Grain Yield Prediction and Plant Height Measurment using UAV Imagery

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Video

Why UAVs?

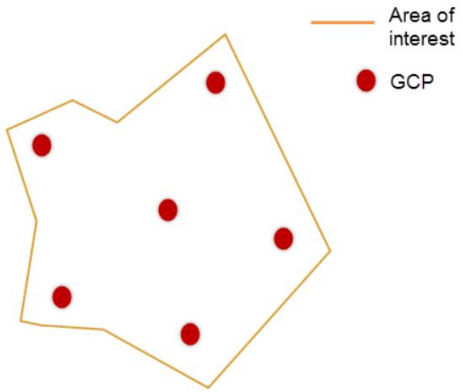
- Traditional phenotyping: time consuming, labor intensive, costly and low throughput, UAV imagery caught interest in this field.

- UAV images have shown a promising capability to predict Grain yield as an important trait in plant phenotyping.

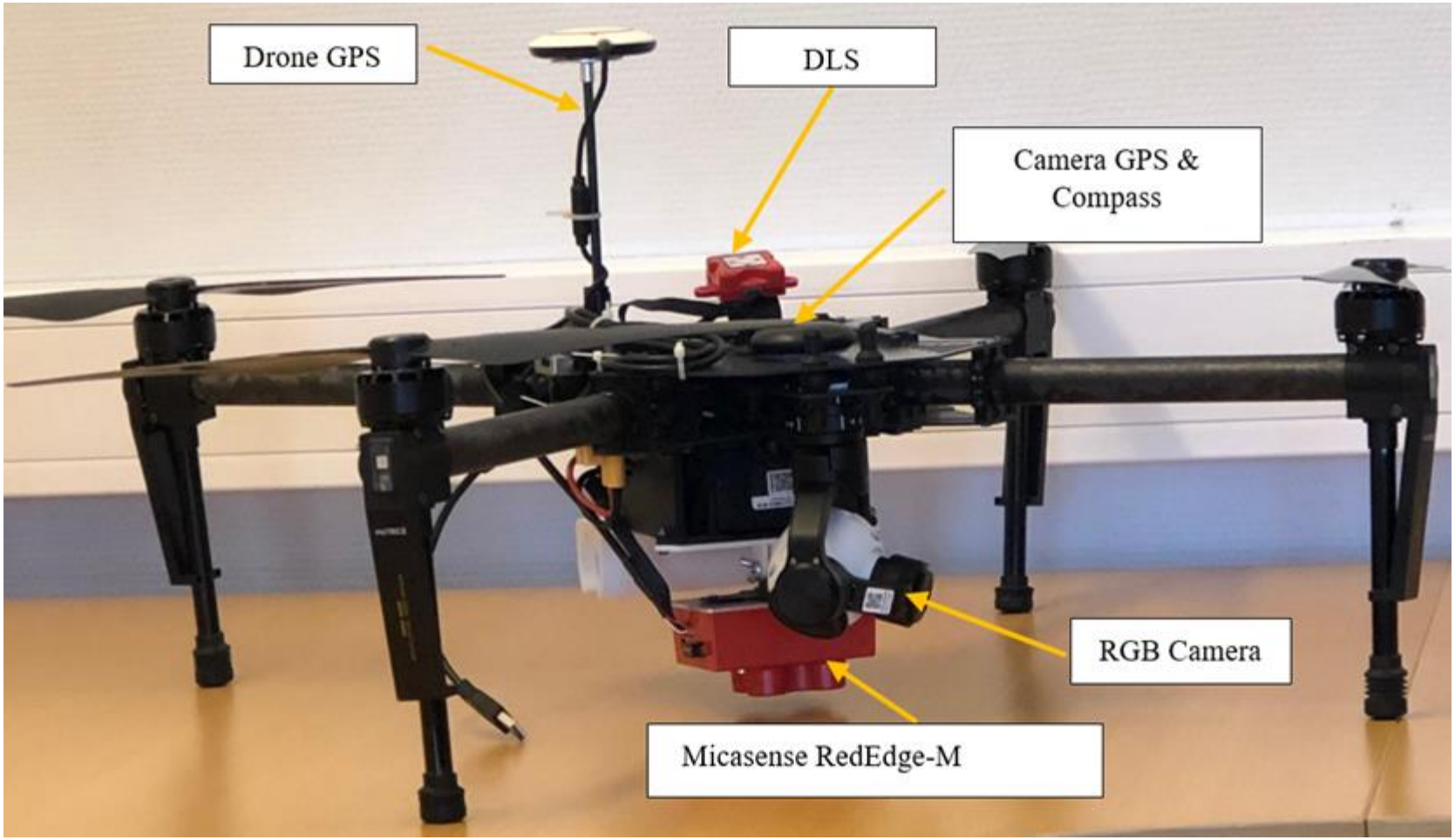
How to Start a Project:

Before Starting a Project

A minimum number of 5 GCPs per project.



Drone and Camera:



Field location and Making Routes in Altizure App:

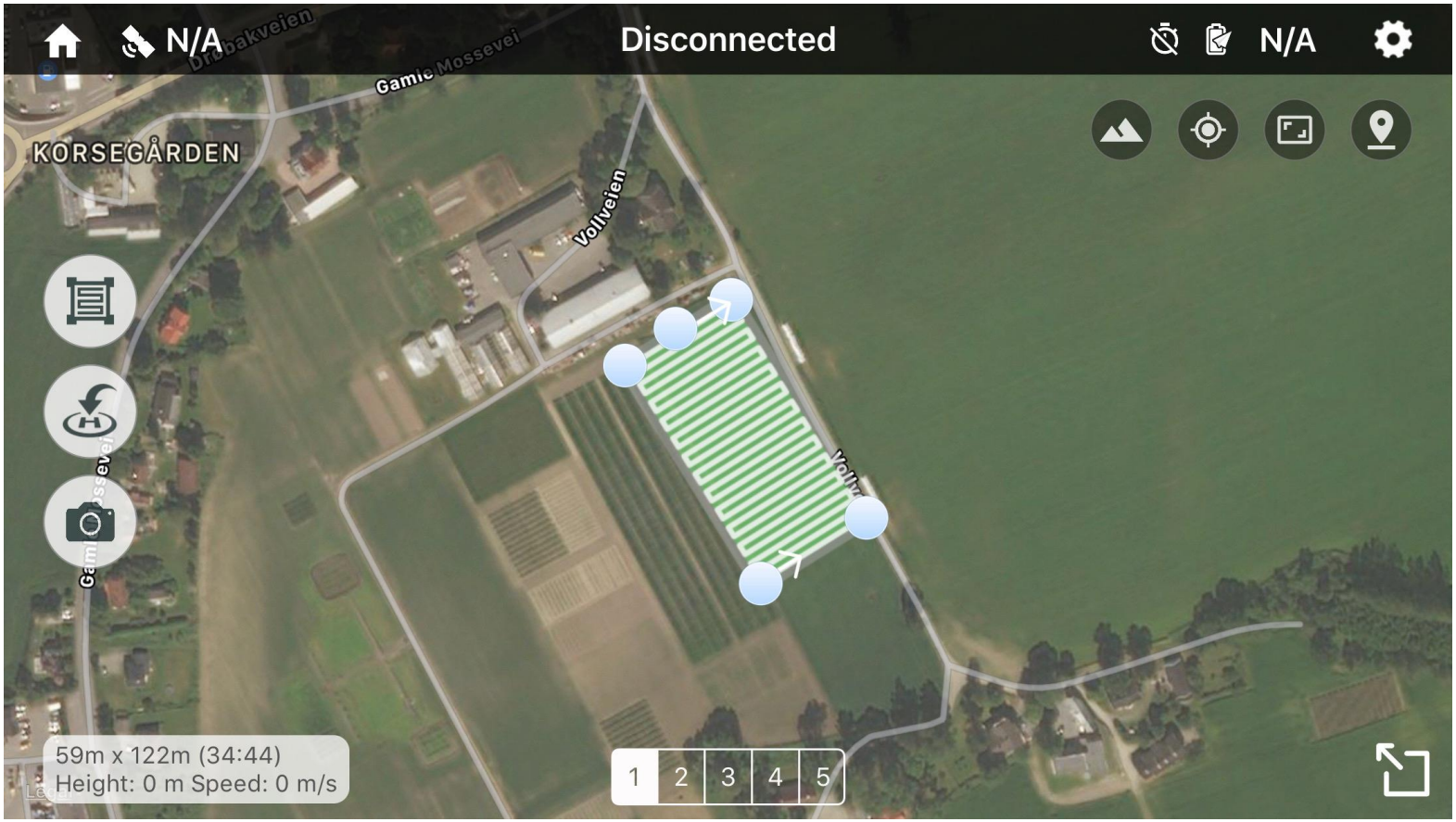
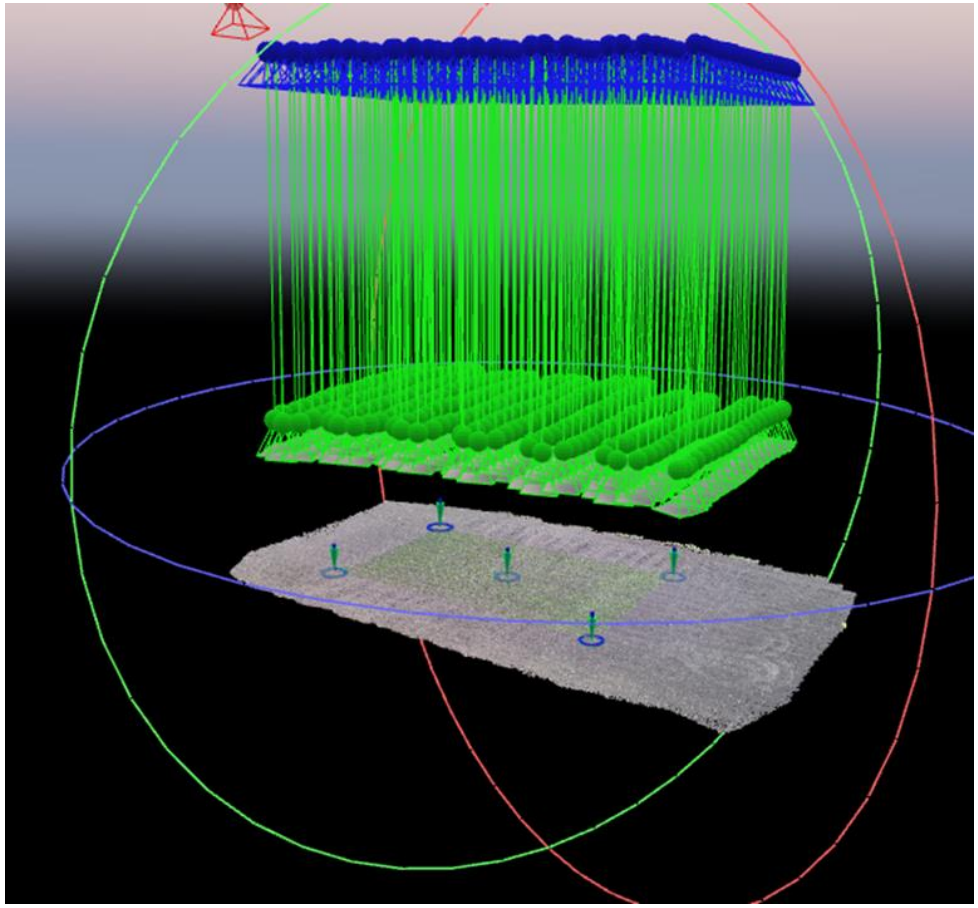
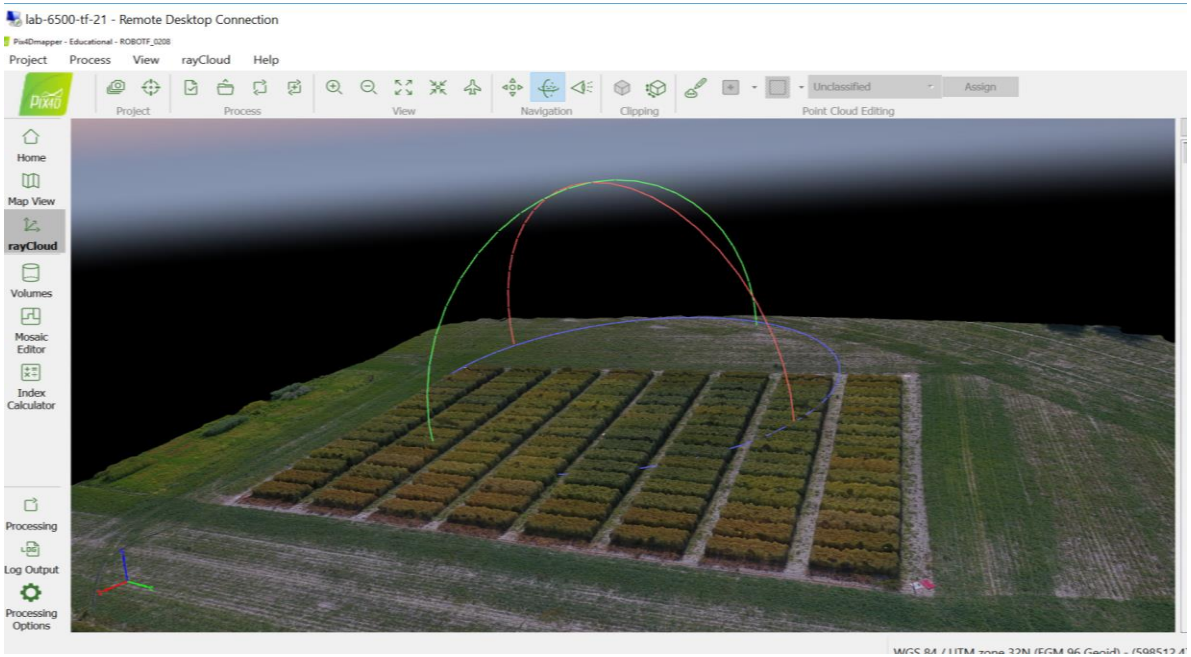
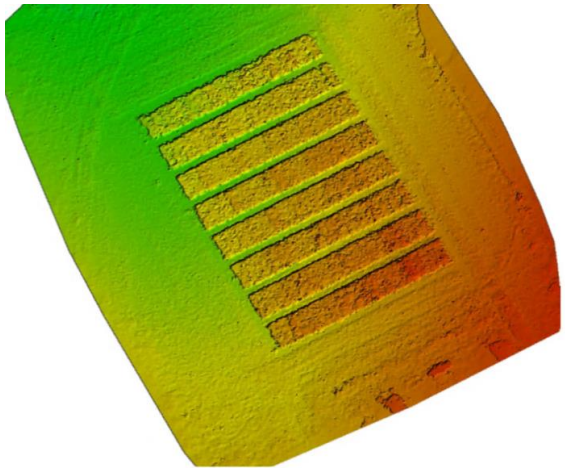


Image Analysis in Pix4D:



3D Model in Pix4D





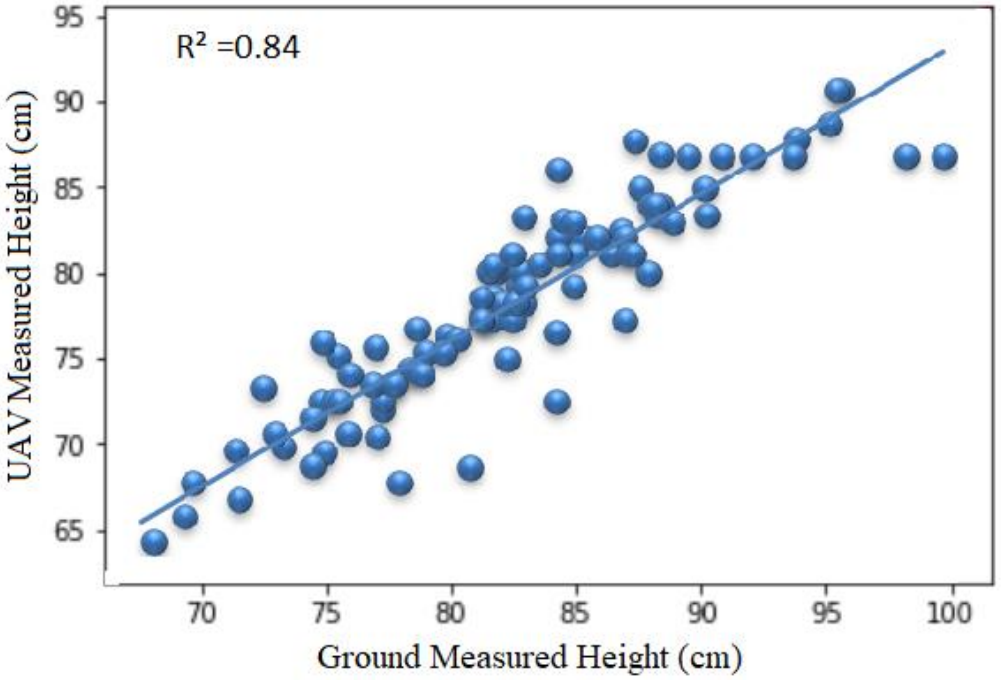
DSM

Plant Height estimation

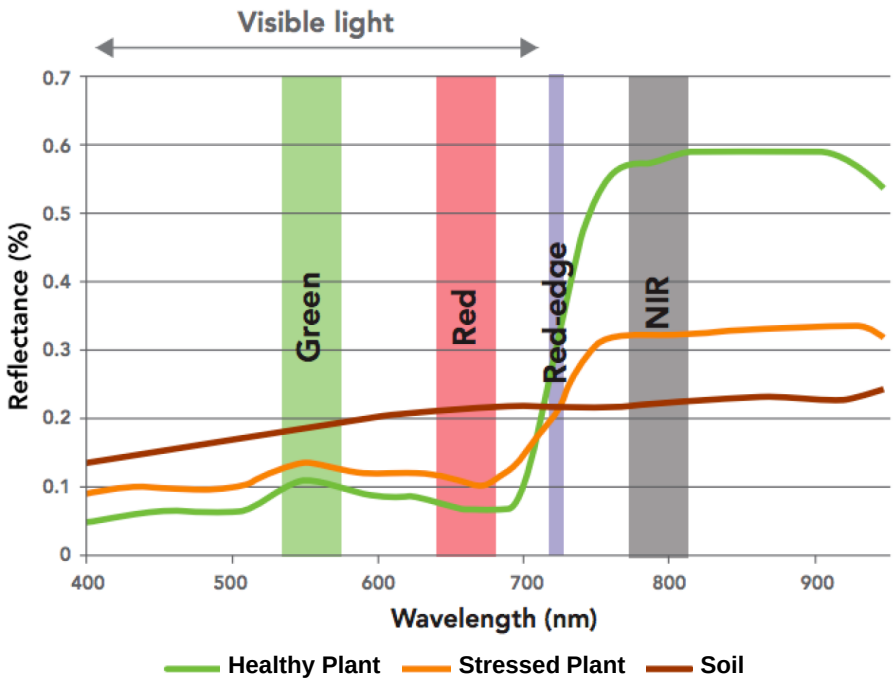
✓Generating of Digital Surface Model(DSM)

✓Generating Digital Terrian Model (DTM)

✓Plant Height = DSM-DTM



Vegetation indices



- Normalized Difference Vegetation Index (NDVI):

$$NDVI = \frac{NIR - Red}{NIR + Red}$$

- MERIS Terrestrial Chlorophyll Index (MTCI):

$$MTCI = \frac{NIR - Rededge}{Redege - Red}$$

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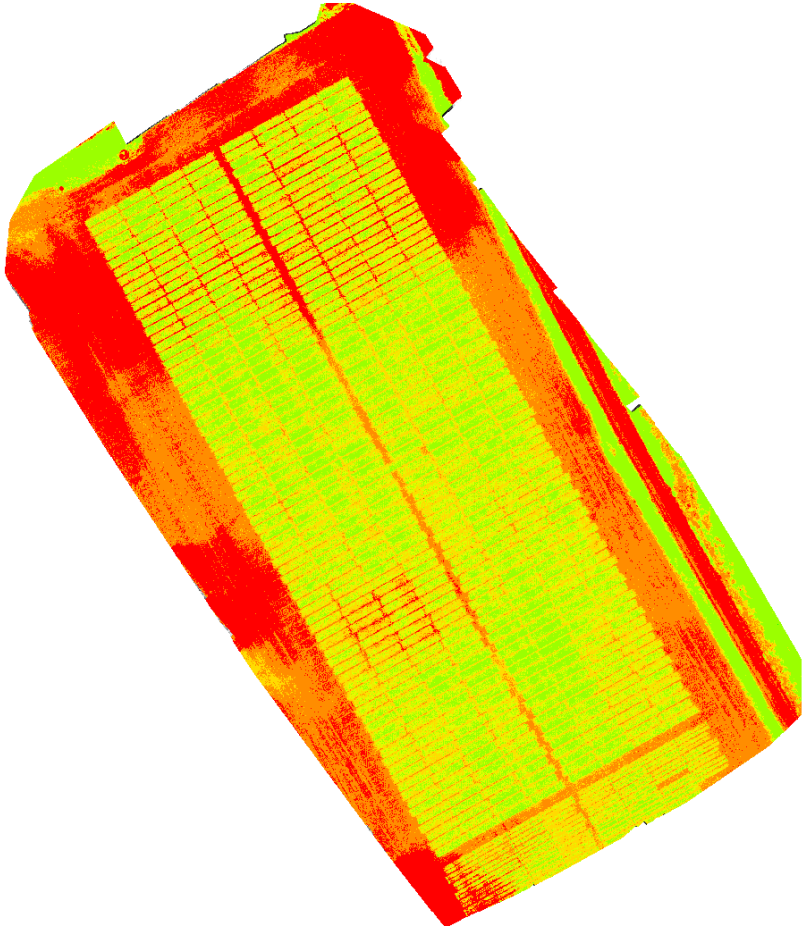
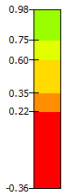
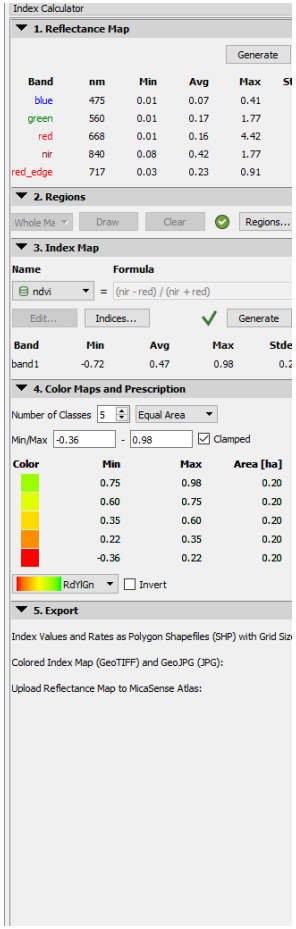
- Enhanced vegetation index - EVI

EVI = 2.5 (NIR – RED)/(NIR +6 RED – 7.5 BLUE +1)

Indices Maps
NDVI

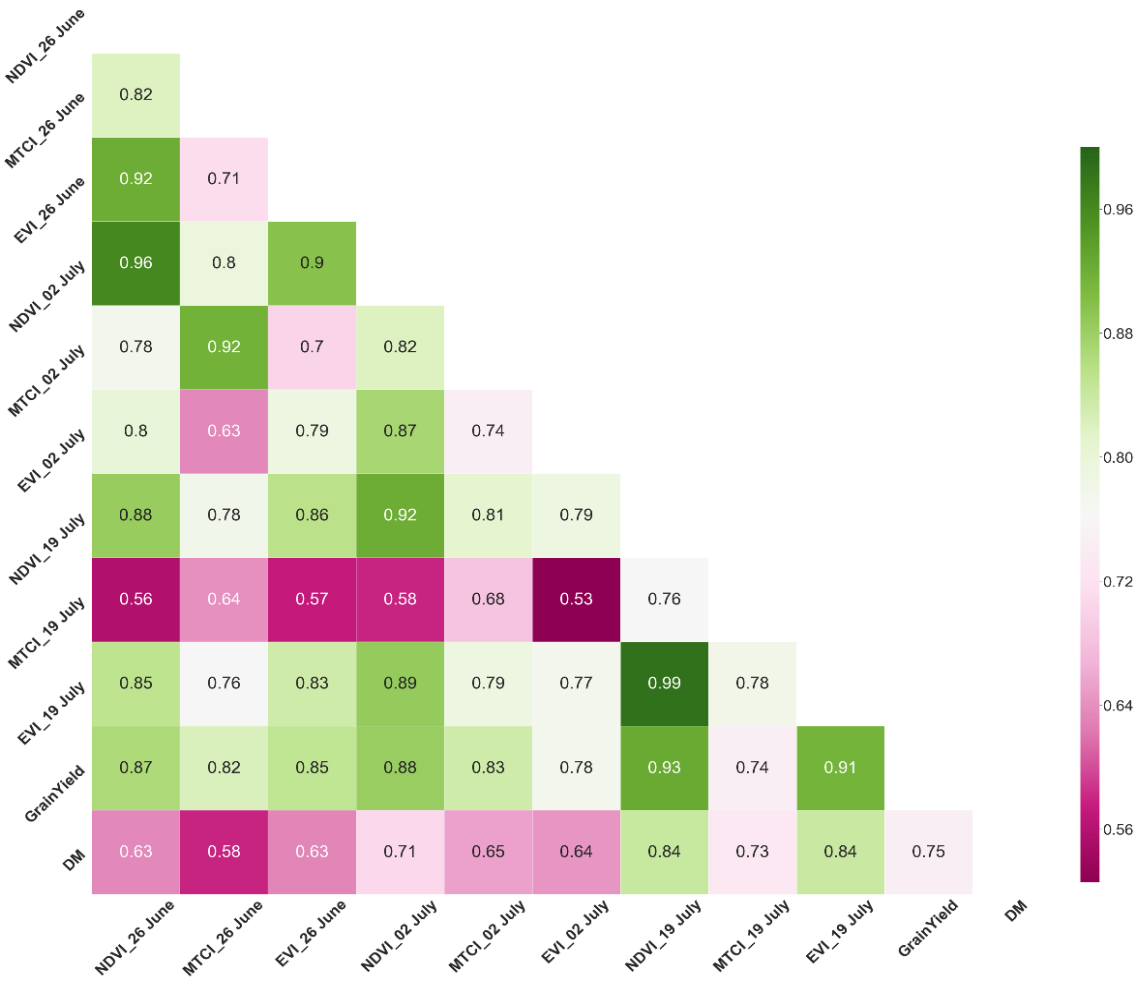






Plot Extraction in QGIS

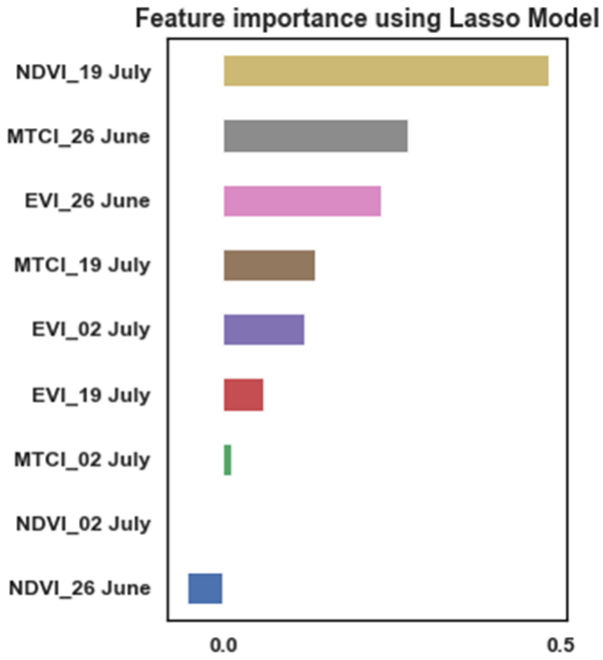
Results



Pearson correlation between traits (DM: days to maturity)

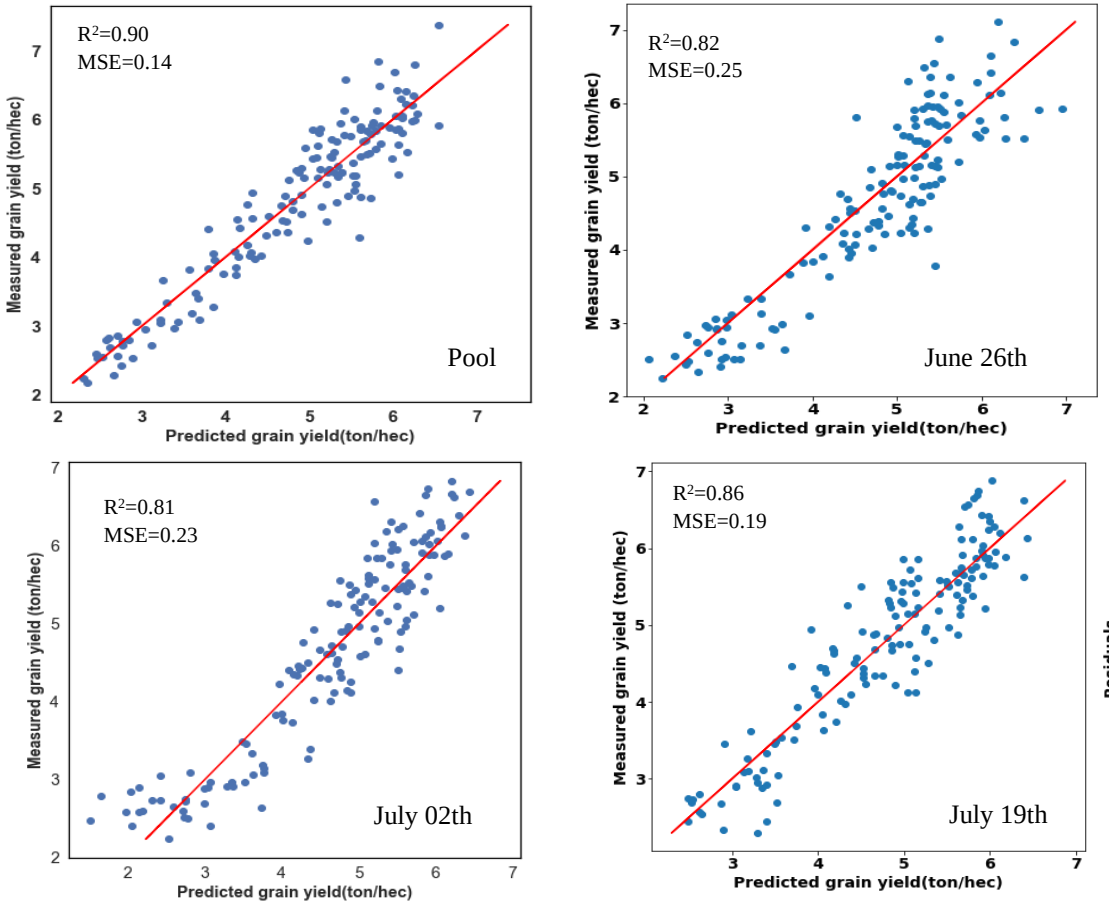
Results

Date	Selected indices	Importance
26.06.2018 (47 days after sowing)	NDVI	0.54
	MTCI	0.5
	EVI	0.14
02.07.2018 (54 days after sowing)	NDVI	0.71
	MTCI	0.42
	EVI	0.008
19.07.2018 (70 days after sowing)	NDVI	1
	MTCI	0.11

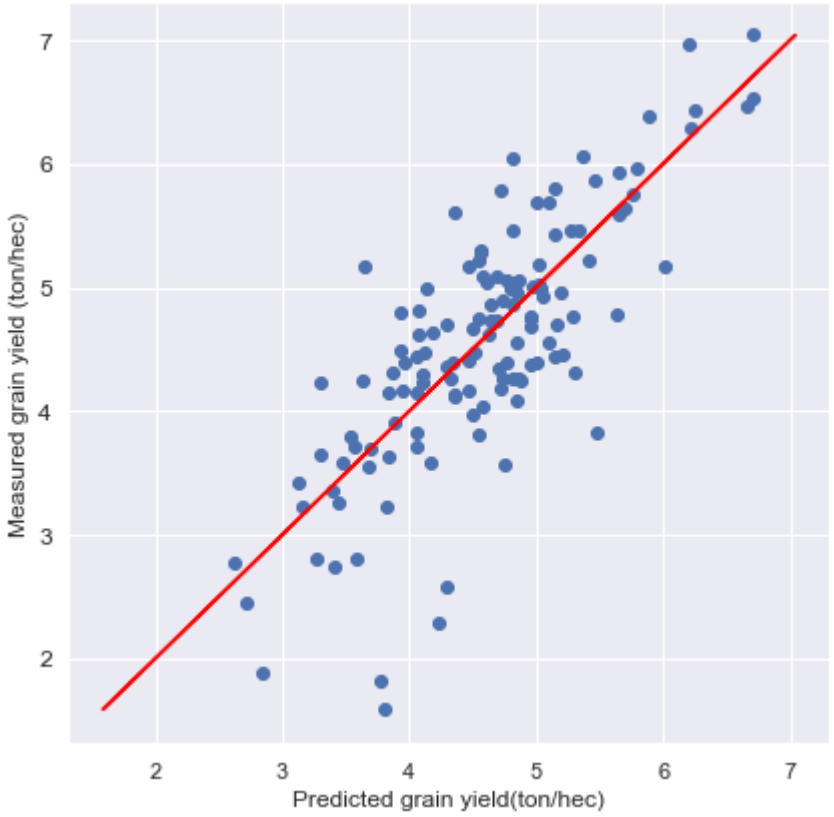


The feature importance of the pool data

Measured grain yield against predicted value

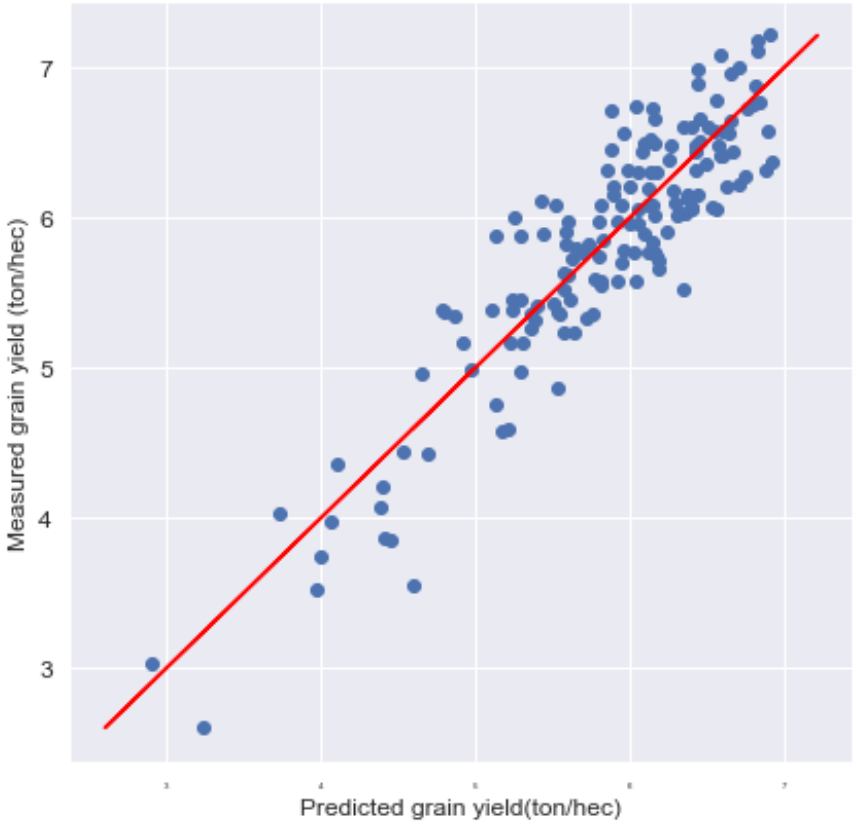


MABASIS 2018



R^2 train: 0.61, test: 0.62
MSE train: 0.38, test: 0.38

MABASIS 2019



R^2 train: 0.81, test: 0.82
MSE train: 0.13, test: 0.12