Cereal morphology through proximal stereo vision

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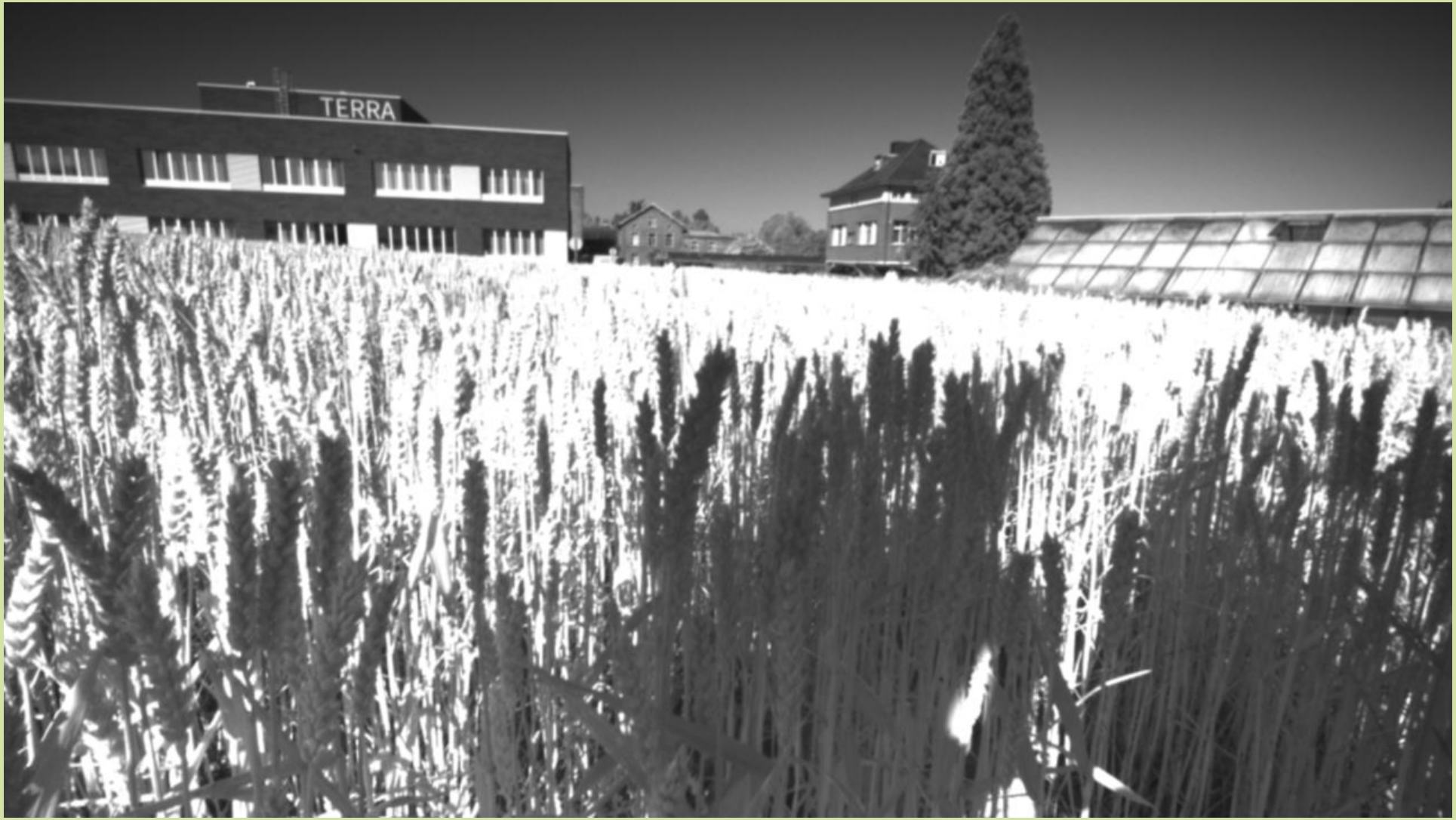
LIÈGE université TERRA

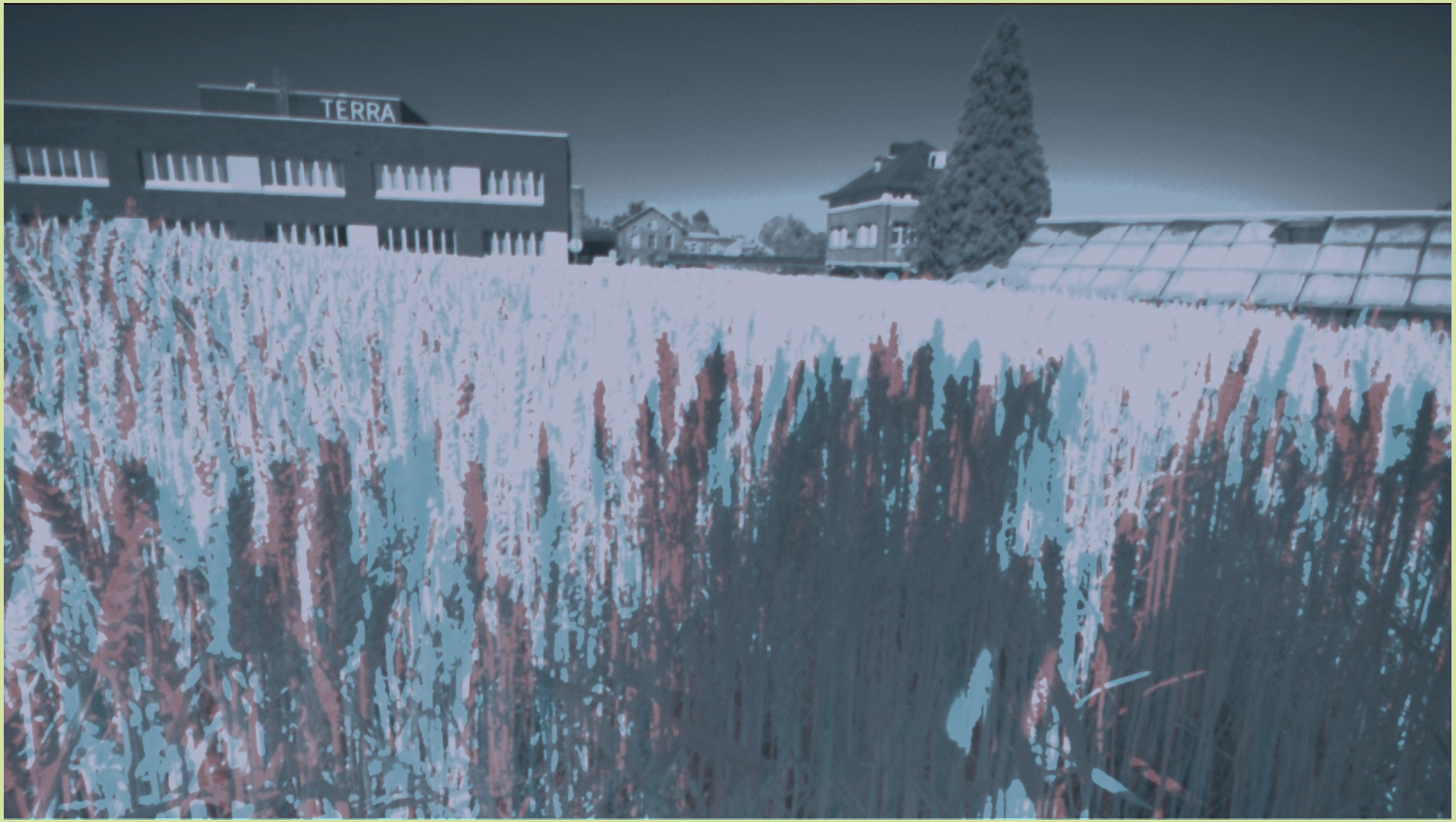
What was our goal ?

Develop a **phenotyping tool** to measure **cereal canopy architecture** in a **non-destructive** way

What is stereo vision ?



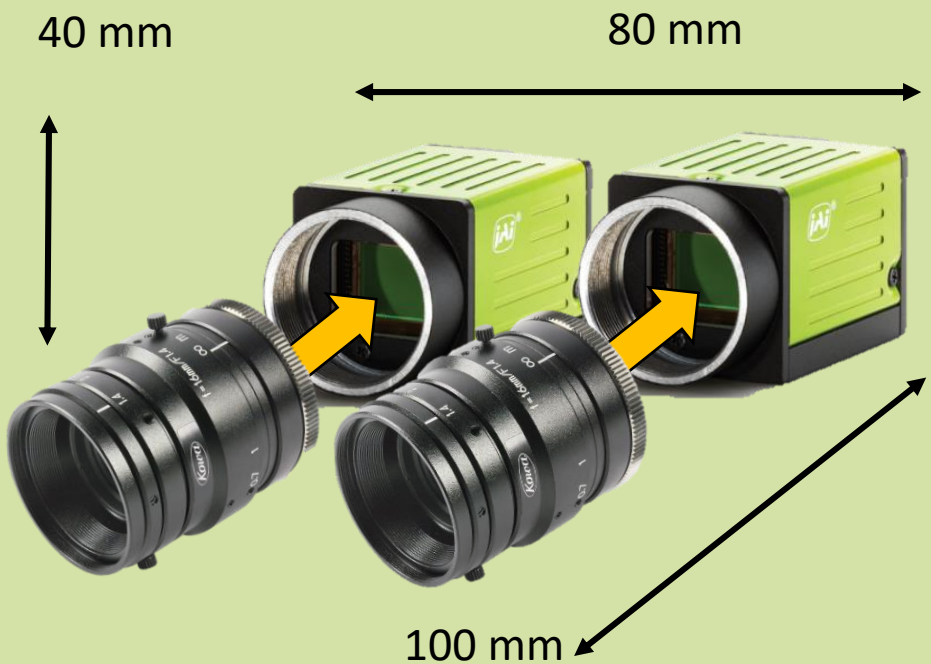
What is stereo vision ?



For who ?

Why choosing stereo vision ?

COMPACT



LOW COST

150 – 2000 €

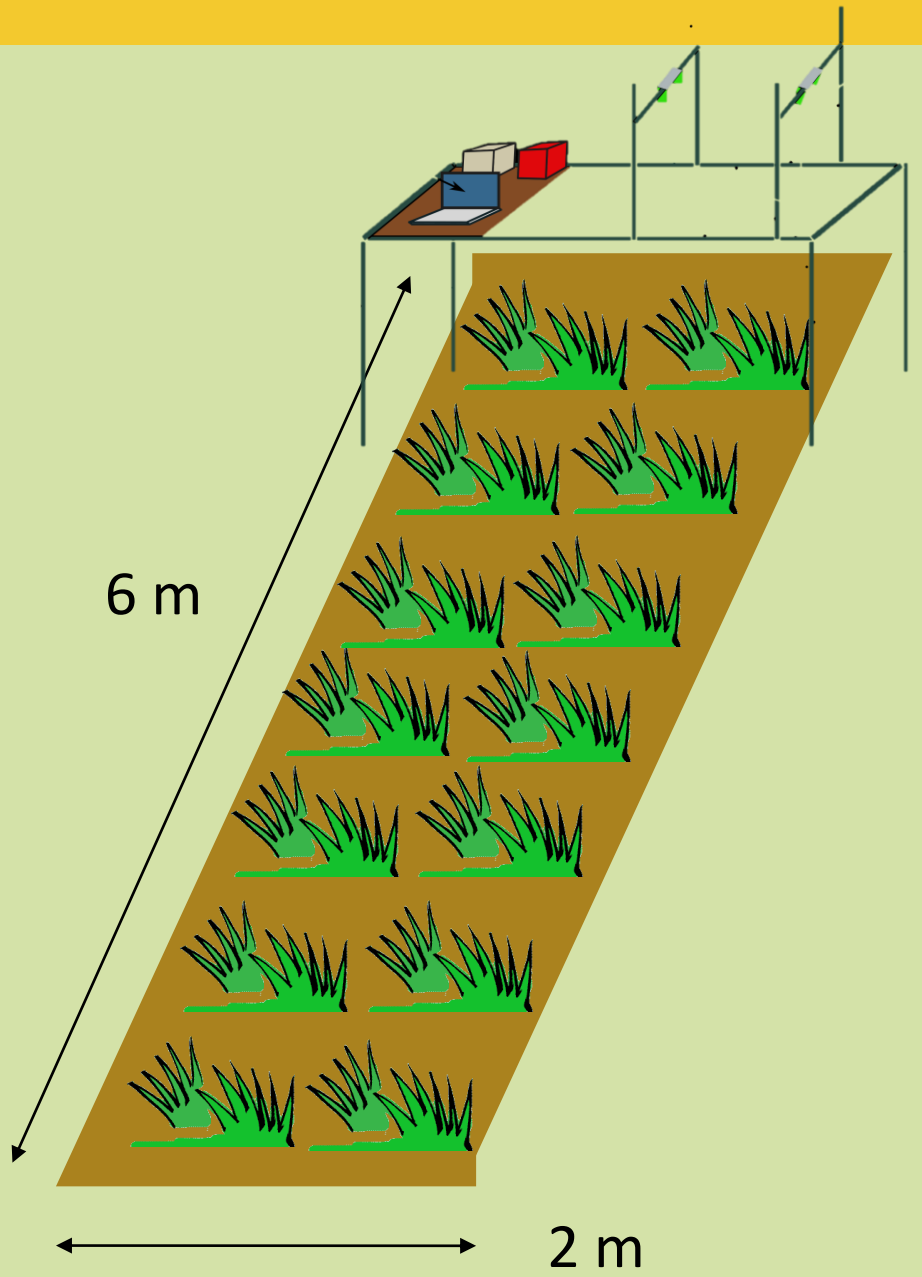
IMAGE

What about the experiment ?

2 RGB cameras

Baseline 50 mm

What about the experiment ?



Shoot image 1 !

Shoot image 2 !

Shoot image 3 !

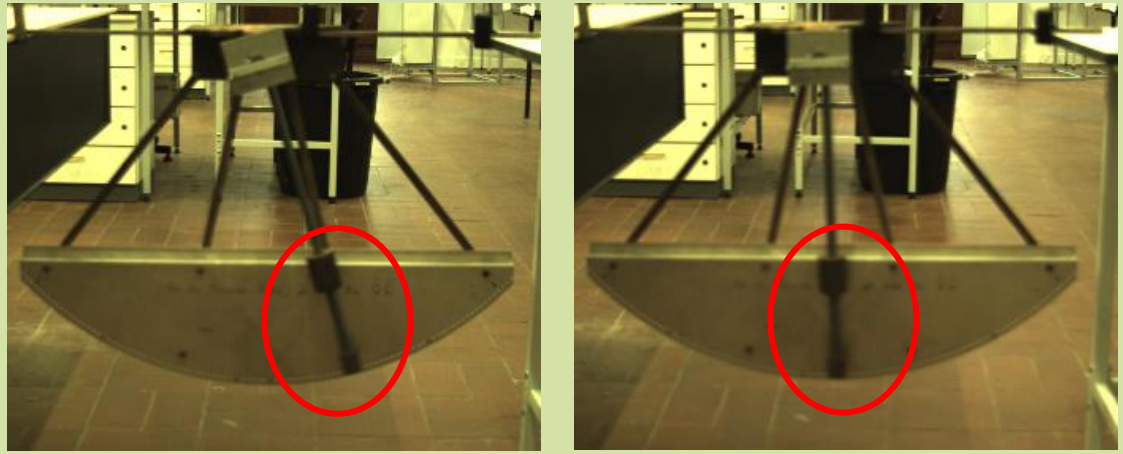
Shoot image 4 !

- **Winter wheat** *Edgar*
- **Spring barley** *Planet*

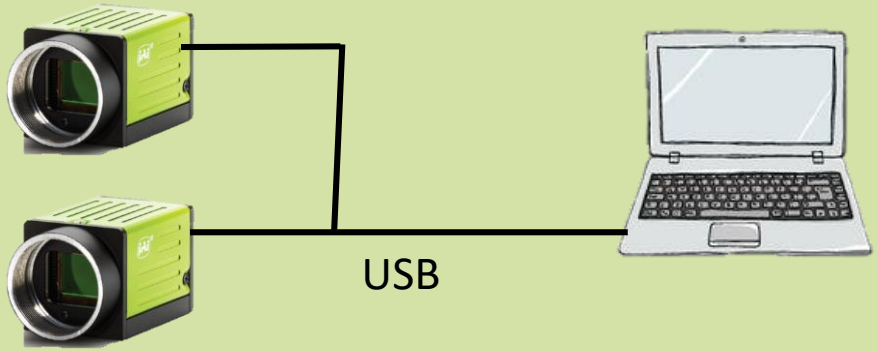
- 4 fertilization practices
- 4 plot replication

Is the wind a problem ?

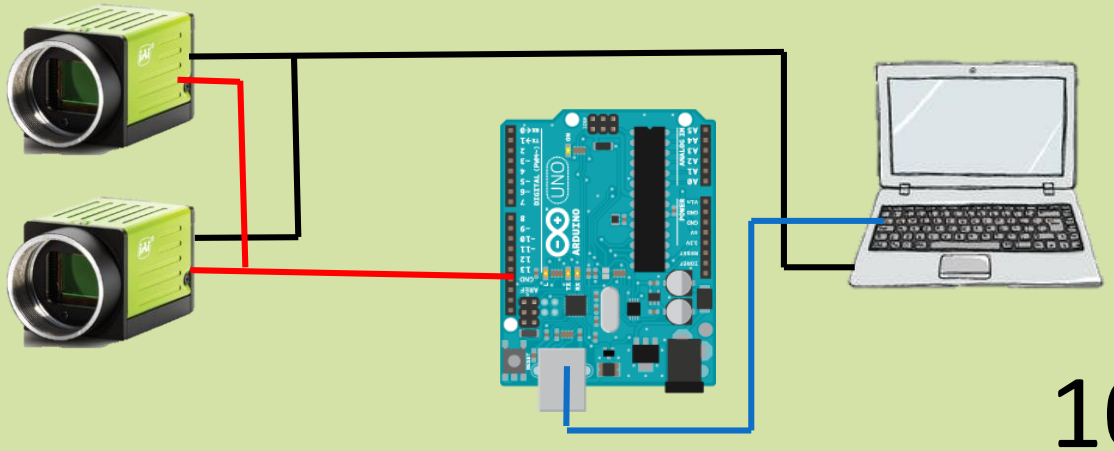
Is the wind a problem ?



Without trigger



With trigger

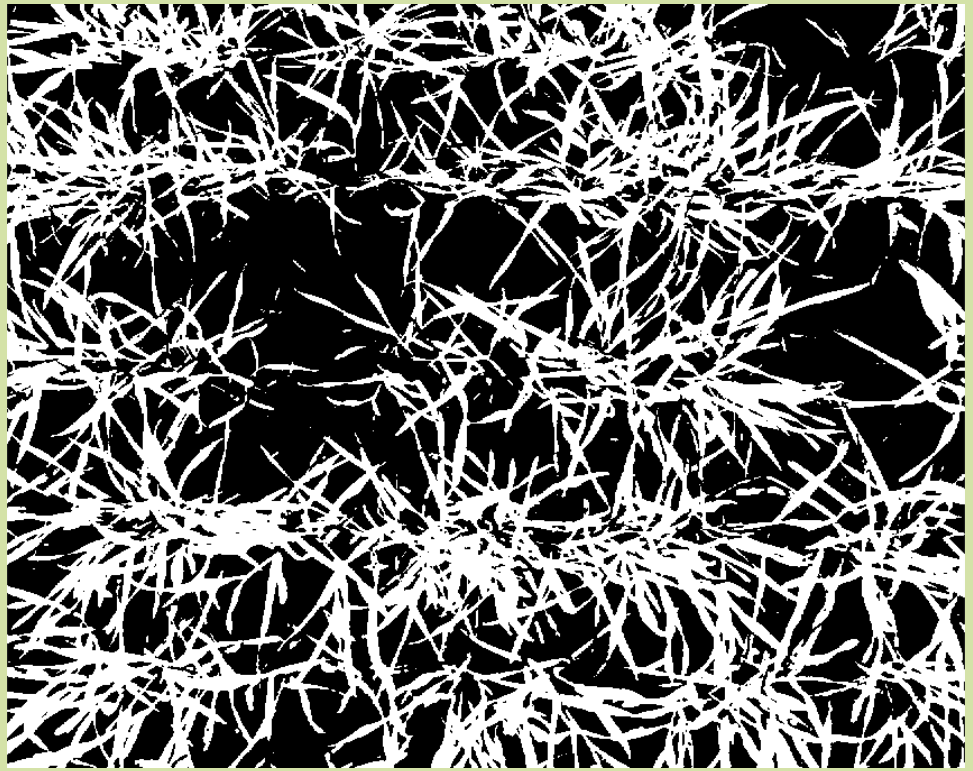


What does it measure ?

Neural networks

SVM

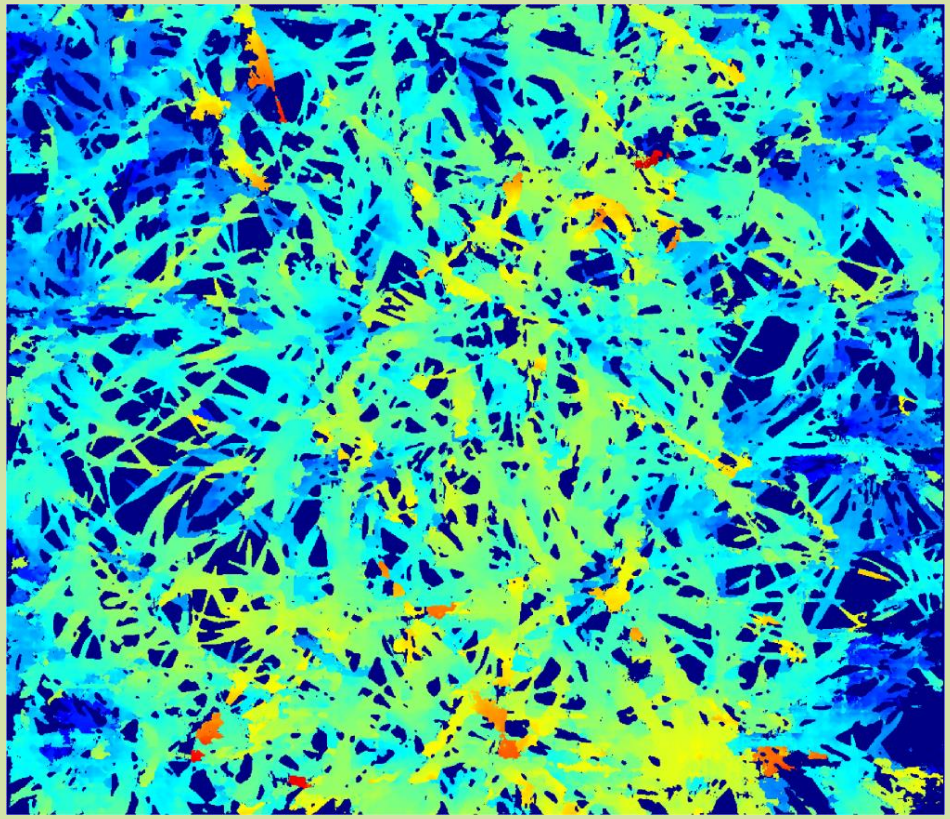
Plant ratio



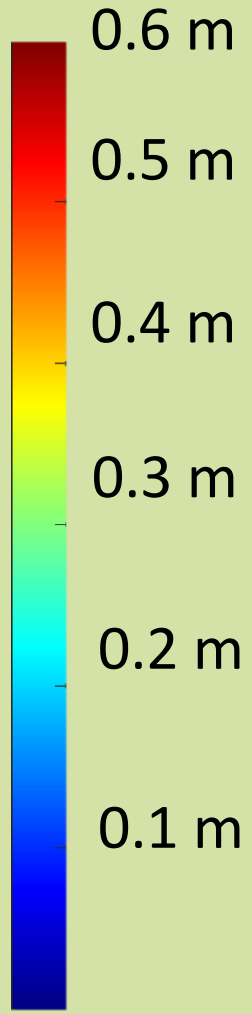
Segmentation accuracy : **98.5 %**

What about the 3D information ?

Some barley

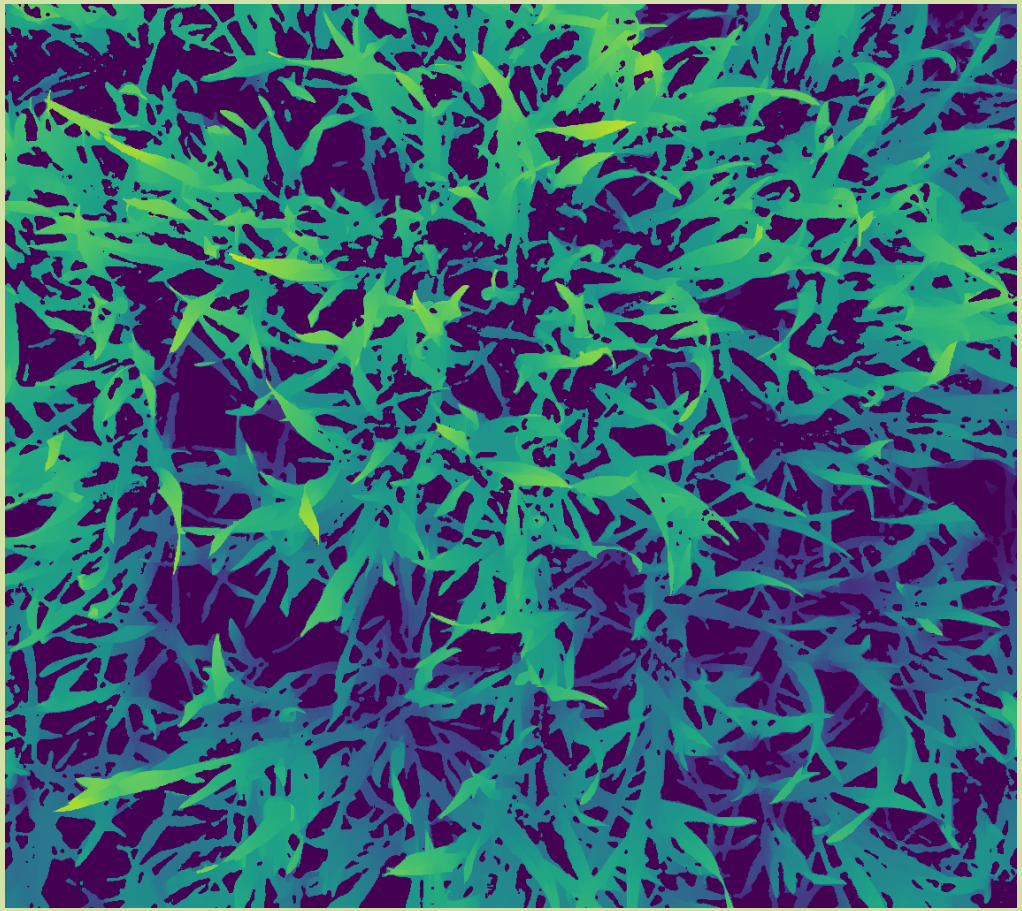


Height map



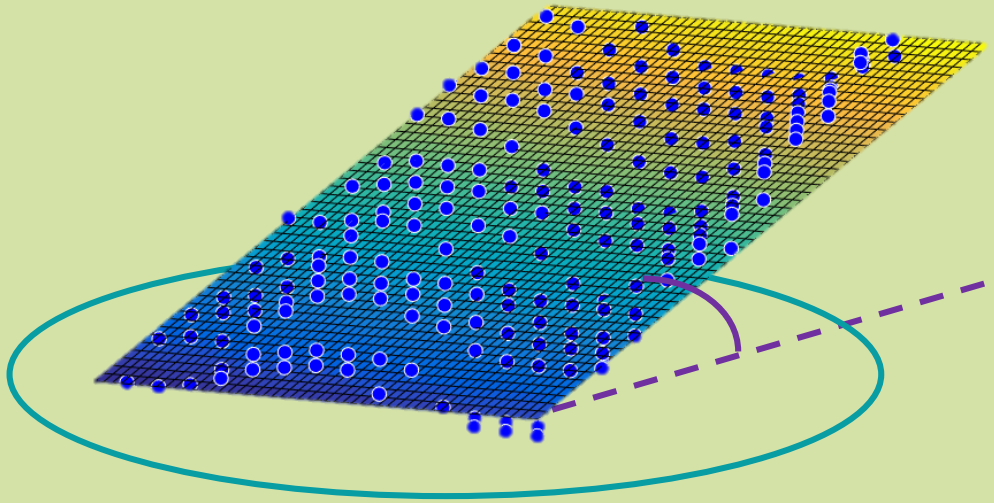
What about the 3D information ?

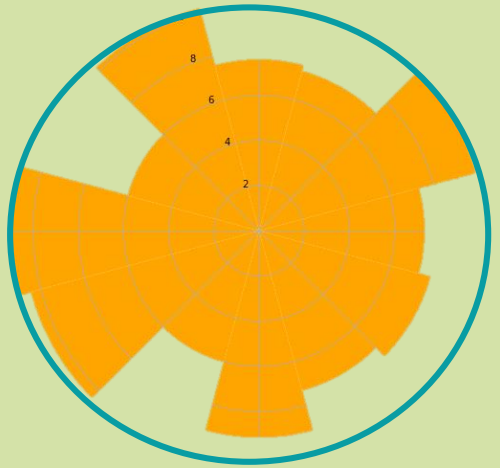
Some wheat



Height map (2019 result)

What about the 3D information ?





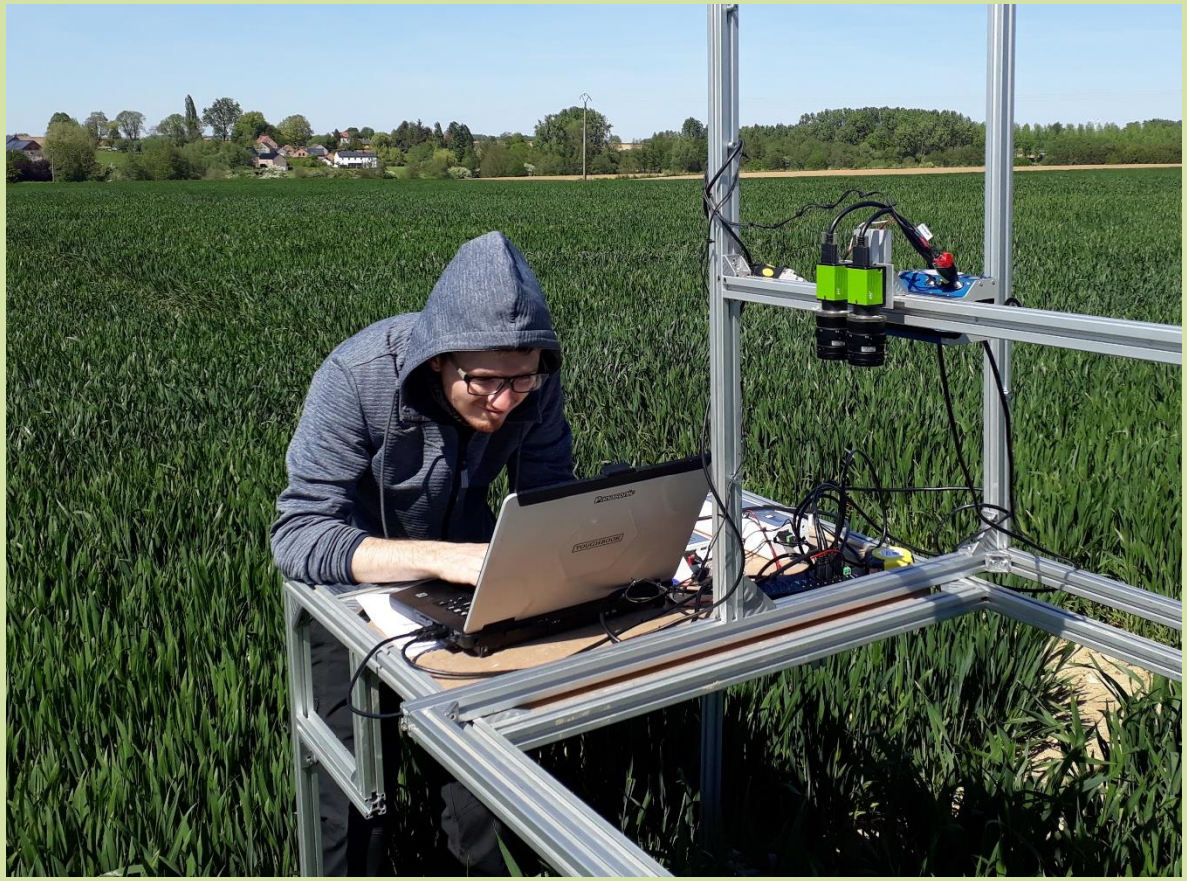
1. Detect leaf edges
2. Sample zone of good matching

3. Fit a plane on the point cloud
4. Compute zenith angle
5. Compute azimut angle

What are the results ? The perspectives ?

- Plant ratio
- Canopy height
- Leaf angles
- Spike counting
- Leaf Area Index
- Height of spikes
- Biomass estimation

Any take home message ?

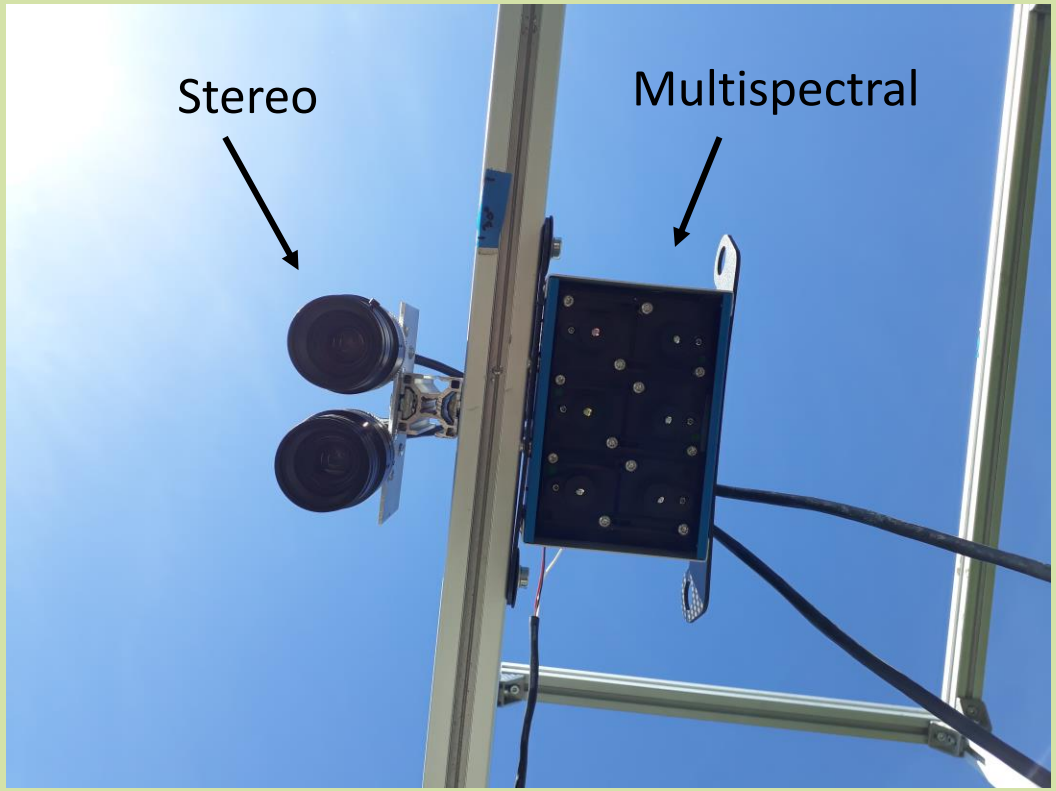


Hello the (outside) world

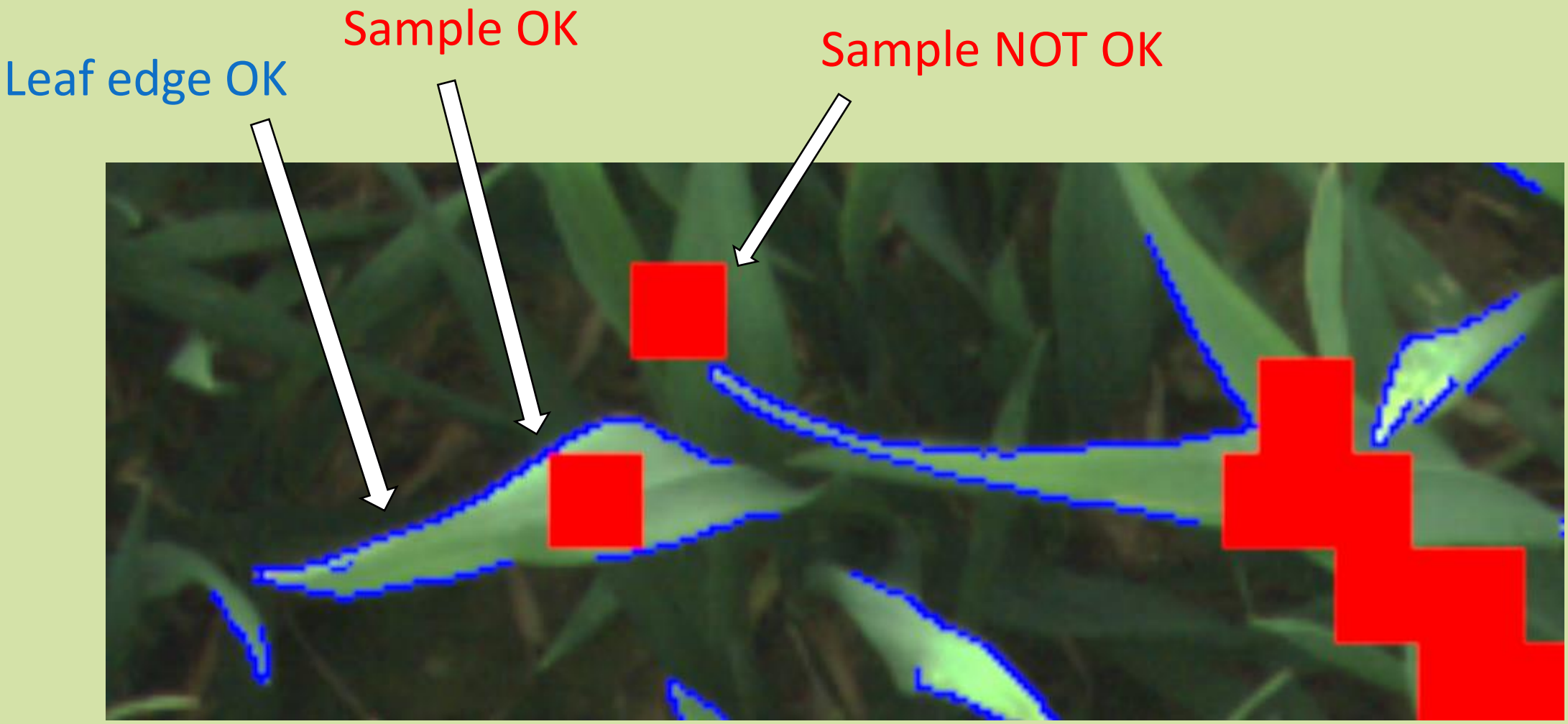
Thank you for your attention !

How to contact me ? : sebastien.dandrifosse@uliege.be

What are the perspectives ?



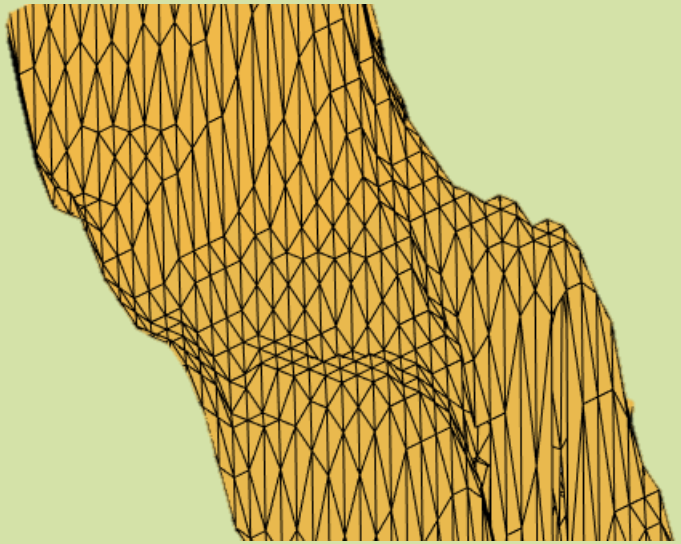
Sampling of leaf zones



How to reconstruct a 3D surface ?

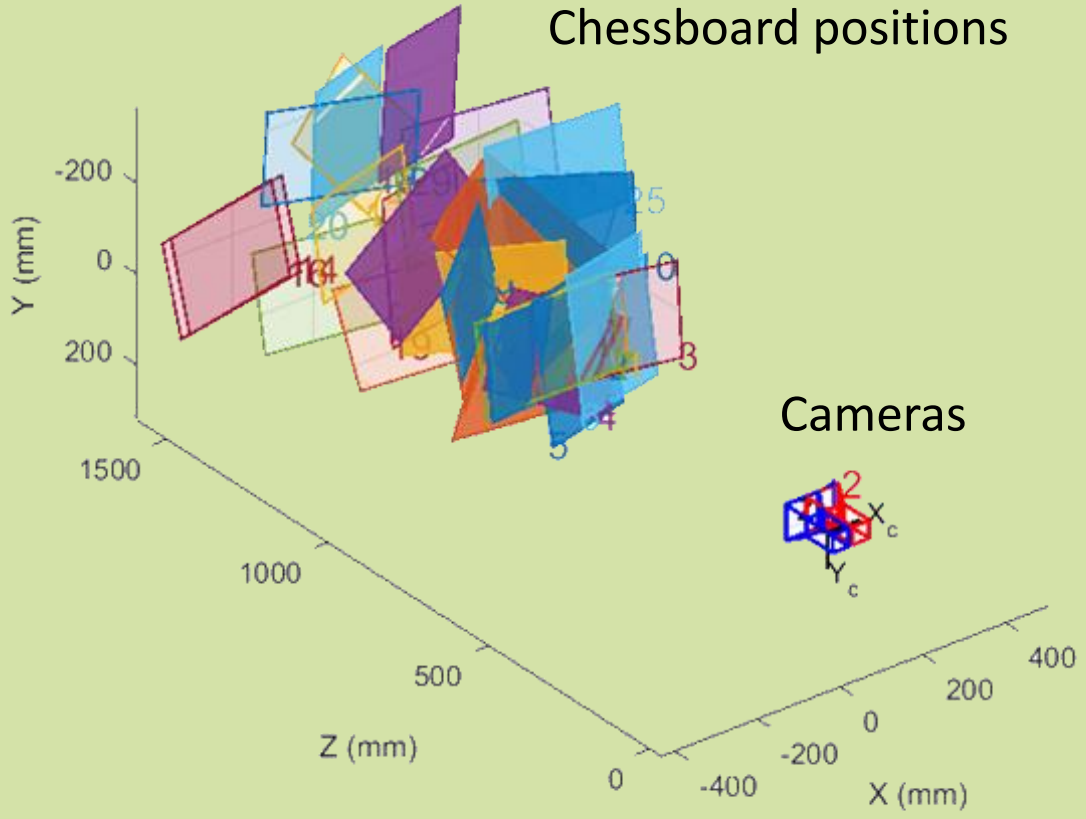
Part of a leaf

3D point cloud

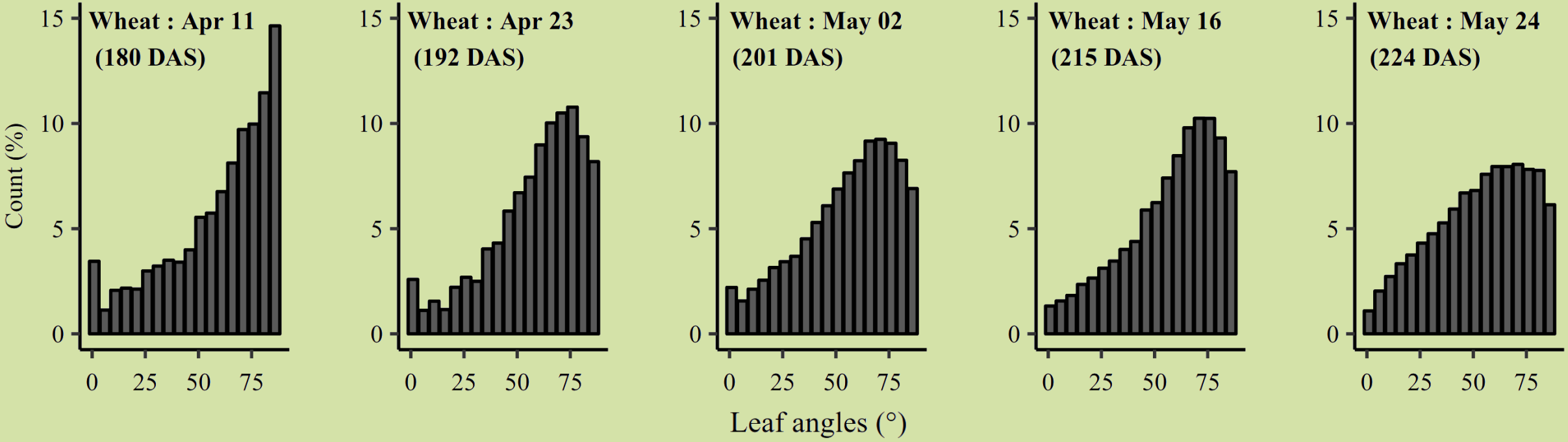


Triangle mesh

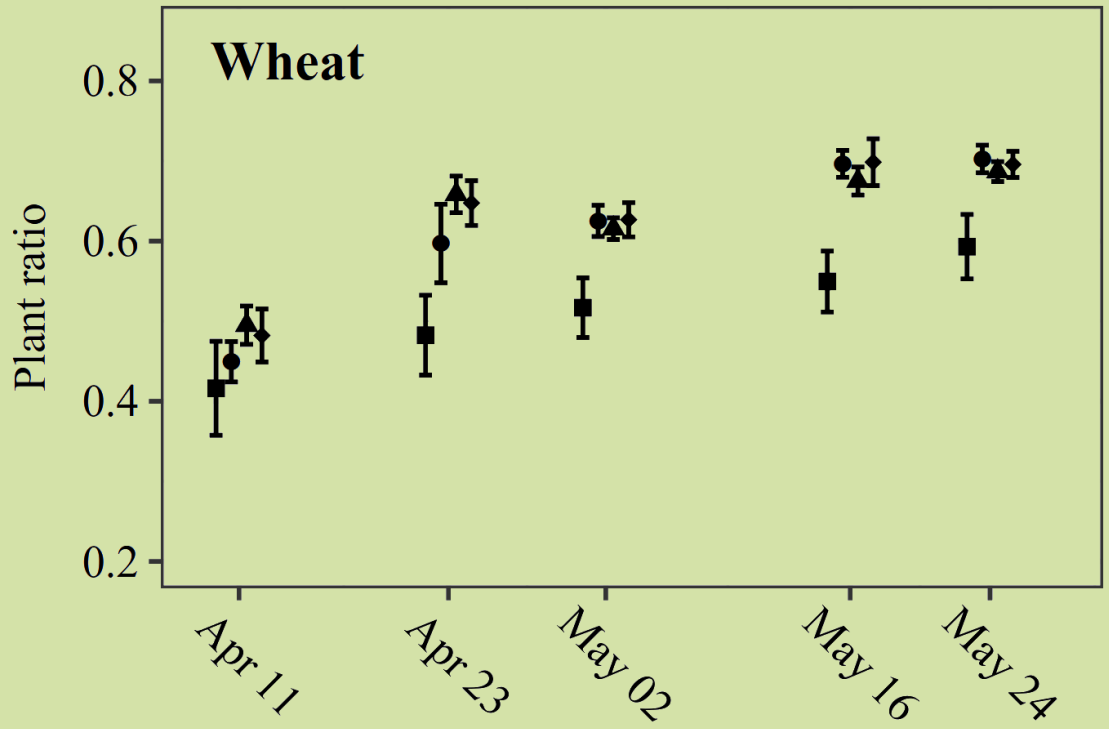
How to calibrate the device ?

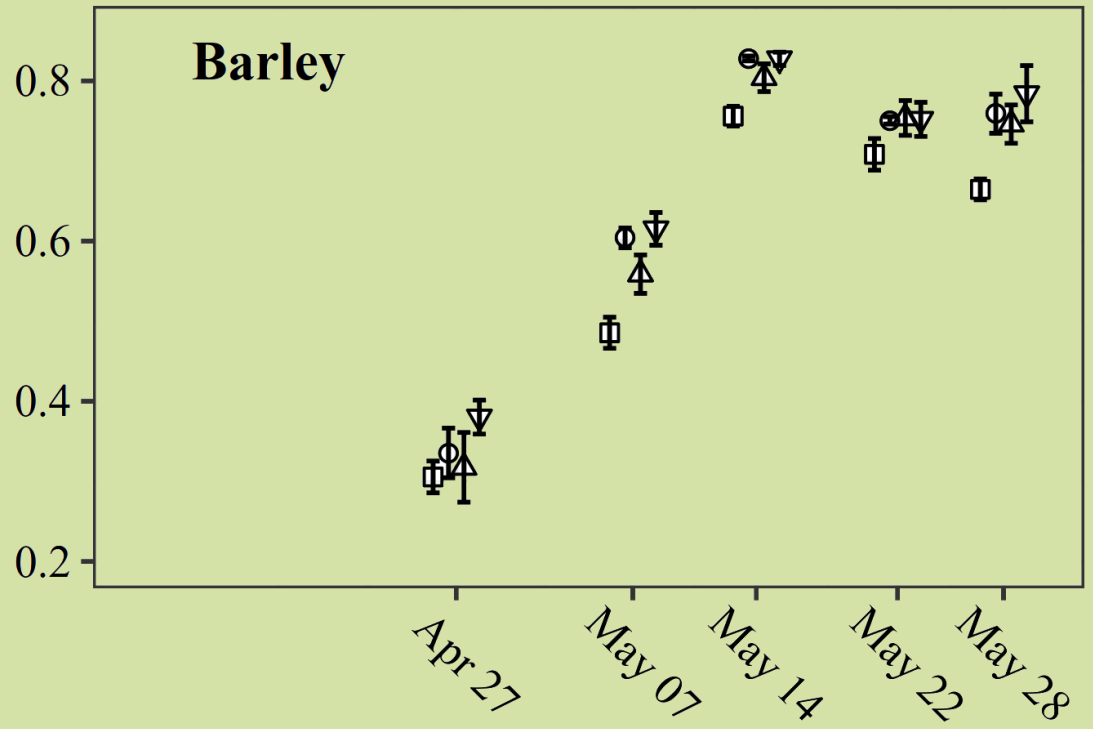


Leaf angle distribution



Plant ratio





Fertiliser at stages: Tillering (2 Apr)
and Stem elongation (21 Apr) (kgN/ha)

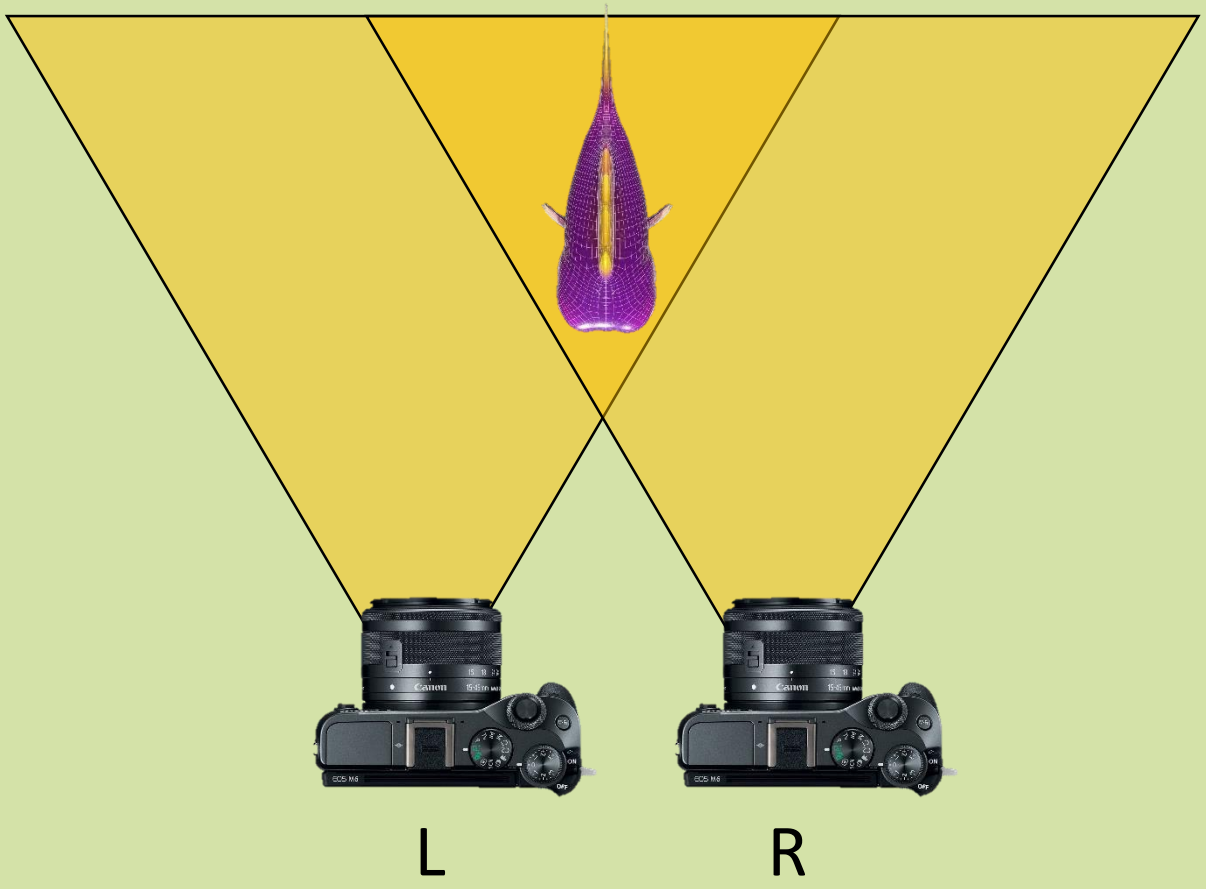
■	0−0	●	30−90
▲	60−0	◆	90−30

Fertiliser at stages : Seedling (14 Apr)
and Stem elongation (13 May) (kgN/ha)

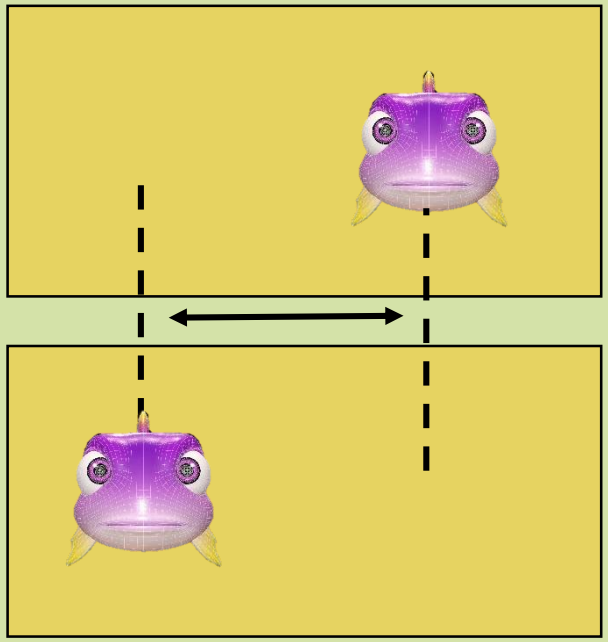
▽	90−30	○	135−45
□	0−30	△	45−15

What is stereovision ?

Stereo vision : from 2D images to 3D information



What camera L sees



What camera R sees