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Exploring the use of high resolution drone data in monitoring a strip cropping system

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Background

- Sensors on drones can provide high-resolution data on spatial and temporal variation in crop performance, without the time consuming and laborious and practices associated with field data sampling.
- **Remote agronomy** can be defined as the use of remote sensing data to identify agronomically-interesting phenomena in the field.
- In the context of complex cropping systems such as stripcropping, the interest lies in recognizing desired inter-crop interactions and specific crop properties that facilitate these interactions.
- Thus, for complex cropping systems, it is valuable to **monitor fields at the system level**, rather than plant level. The use of remote agronomy to assist in this task has yet been little explored.

A vegetation map of the plots (left) was created by applying a Vegetation Index (VI). A VI highlights certain vegetation properties (e.g. greenness).

Four vegetation properties were extracted **per plot** :
1. Vegetation height (m)
2. Vegetation cover (m^2)
3. Triangular Greenness Index (sensitive to chlorophyll)
4. Yellowness Index (sensitive to chlorosis)

Objective

To explore the capacity of remote agronomy in assisting the management of complex cropping systems.

Case study: Vitalis stripcropping field in Voorst, the Netherlands.

Main research question:

How can high-resolution Red-Green-Blue (RGB) imagery assist in monitoring variability in vegetation properties and interactions in a strip cropping system at the inter-plot level?

Methods

- 33 strips, with plots of 1.5m x 15.5m (experimental unit)
- Different cultivars of six crop species (pumpkin, cauliflower, fennel, lettuce, leek) were intercropped with each other and with grass-clover mixture

- Images of one flight (11th August 2021) stitched together to produce an **orthomosaic** (2D image) and **Digital Surface Model** (DSM)
- High resolution of 0.18cm/pixel

Results
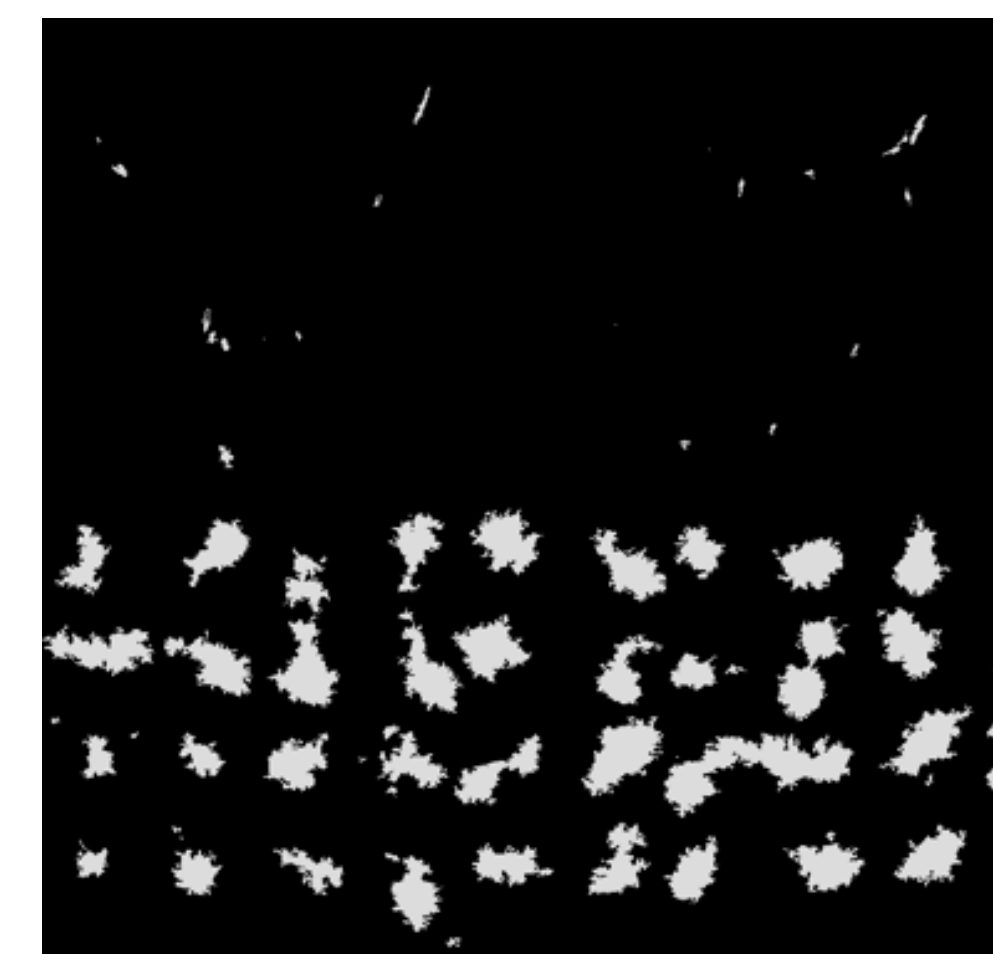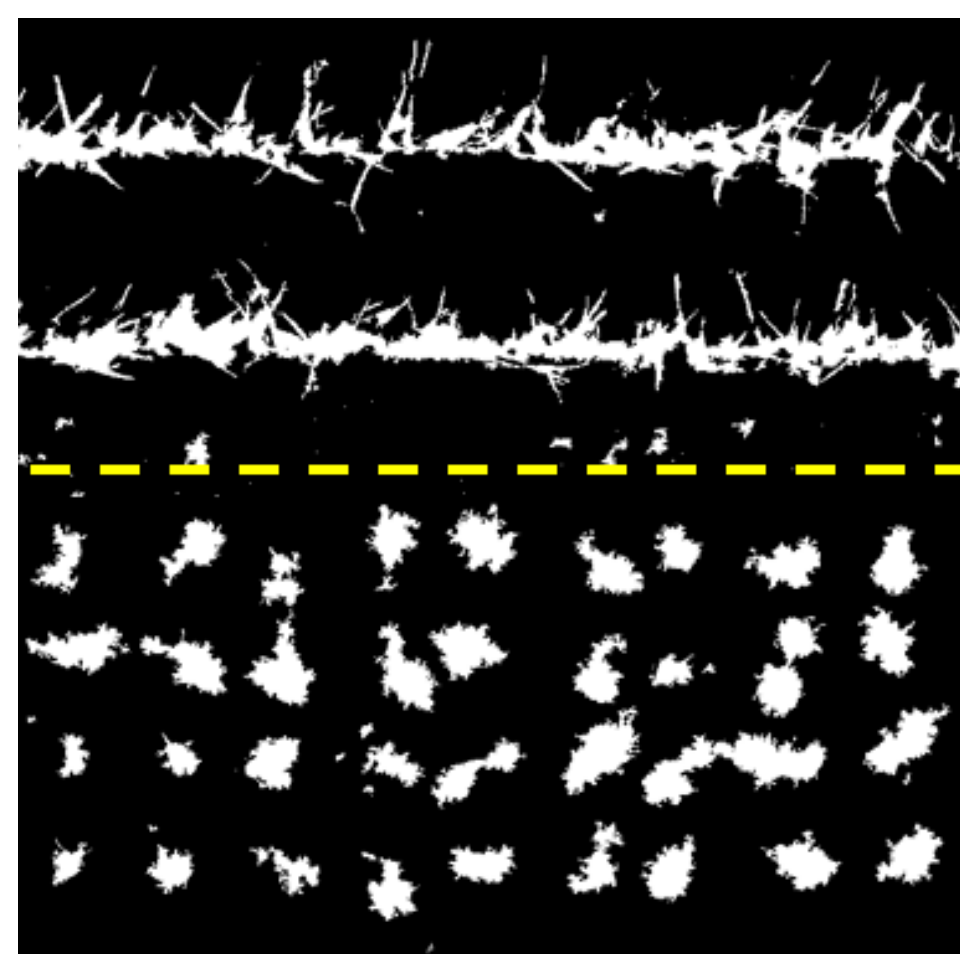
Complex cropping system = more complex analysis (top left figure)
- Analysis has to be done **per strip** to capture the spectral signatures of all crops.
- If not applied, certain crops (e.g. leek) are identified as soil pixels.

Limitations of remote agronomy (top right figure)
- Differences in illumination can sometimes result in less accurate identification of vegetation pixels.

Extraction of vegetation properties (example below)
- Triangular Greenness Index (indication of crop health) differed significantly per intercropping treatment for fennel.

Triangular Greenness Index (TGI) of fennel per treatment
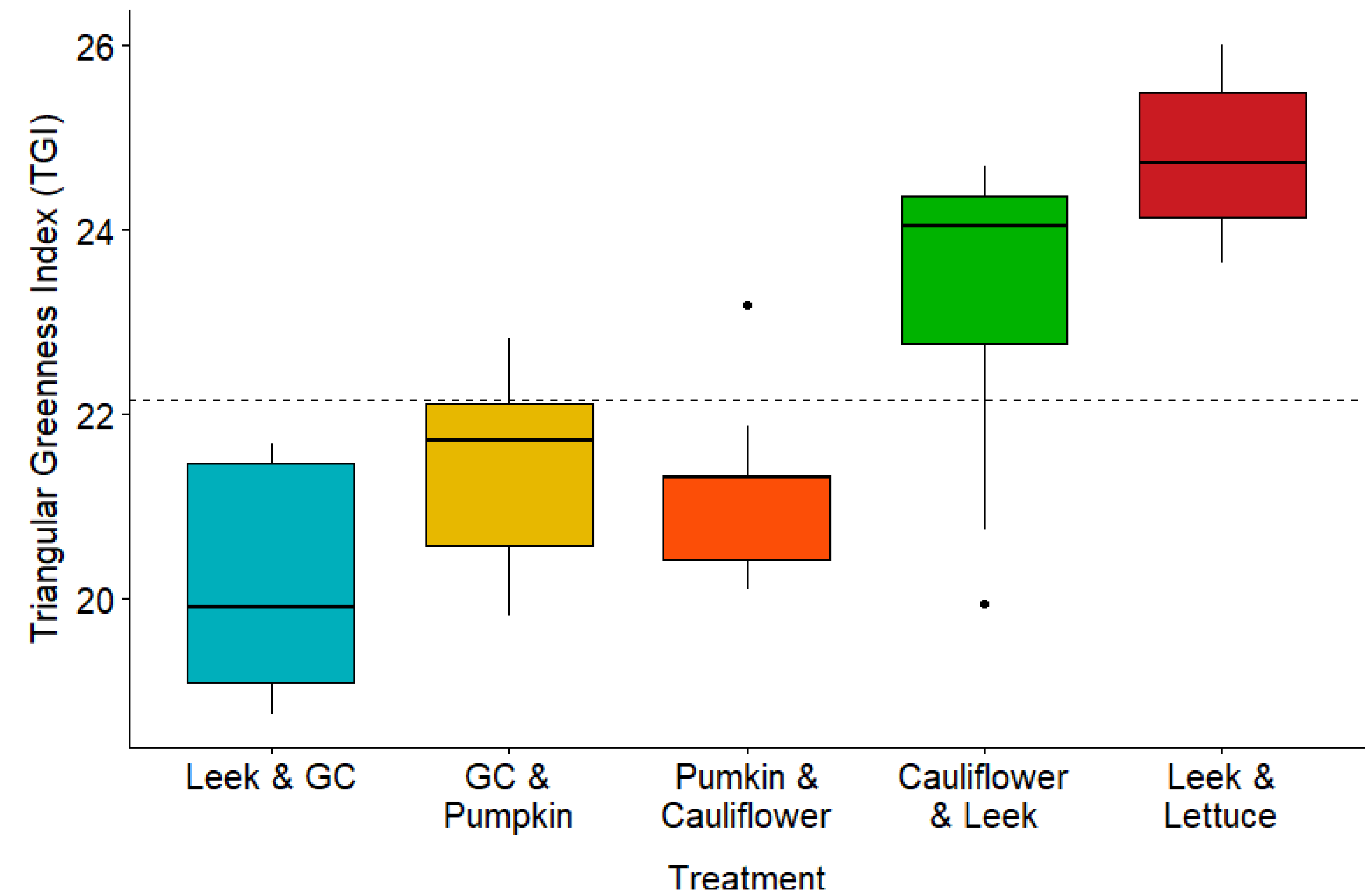
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