

**Technical Working Party for Agricultural Crops****TWA/53/3****Fifty-Third Session  
Virtual meeting, May 27 to 30, 2024****Original:** English  
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**IMAGE ANALYSIS AND NEW TECHNOLOGIES IN DUS EXAMINATION***Document prepared by an expert 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 an expert from the United Kingdom, at the fifty-third session of the Technical Working Party for Agricultural Crops (TWA).

[Annex follows]



# *UAV-Based Field Phenotyping in United Kingdom Agricultural DUS testing*

Alex Talibudeen - United Kingdom  
UPOV TWA/53 (2024)

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## *UAV/Drones*

*Low-cost UAVs for image capture*



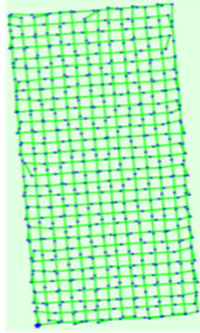
*UAV with RGB camera*



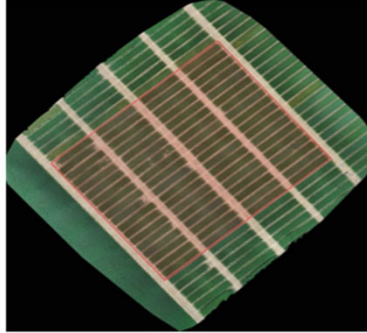
*UAV with multispectral camera*

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### Image Capture



Flight Plan

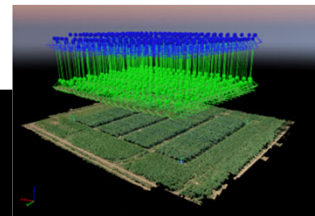
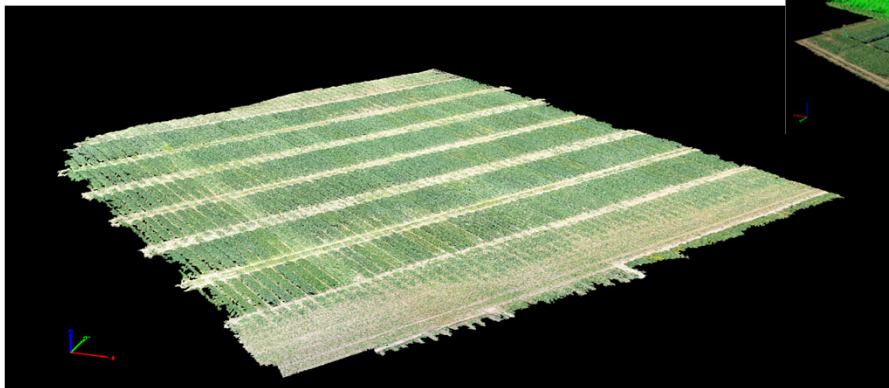


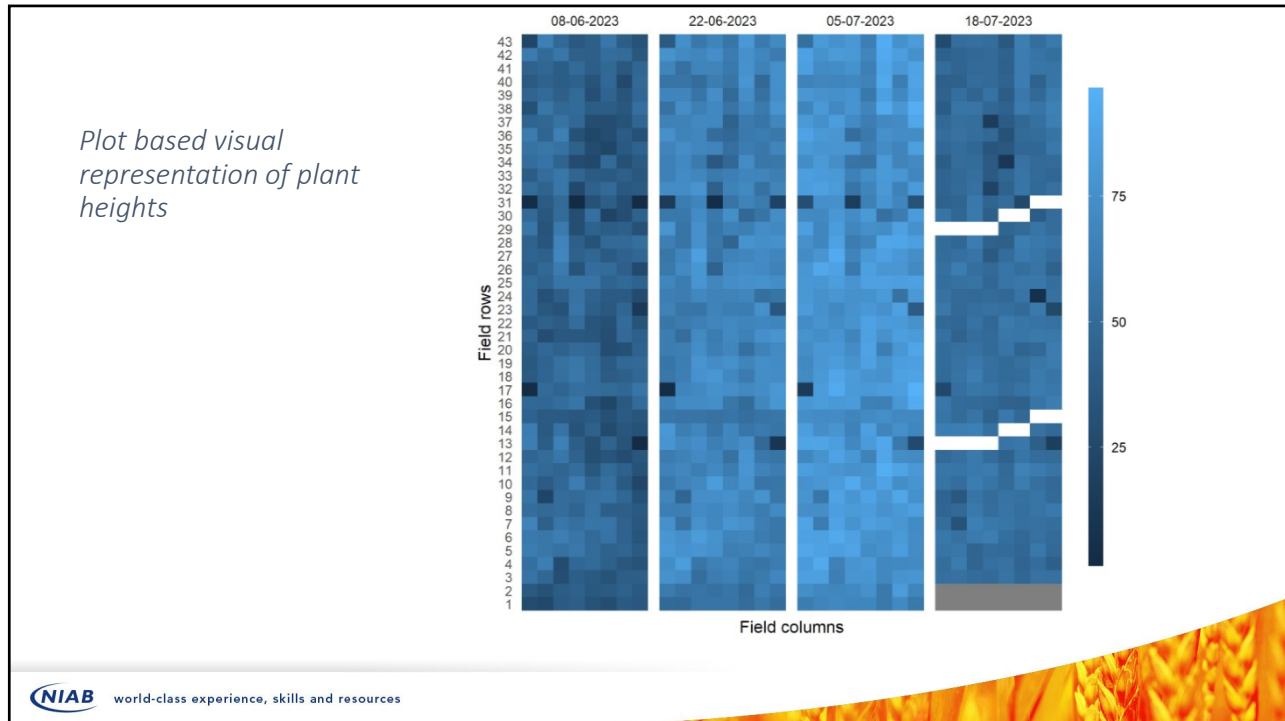
2D orthomosaic reconstruction



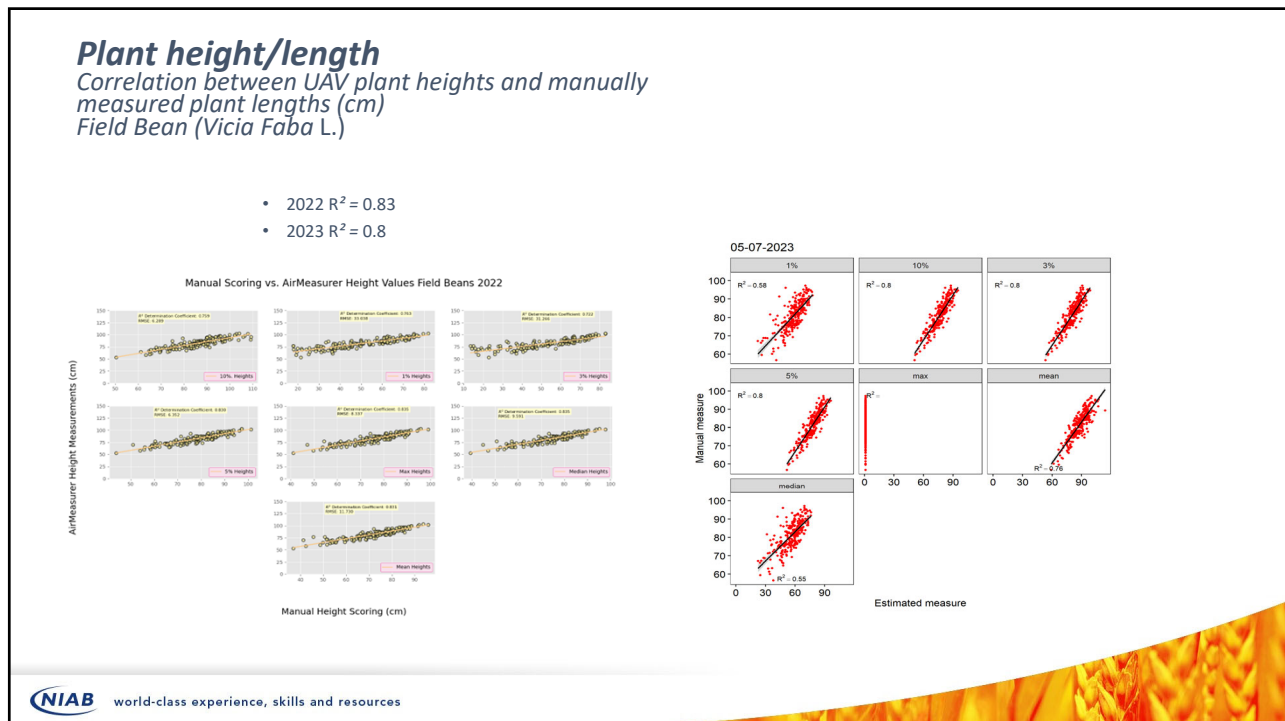
Detail image with ground control point (GCP)

### 3D field-level representation





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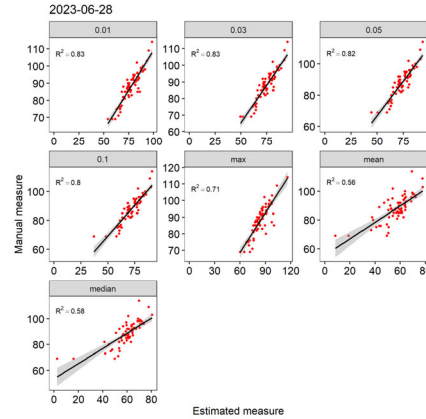
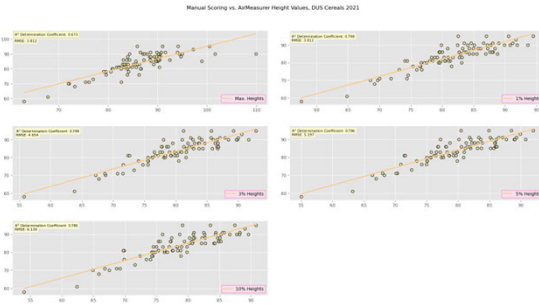


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## Plant height/length

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

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

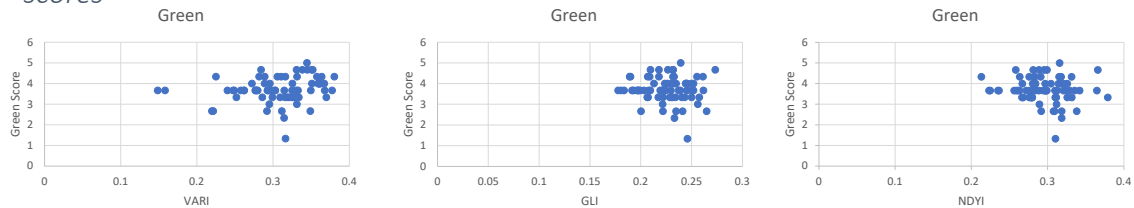


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## Green Colour assessment

Field Beans

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

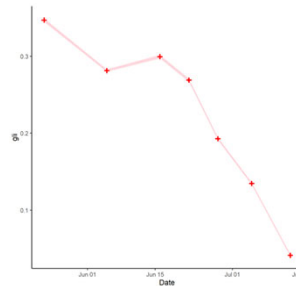


$(VARI = \frac{G-R}{G+R-B})$  visible atmospherically resistant Index;  $(GLI = \frac{2G-R-B}{2G+R+B})$  green leaf index;  $(NDYI = \frac{G-B}{G+B})$  normalised difference yellowness index

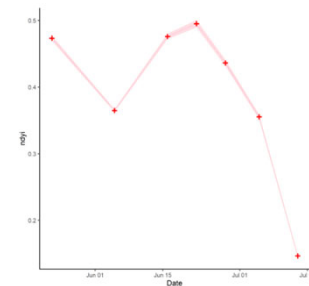
- Multispectral imaging using red edge (RE) and near infrared (NIR) could provide additional information to investigate evaluation of green intensity further.

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



GLI



NDVI

## *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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