1st Virtual Wheat CAP UAS Workshop – 27 January 2022

Amir Ibrahim, Texas A&M Regents Professor, Wheat breeder/geneticist

Jackie Rudd, Texas A&M Regents Professor, Wheat breeder/geneticist

Jinha Jung , Purdue Assistant Professor Civil Engineer/ Programmer

Mahendra Bhandari, Texas A&M, physiologist, Remote Sensing, Assistant Professor,

Anjin Chang, Texas A&M AgriLife, Engineer, UAS for precision ag & HTP

Juan Landivar-Bowles, Texas A&M AgriLife Corpus Christi, Professor, Agronomist, Center Director

Shuyu Liu, Texas A&M Professor, Geneticist

Shannon Baker, Texas A&M, Certified Pilot, Program Manager and Research Associate

Russ Garretson, Texas A&M Certified Pilot, PhD Student, Extension Program Specialist I

Jose L. Scott, Texas A&M Engineer/ Programmer, Graduate Assistant Research,

The UAS Objectives

- Implement a centralized BrAPI-compliant pipeline for UAS-HTP data processing, analysis and management to accelerate adoption and deposit into the T3 database.

Agenda

- 1:00 - 1:10 p.m. Brief introduction of the team and opening remarks - Amir Ibrahim
- 1:10 - 1:20 p.m. General overview of UAS-HTP at TX wheat breeding programs - Shannon Baker
- 1:20 - 2:00 p.m. Platforms and Sensors - Jinha Jung
- 2:00 - 3:00 p.m. Standard data collection procedures - Shannon Baker and Jinha Jung
- 3:00 - 3:10 p.m. Break
- 3:10 - 3:30 p.m. Raw data preparation before uploading in the Wheat CAP UAS Hub - Jose Landivar
- 3:30 - 3:55 p.m. Utilizing Wheat CAP UAS Hub - Mahendra Bhandari
- 3:55 - 4:00 p.m. Closing remarks - Amir Ibrahim
- 4:00 p.m. Adjourn

Pre-proposal Survey

- Surveyed the UAS capabilities of 19 public wheat breeding programs (https://www.triticeaecap.org/the-wheatcap-uas-survey/) prior to preparation of the proposal.
- Fifteen programs have some capacity but can further benefit from a centralized WheatCAP training and support for standardized data collection protocols, streamlined data processing, advanced analytics algorithm development, and big data storage.
- A centralized online platform developed by TAMU/Purdue UAS-HTP group (https://wheatcap.uashubs.com/) for data receiving, processing, and importation.
- A 2nd survey will be conducted to estimate the number of programs submitting data during year 1.

Initial data file

Year	EXPT	TEST_N	PLOT_ID	PLOT	BLOC	ENTRY	NAME	Is_private
2021	BI	DEMO	202112039001	1	1	1	Tascosa	No
2021	BI	DEMO	202112039002	2	1	2	Sturdy	No
2021	BI	DEMO	202112039003	3	1	3	Caprock	No
2021	BI	DEMO	202112039004	4	1	4	TAM W-101	No
2021	BI	DEMO	202112039005	5	1	5	TAM 105	No
2021	BI	DEMO	202112039006	6	1	6	TAM-107	No
2021	BI	DEMO	202112039007	7	1	7	TAM 110	No
2021	BI	DEMO	202112039008	8	1	8	TAM 111	No
2021	BI	DEMO	202112039009	9	1	9	TAM 112	No
2021	BI	DEMO	202112039010	10	1	10	TAM 113	No
2021	BI	DEMO	202112039011	11	1	11	TAM 114	No
2021	BI	DEMO	202112039012	12	1	12	TAM 115	No
2021	BI	DEMO	202112039013	13	1	13	TAM 205	No
2021	BI	DEMO	202112039014	14	1	14	TAM 304	No

Unmanned Aerial System (UAS) data processing pipeline

UAS data collection

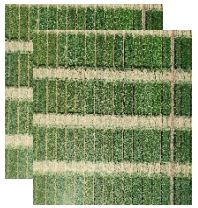
Level 0
Raw UAS data

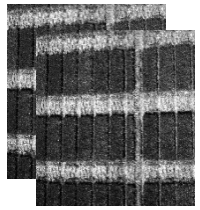
Level 1
Model development
Orthomosaic
Digital Surface Model
Surface temperature model

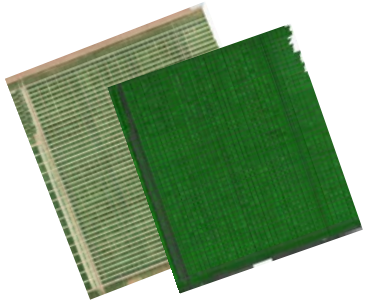
Level 2
Data extraction
Excess Green Index
Normalized Difference RedEdge Index
Normalized Difference Vegetation Index
Canopy cover, canopy height, canopy volume

RGB

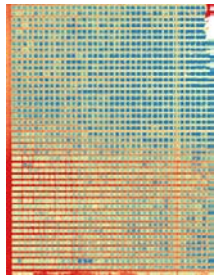
Multi-spectral







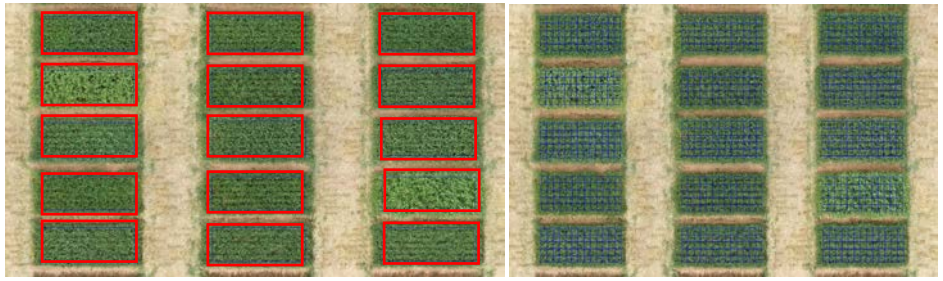
Orthomosaics



Digital surface model

Agisoft Metashape software

- Level 0 photos/folder upload
- Align photos
- Georeferencing
- Build dense point cloud
- Build digital elevation model
- Build orthomosaic
- Export orthomosaic
- Export digital surface model



Plot and grid boundaries to extract phenotypic data

WheatCAP UAS hub

- WheatCAP UAS hub will be hosted in the Oracle cloud system
- WheatCAP UAS will host all level of datasets (raw, processed products, and extracted phenotypic features)
- To maintain the data security, data will not leave the US
- The team applied for Oracle research cloud credits and is in discussion with Oracle team to receive the required storage, processing, and security capabilities needed ho host the Hub

UAS Hub Technical Support

- For technical support with the Wheat CAP UAS Hub, contact Jose L. Scott at: jose.landivarscott@ag.tamu.edu
- Office: (361) 265-9201
  - Access
  - Project creation
  - Data submission
  - Data download
  - Etc.