UPOV
International Union for the Protection of New Varieties of Plants

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Technical Working Party on Testing Methods and Techniques **TWM/2/8**

Second Session
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UAV-BASED FIELD PHENOTYPING IN THE UNITED KINGDOM AGRICULTURAL DUS TESTING

Document prepared by experts from the United Kingdom

Disclaimer: this document does not represent UPOV policies or guidance

The annex to this document contains a copy of a presentation "UAV-Based Field Phenotyping in the United Kingdom Agricultural DUS testing", to be made by experts from the United Kingdom, at the second session of the Technical Working Party on Testing Methods and Techniques (TWM).

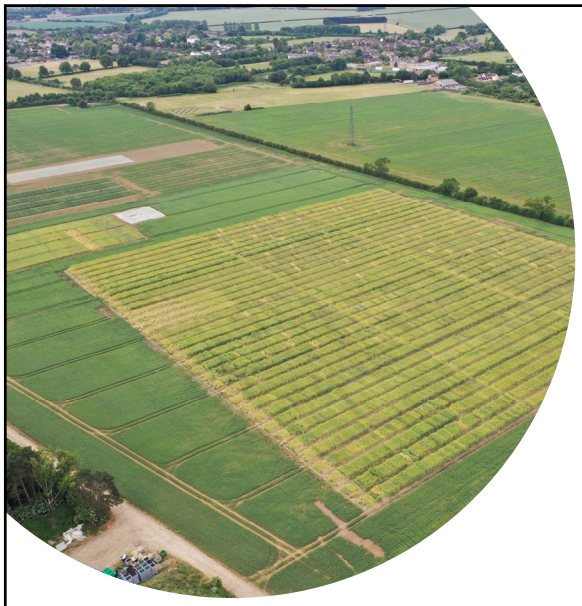
[Annex follows]

UAV-Based Field Phenotyping in the United Kingdom Agricultural DUS testing

Alex Talibudeen - United Kingdom

UPOV TWM/2 (2024)

1



UAV/Drones

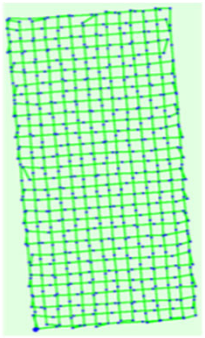
Low-cost UAVs for image capture

UAV with RGB camera

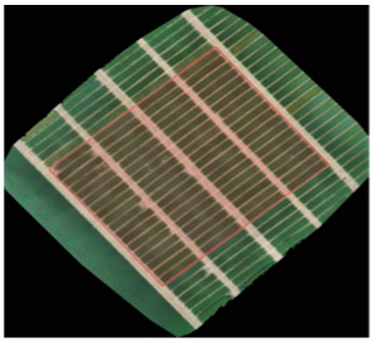
UAV with multispectral camera

2

Image Capture



Flight Plan



2D orthomosaic reconstruction

Detail image with ground control point (GCP)

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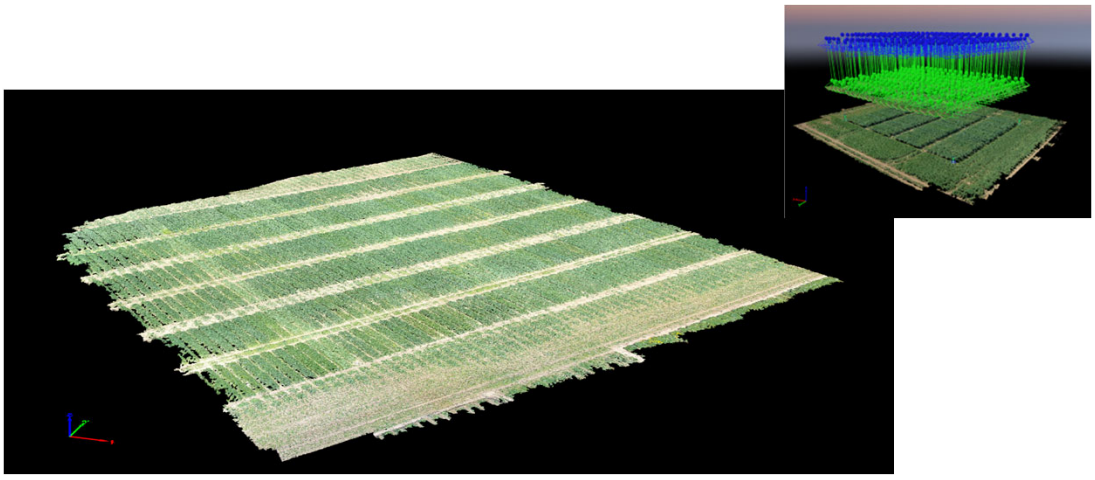
3

3D field-level representation



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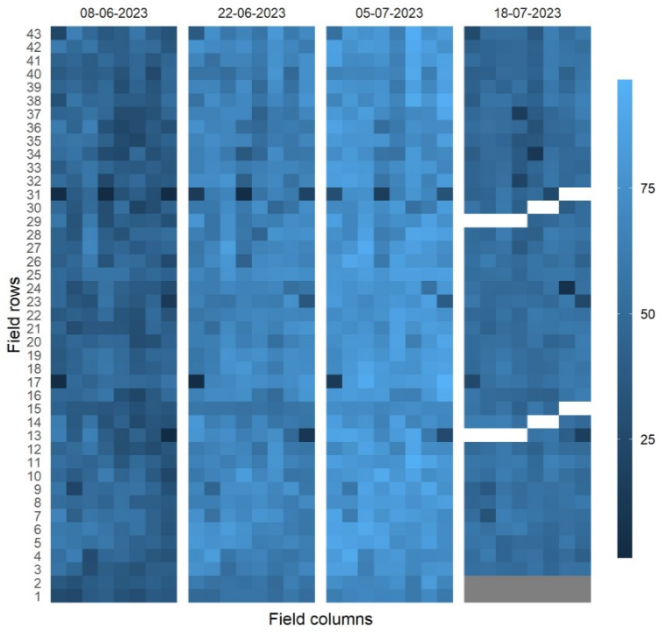
Plot based visual representation of plant heights

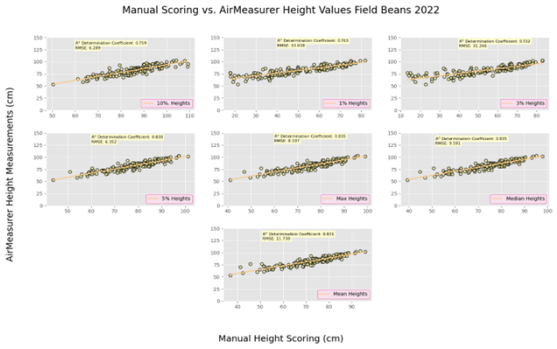


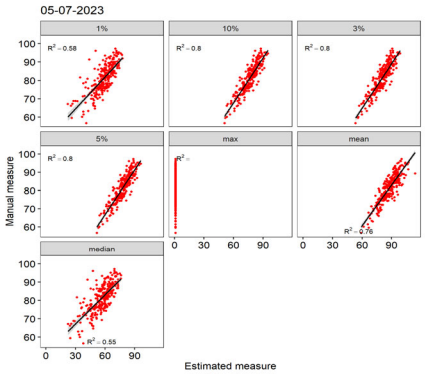
5

Plant height/length

Correlation between UAV plant heights and manually measured plant lengths (cm)
Field Bean (Vicia Faba L.)

- 2022 $R^2 = 0.83$
- 2023 $R^2 = 0.8$



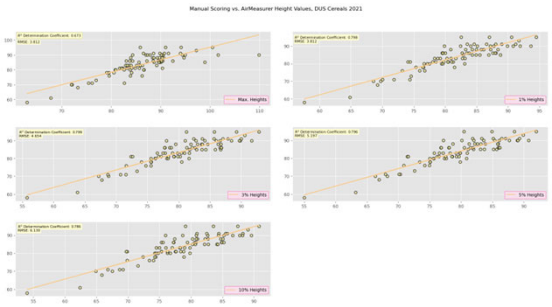


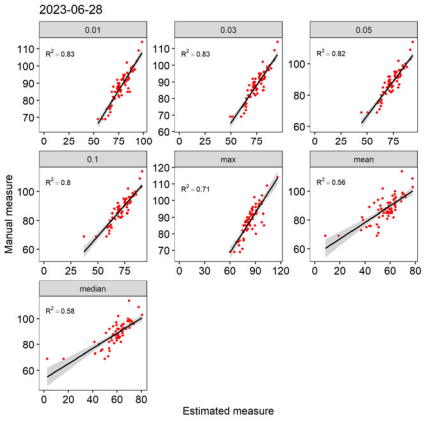
6

Plant height/length

Correlation between UAV plant heights and manually measured plant lengths (cm)
Spring Wheat (Triticum aestivum L.)

- 2022 $R^2 = 0.79$
- 2023 $R^2 = 0.82$



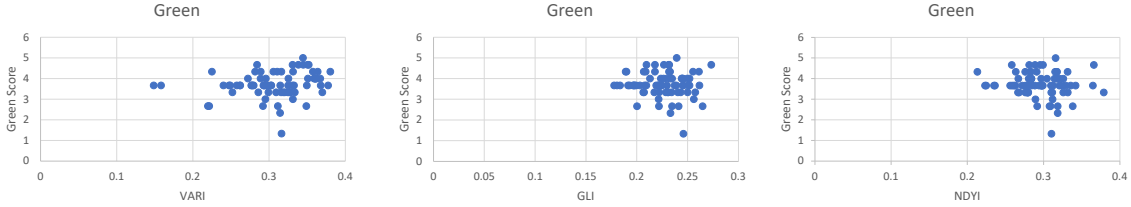


7

Green Colour assessment

Field Beans

- *RGB images used to investigate correlation between vegetative indices and green colour scores*



(*VARI* $\frac{(G-R)}{(G+R-B)}$ visible atmospherically resistant Index; GLI $\frac{2G-R-B}{(2G+R+B)}$ – green leaf index; NDYI $\frac{(G-B)}{(G+B)}$ = normalised difference yellowness index)

- *Multispectral imaging using red edge (RE) and near infrared (NIR) could provide additional information to investigate evaluation of green intensity further.*

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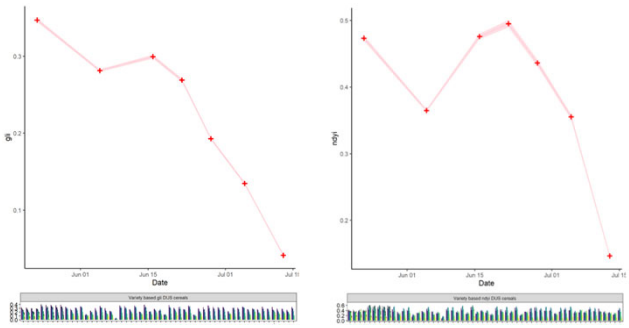
Vegetative indices in combination with canopy measurements could be used to establish growth profiles and assess timing of maturity.



GLI NDYI

Next steps

- *COYD comparison of manual vs UAV measurements*
- *Refine analysis pipeline to include a measure of standard deviations within plots and determine assessment of uniformity*
- *Investigate multiple flights at different growth stages to define growth profiles.*
- *Investigate the measurement of advanced vegetative indices from multispectral imaging.*

Conclusions

- *Good accuracy in detecting and estimating plant heights and correlation with manual plant length measurements good in example cases.*
- *Data capture considerations – flight timing/frequency and obstacles*
- *Potential for additional assessments using multispectral images*
- *Data storage costs involved can be high.*
- *Method of data capture may not be appropriate for all species or trial size*

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[End of Annex and of document]