually collected measurements of broccoli head size, from 2020 (UK) and 2021 (Spain and UK)
  - Scanned broccoli plants using 3d scanner equipped in a rover.
  - MET weather data
  - Weather station data (from Soil Moisture Sense: `http://soilmoisturesense.com/`)
- Focus of this talk:
  - Manual data from 2020
  - EarthRover data from 2020

Experiment set up: Manual data from 2020

- Manually collected data gathered from 14 different sites at 6 different locations (fields).
- Each site contains a single broccoli variety. 5 different varieties of broccoli (Ironman, Parthenon, Steel, Titanium, Triton).
- Data collected over 10 weeks.



- Circular areas are the location (field) from where the manual data was collected.
- Each location has different varieties (sites)

What are we measuring and what are we trying to predict?

- **Broccoli head size.**
- Which variables have an impact in the Broccoli head size?.

Growing patterns based on the variety

- Similar growing patterns among sites with the same variety.
- Some varieties have similar growing patterns
- Growing patterns depend on the varieties.

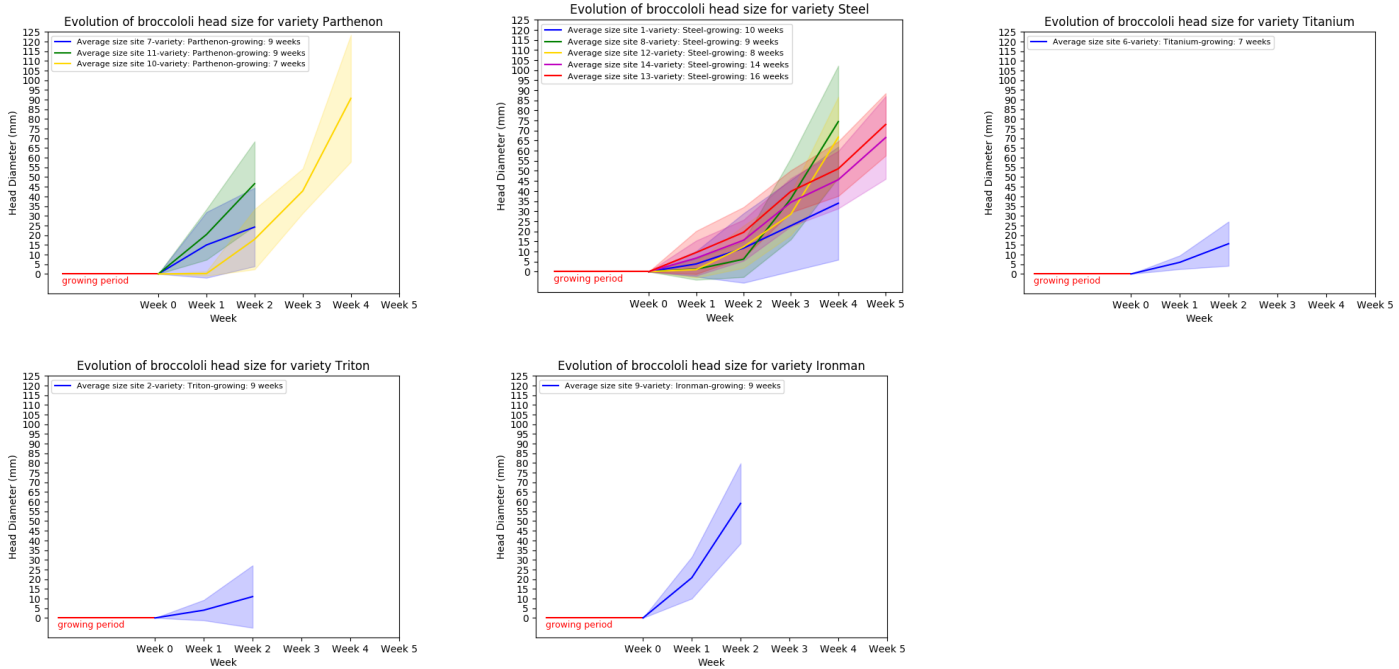


Figure: **Varieties**: Parthenon, Steel, Titanium, Triton, Ironman

Growing patterns based on location

- Each location(site) present similar irrigation and plant treatments.
- Different broccoli varieties within same site follow similar growing patterns.

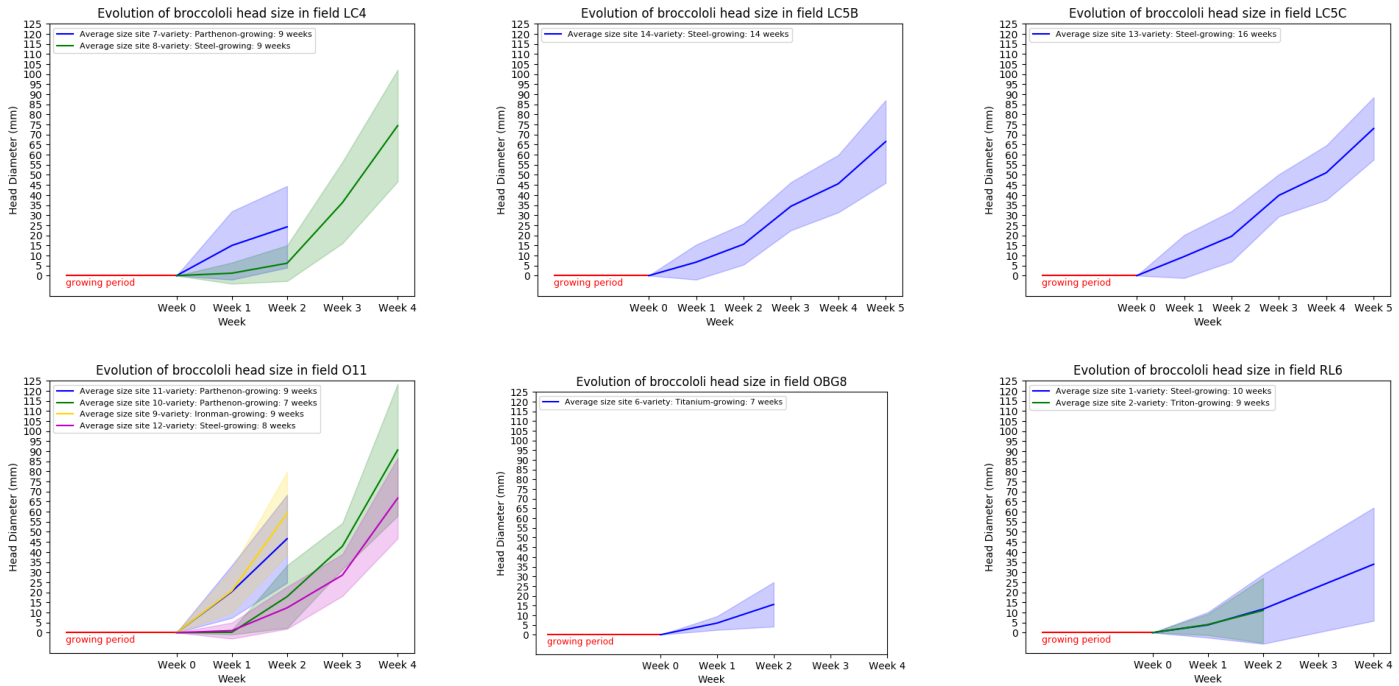
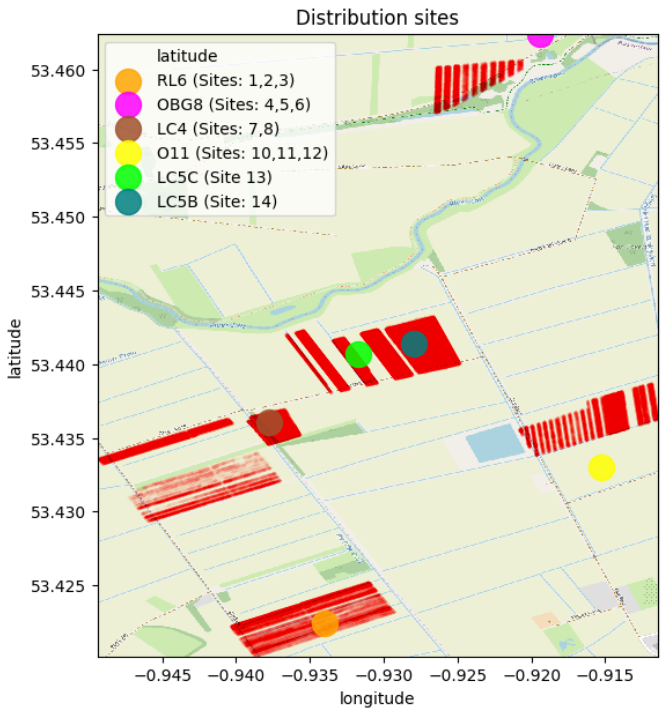


Figure: **Fields**: LC4, LC5B, LC5C, O11, OBG8, and RL6

Experiment set up: Rover data from 2020

- Over 2 million of 3D scanned broccoli plants.
- Extract information from 3D scans and verify it with the 2020 manual data.
- Large number of samples will help to identify complex growing patterns in broccoli plants.



- Red areas indicate the location of the scanned broccoli plants.
- Not all the scanned plants come from the manual data sites.

Conclusion, further steps & challenges

So far

- Evaluate sources of variability in growing patterns of broccoli plants (to included in predictive models).
- Acquire large broccoli datasets.

Further steps

- Matching and verifying rover data from 2020 with the Manual data from 2020.
- Include new information (weather, plant treatment...).

Challenges

- Time-series models that output uncertainty estimates.
- Include uncertain dependent variables in prediction models, e.g. future weather data.
- Deal with missing data, e.g. plant treatment information is not available.