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Scalable Non-contact Phenotyping: from Pot to Field

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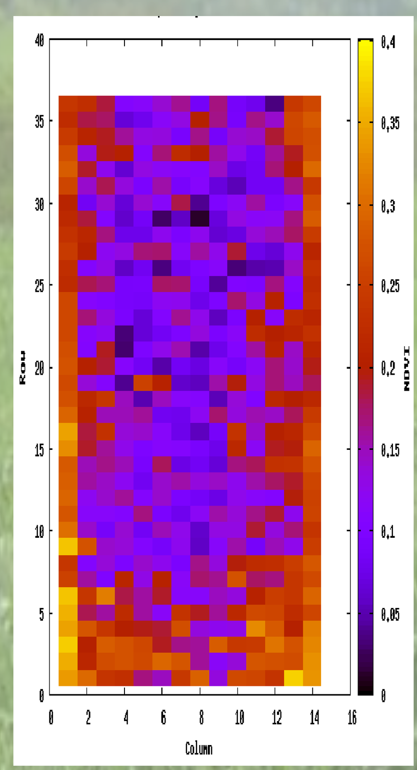
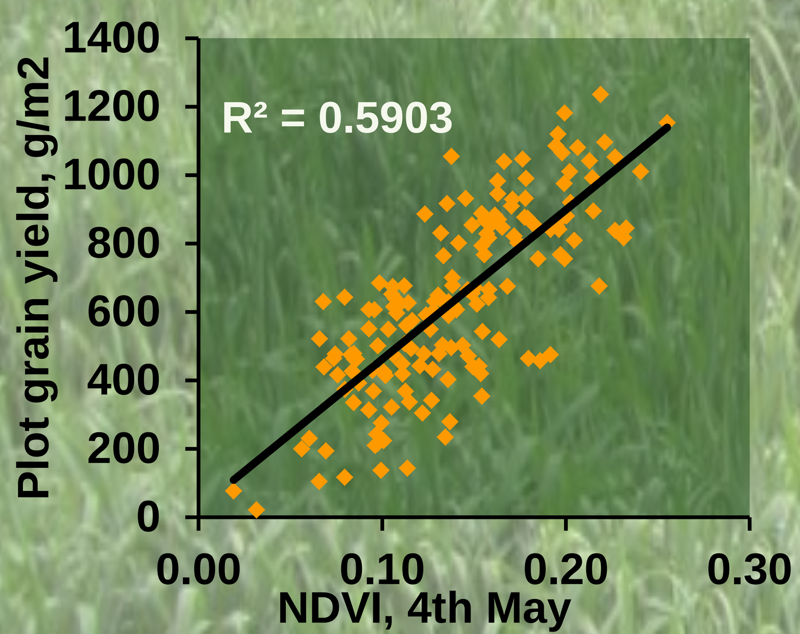
Phenotyping Platforms at IBERS and The National Plant Phenomics Centre (NPPC)

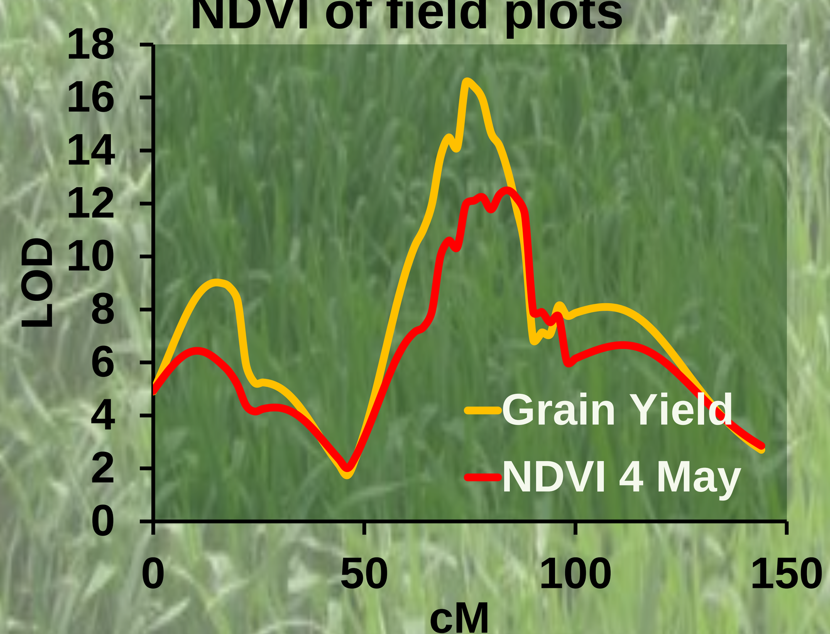
The NPPC is a BBSRC funded National Facility and access is available to UK researchers (www.plant-phenomics.ac.uk). High-throughput, non destructive measurements are used to assess variation in plant performance within genetically defined populations of crop and model plants. In this poster results from phenotyping a winter oat mapping population in the field using Unmanned Aerial Vehicle (UAV) imaging and in pots in the NPPC are compared to those obtained from conventional field screening.


UAV imaging of field plots



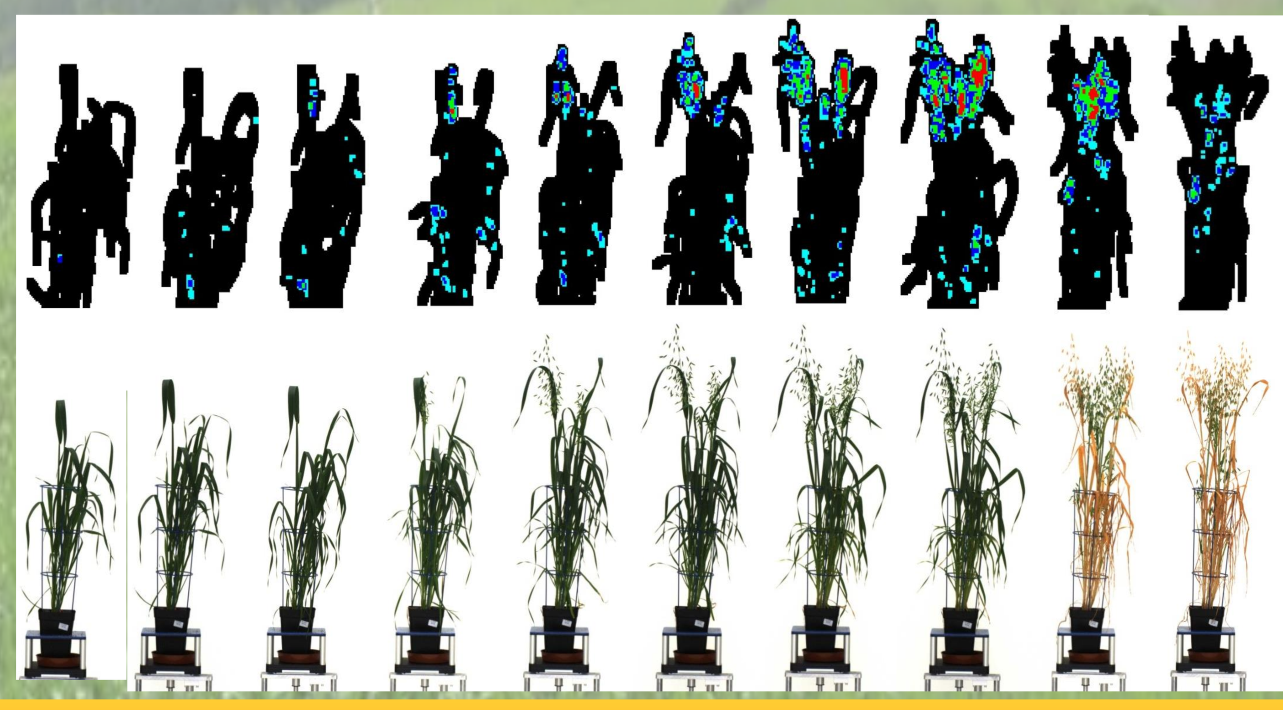
NDVI of field plots



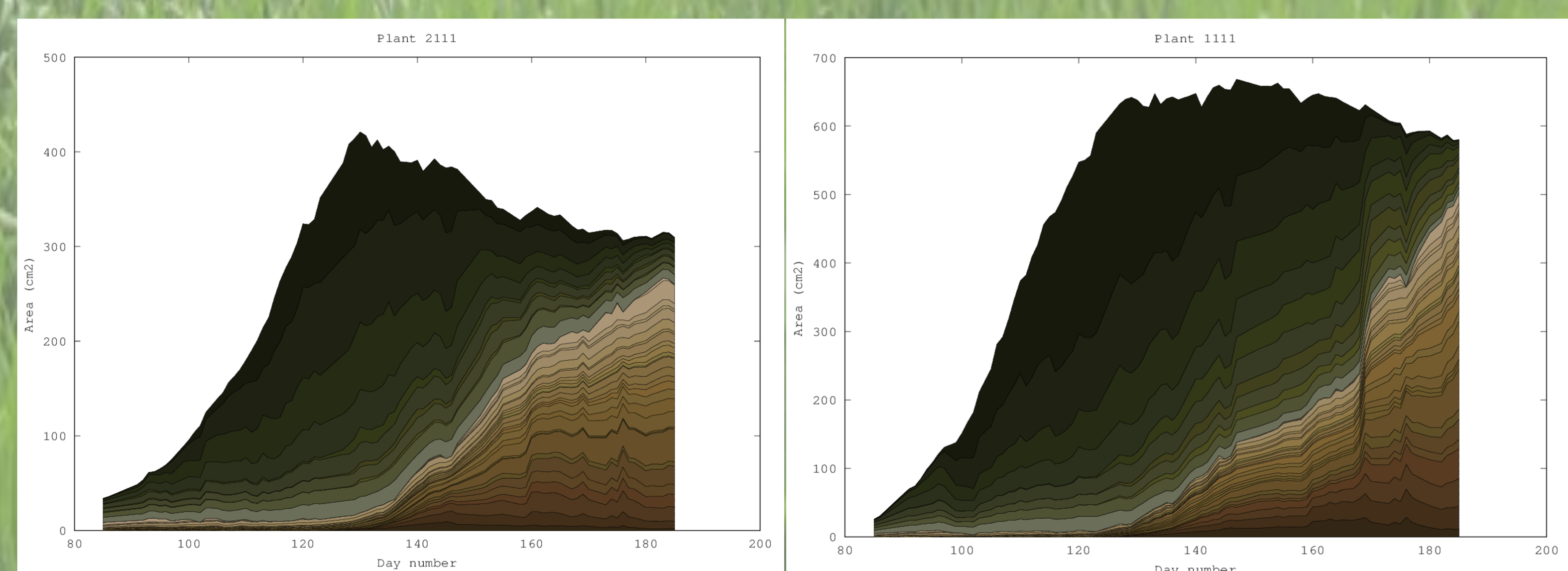


The Normalised Difference Vegetation Index (NDVI) of plots imaged on the 4th May was not only an excellent predictor of final grain yield but also identified the same Quantitative Trait Locus (QTL) as for yield itself.

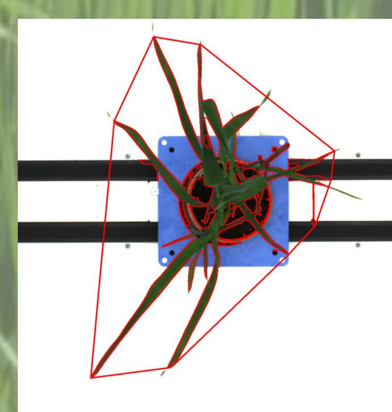
Automated greenhouse: imaging, watering, weighing



Panicle detector at different growth stages



Temporal signals describing the growth and colour of two plants used to visualise and quantify developmental processes

Plants are imaged from a range of angles and from above and data extracted

Extracting Trait Information from the NPPC

Plants, including biomass crops (*Miscanthus*), cereal crops (wheat and oats) and model plants (*Arabidopsis*) are grown in controlled environments and imaged daily or weekly during a growth phase in an experiment (such as droughting). A variety of sensors e.g. RGB, thermal, NIR, chlorophyll fluorescence, temperature, incident light and humidity can be mounted on the platforms to measure different aspects of plant performance. Computer vision techniques are being developed to score a variety of parameters that have previously been measured manually.

Extracting informative features automatically from large image sets presents interesting challenges. Regular imaging under defined environmental conditions can be used to identify candidate genotypes that will perform well in future climate scenarios.

Conclusion

The plant phenotyping bottleneck is being addressed with the development of high-throughput phenotyping platforms. These produce large datasets, which when analysed give us useful measures about plant growth relating to yield.

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