



Hyperspectral imaging for high throughput QTL detection in raspberry



Dominic Williams

Hyperspectral Imaging

- Non invasive/ non destructive measurements
- Can be used to image large numbers of plants in short time scale



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Hyperspectral Imaging



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- Image where spectra at every point in the image is recorded
- Visible and near infrared (VNIR) 400-1000nm
- Short wave infrared (SWIR) 900-2500nm
- Line scanner

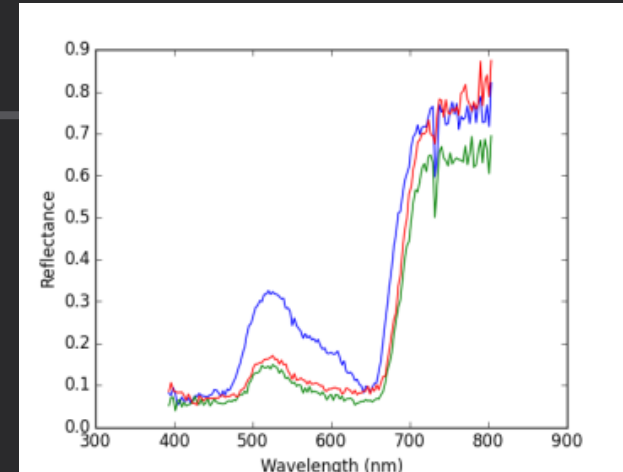
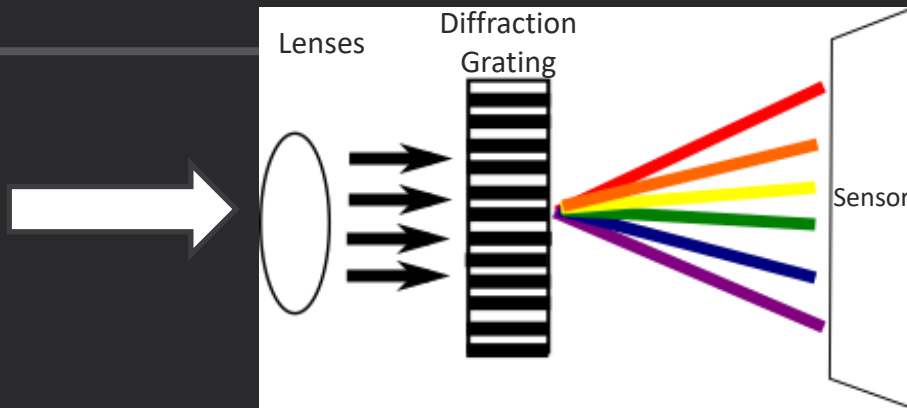
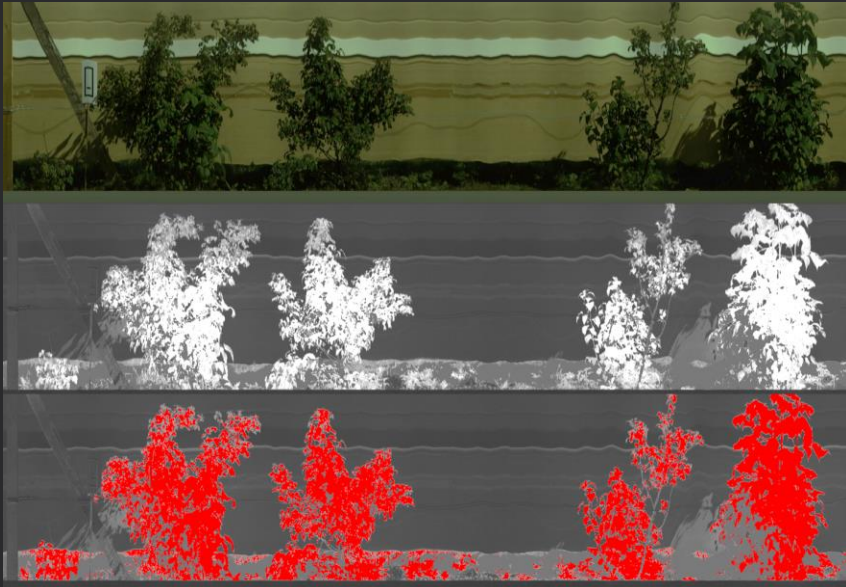


Image analysis



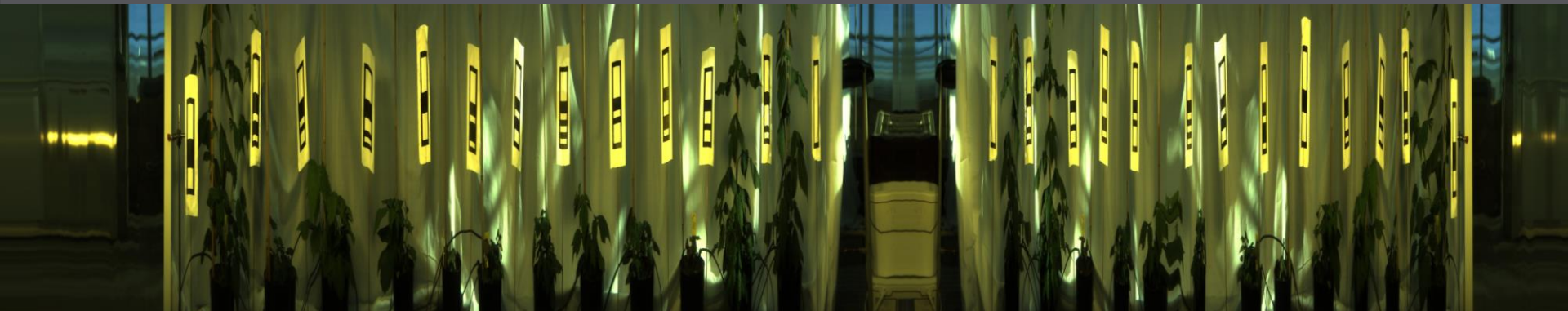
- Want to identify plants and white reference
- Need to split into individual plants and match these plants to plan
- Volume of data means need to automated process as much as possible

Raspberry stress Glasshouse Experiment

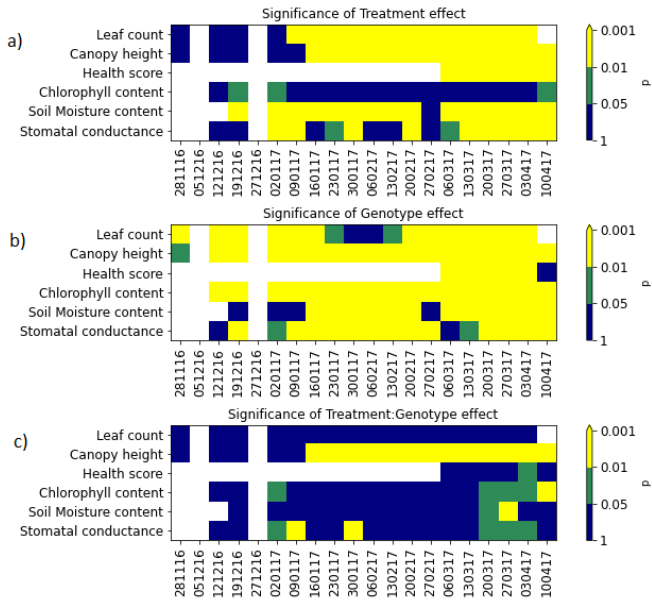


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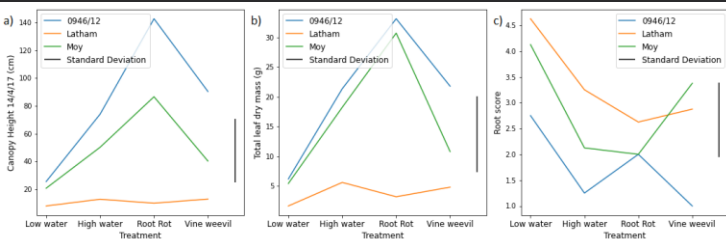
- Three genotypes - Latham, Glen Moy, Root rot marker plant
- Four treatments – High water, control, Root rot, Vine weevil
- 96 plants



Biophysical results



- Differences shown between genotypes and treatments
- Interactions mainly seen for canopy height
- Root rot shows most differences

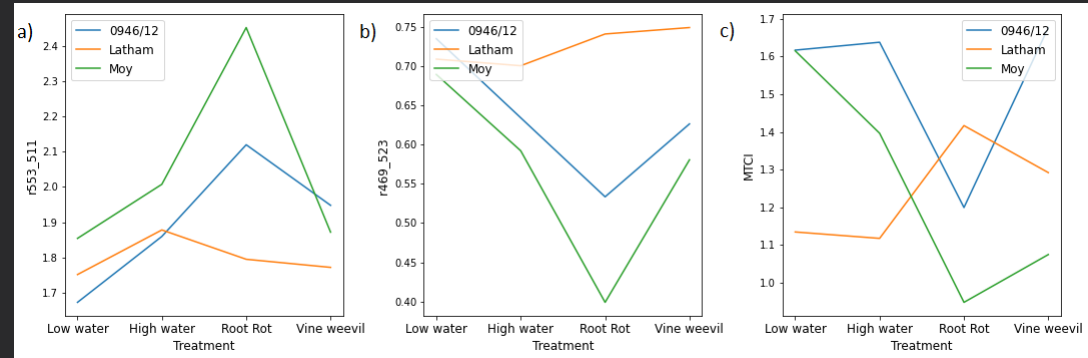
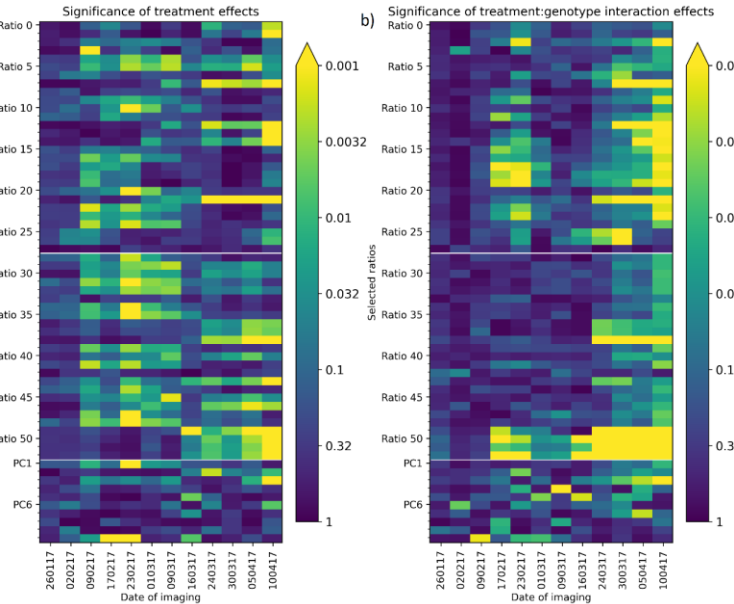
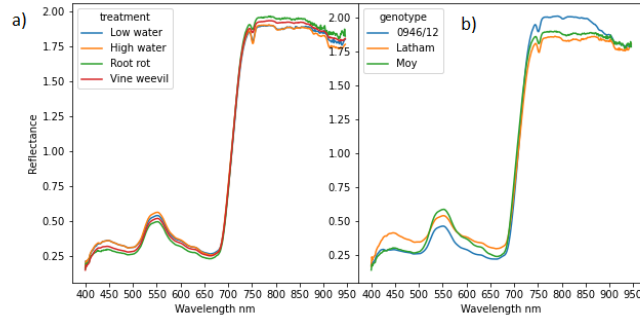




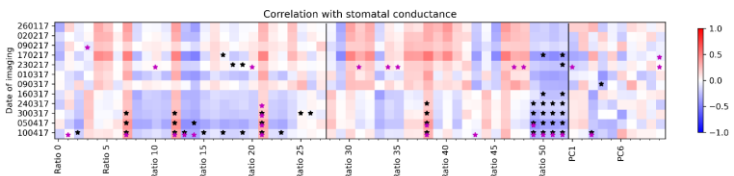
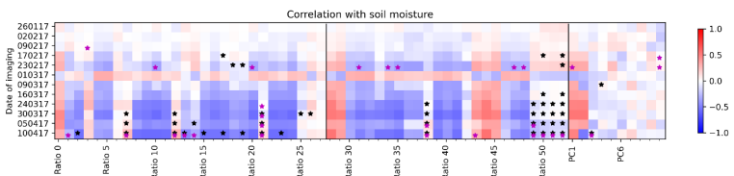
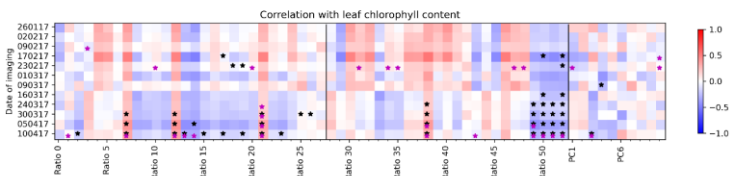
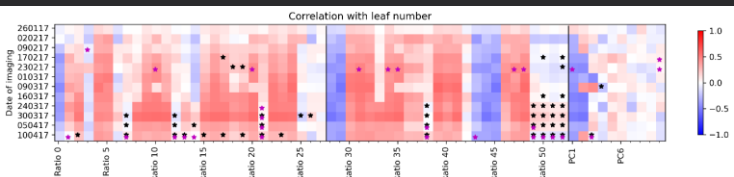
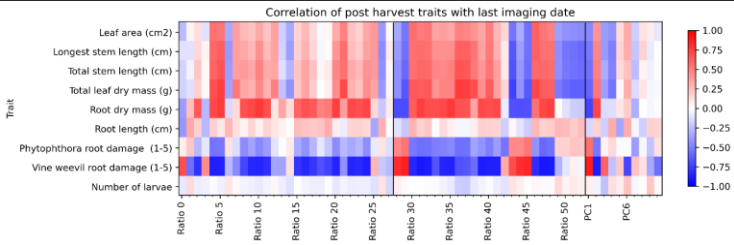
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Spectral results

- Biggest differences seen between genotypes
- Significant differences also seen between treatments and interaction effects



Comparison with manual measures



- Ratios found that correlate with biophysical traits both above and below ground measures
- Correlations found with leaf number and chlorophyll content
- Implies wavelength ratios can be used as proxy for below ground stress

Conclusions



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- A number of ratios have been found to distinguish stress treatments
- Implies a use of hyperspectral imaging for stress phenotyping would be successful
- Physiological processes underpinning spectral changes are unknown

Thing measuring	Ratios	Definitions
Distinguishing treatment	SR4	R700/R670
Treatment*genotype interaction	r509_512	R509/R512
	r568_641	R568/R641
	r557_658	R557/R658
	r537_644	R537/R644
Leaf Number correlation	ch1green	R800/R550 – 1.0
Soil Moisture correlation	r719_691	R719/R691
Chlorophyll content correlation	r557_658	R557/R658
Root dry mass correlation	GRVI	nir/green
Leaf dry mass correlation	R753_417	R753/R417



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