

Variable rate application: using 3D imagery to understand deposition of plant protection products in wheat canopies

Variable rate application

- The most common method for plant protection product (PPP) application is a uniform dose, regardless of canopy or temporal variation.
- Matching applications to suit canopy requirements has the potential to reduce PPP use.

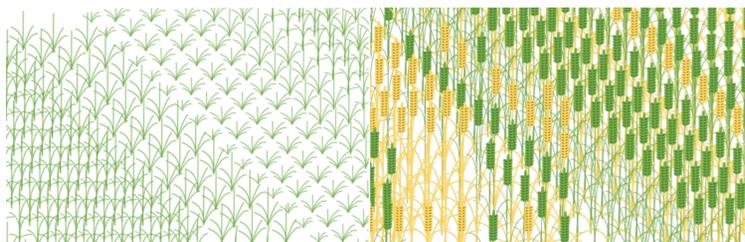
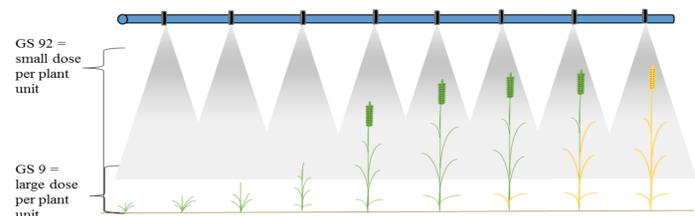


Fig 1. Example of canopy variation, early growth stage (left) later growth stage (right)

Fig 2. Rationale behind dose adjustment to suit canopy variation in wheat



- The highest cost per ha is for PPPs, more targeted use could save farmers money.
- PPPs not used by crops leach into the local environment and cause damage to ecosystems.
- Reduced PPP dose will reduce resistance to products and keep them in use for longer.

Current method of sampling

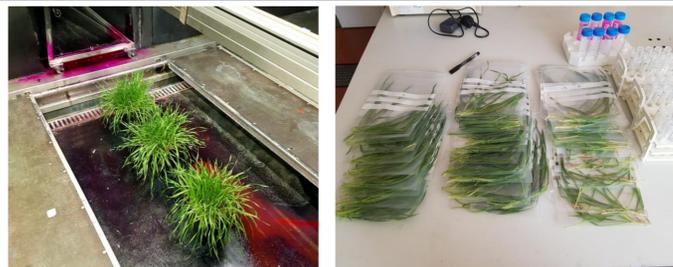
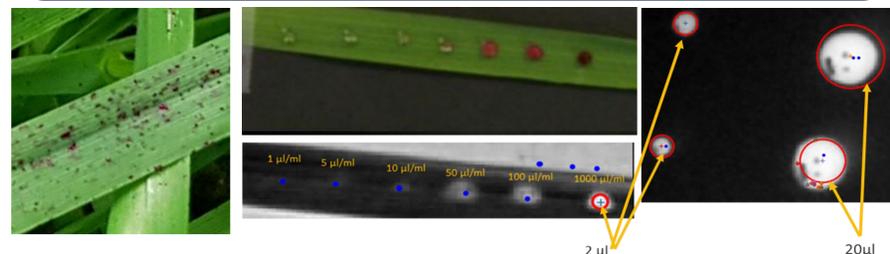


Fig 3 (left): Sprayer tunnel at Silsoe Spray Applications with boom sprayer simulator. Fig 4 (right): individual plants cut, ready to be washed.

- Pink dye is used to represent plant protection product sprays as it is clear in photographs.
- Whole plants are sprayed, destructively sampled and washed.
- The concentration of the dye in the wash-off indicated the quantity of dye deposited on the plant.

Non-destructive sampling



- Photographs of the sprayed wheat plants are run through a blob detection programme – trained by destructive sampling and individual blob detection.
- This will give an estimate of dye deposition.

3D growth stage detection

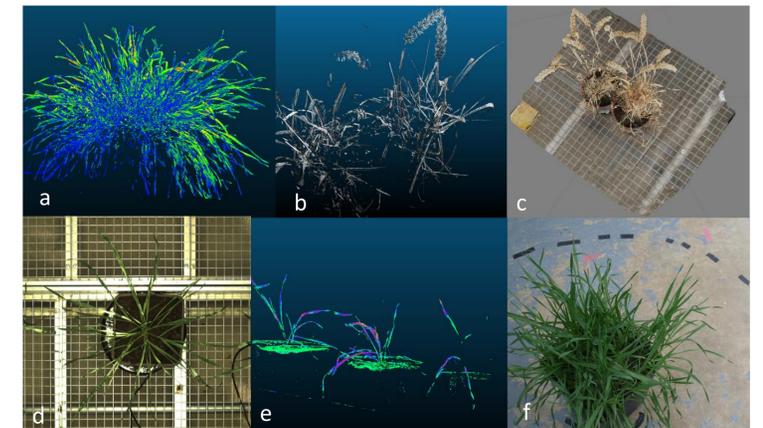


Fig 5: a, b, e – LiDAR images taken from Cranfield Gantry Glasshouse. c, RGB photogrammetry reconstruction. d – RGB photographs from Cranfield Gantry. f – RGB Photograph taken for RGB photogrammetry construction.

- Using both the LiDAR and RGB camera on the gantry at Cranfield University allows for easy control of trials and subjects of imagery.
- Detecting growth stage from an imaging platform (drones, satellite, or plane) would allow rapid monitoring of multiple sites across fields.
- Areas of variation detected by imagery would aid a variable application of PPP dose and allow for a more timely application.
- Imagery based growth stage detection would remove destructive field sampling, saving time and reducing yield loss.