Cloud-based application for citrus precision agriculture using AI

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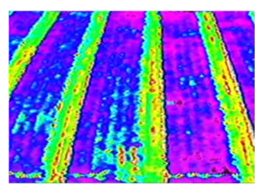
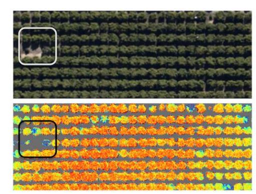
UAVs in Agriculture



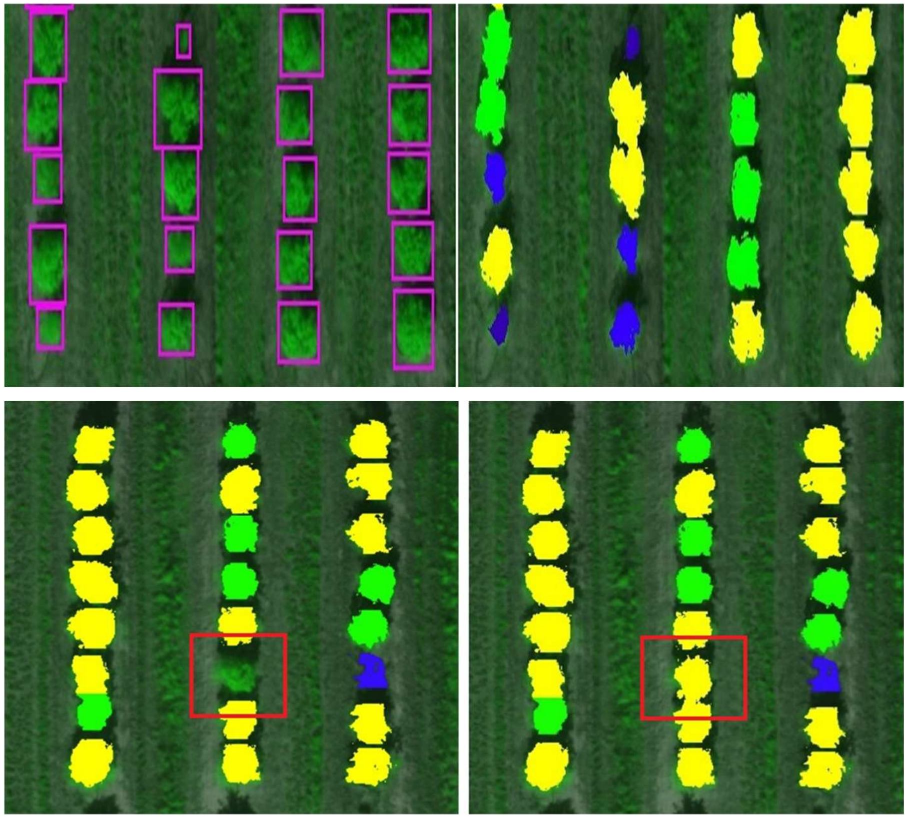




UAV-based Object Detection using Artificial Intelligence (AI)

Image Source: PrecisionMapper



Ampatzidis Y., and Partel V., 2019. UAV-based High Throughput Phenotyping in Citrus Utilizing Multispectral Imaging and Artificial Intelligence. Remote Sensing, 11(4), 410; doi: 10.3390/rs11040410.

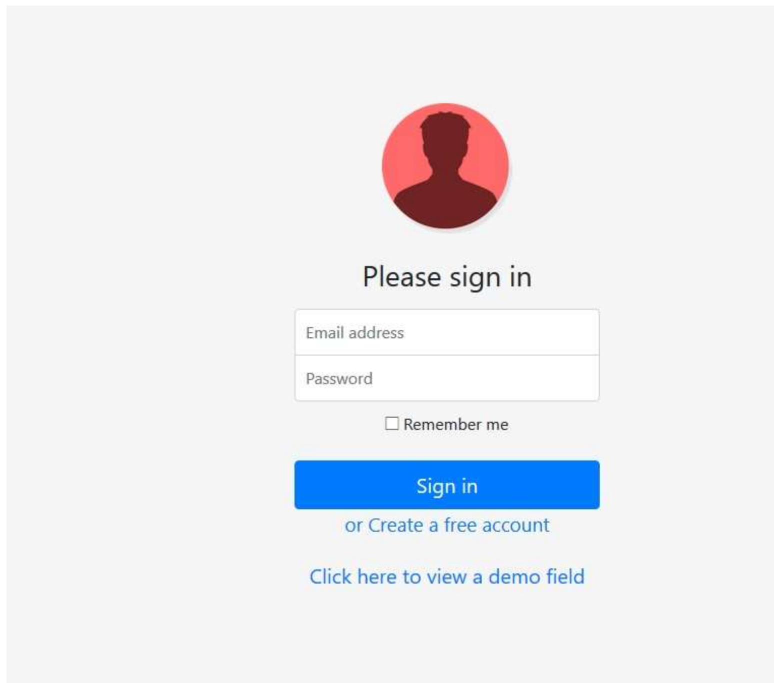
Ampatzidis Y., Partel V., Meyering B., and Albrecht U., 2019. Citrus rootstock evaluation utilizing UAV-based remote sensing and artificial intelligence. *Computers and Electronics in Agriculture*, 164, 104900, doi.org/10.1016/j.compag.2019.104900.

Agroview – sing in

Agriculture Intelligence

Awards

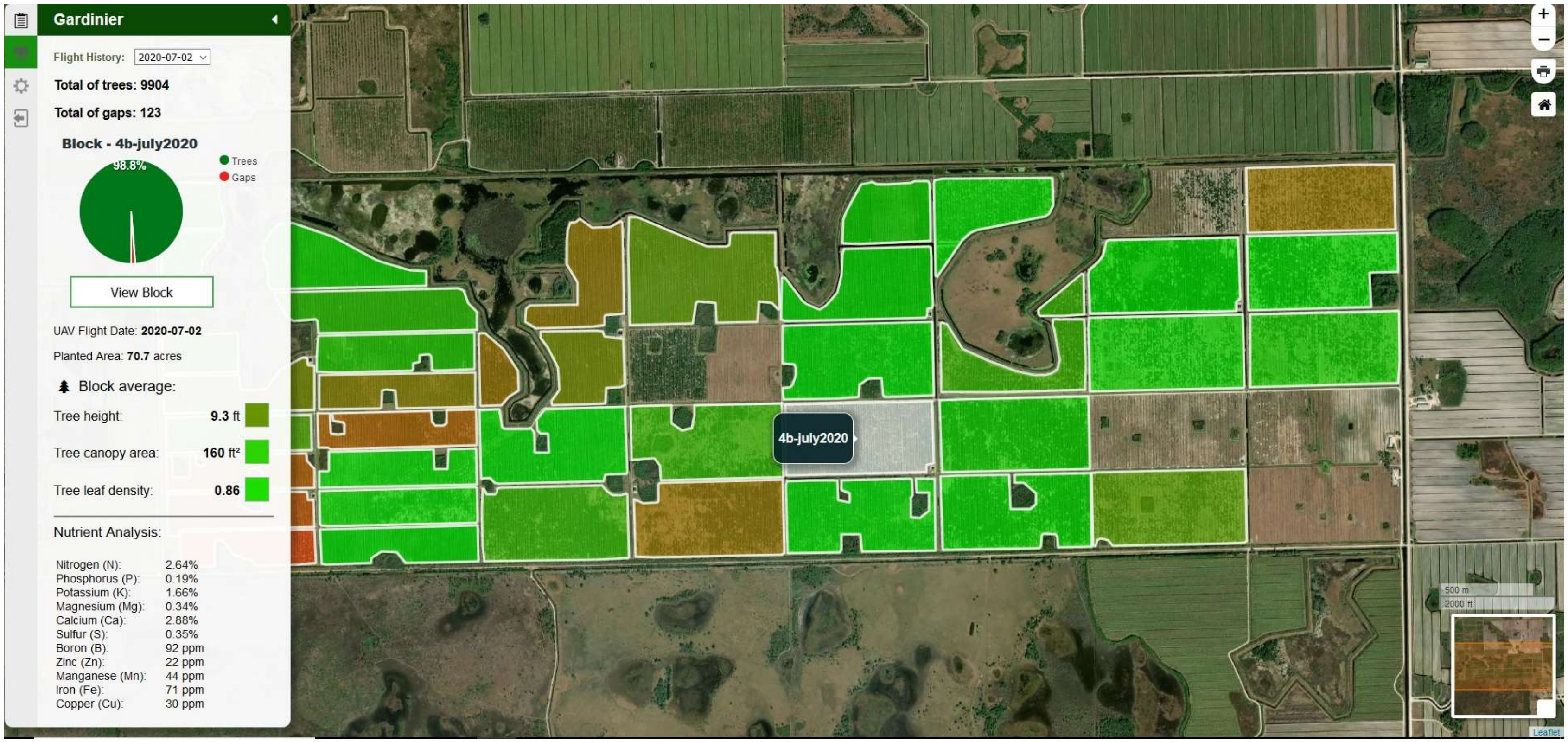
- 2020 UF Invention of the Year.
- 2021 ASABE AE50 winner (2020 top innovative new product).
- 1st Runner Up at the 2020 Florida Aerospace & Technology Competition.
- Finalist at the 2020 Cade Prize.



NVIDIA Applied Research Accelerator Award

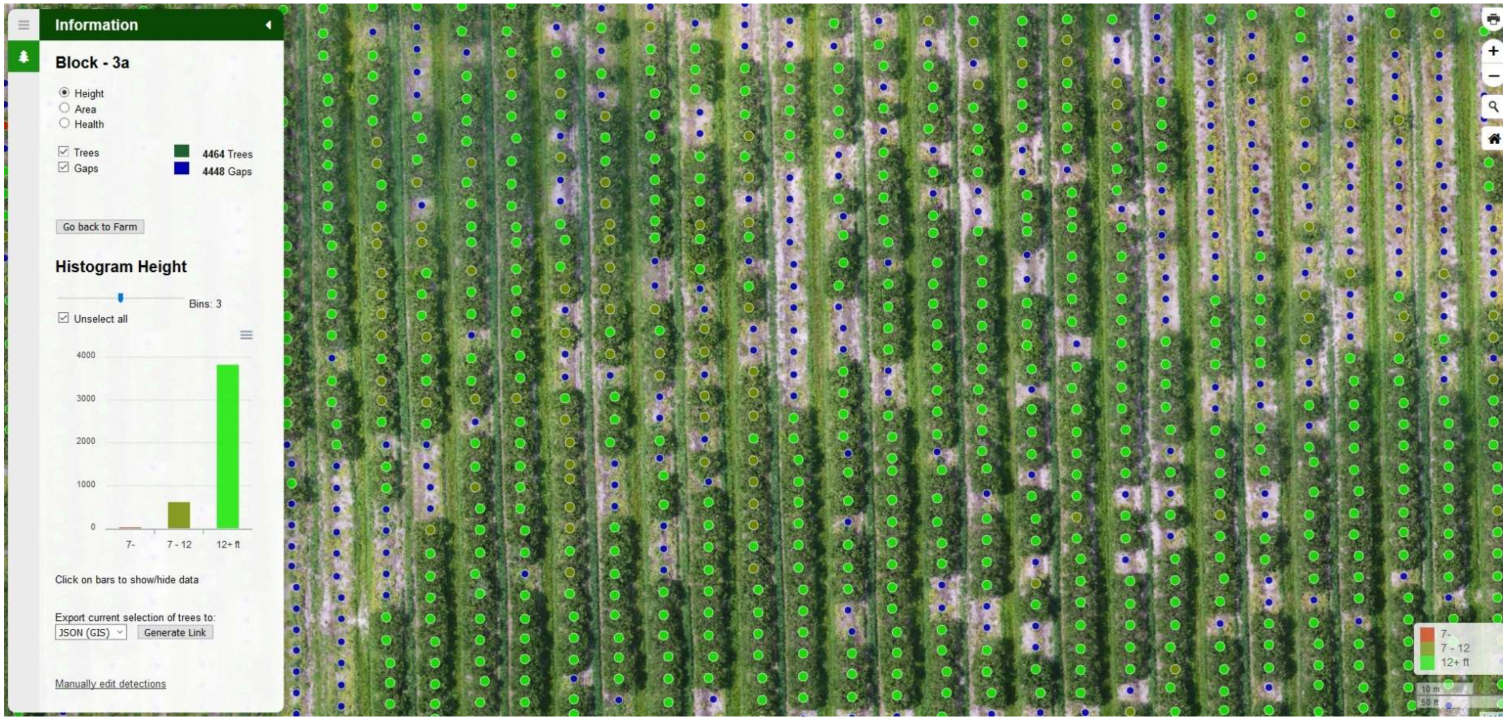
- UAV and ground-based high throughput phenotyping in citrus utilizing artificial intelligence. Huanglongbing Multi-Agency Coordination (MAC) Group. Duration: 8/1/2019 – 7/31/2021.
- UAV-based high throughput phenotyping in specialty crops utilizing artificial intelligence. Florida Specialty Crop Block Grant Program - Farm Bill (SCBGP-FB). Duration: 1/1/2020 – 8/31/2022.

Agroview – farm analytics



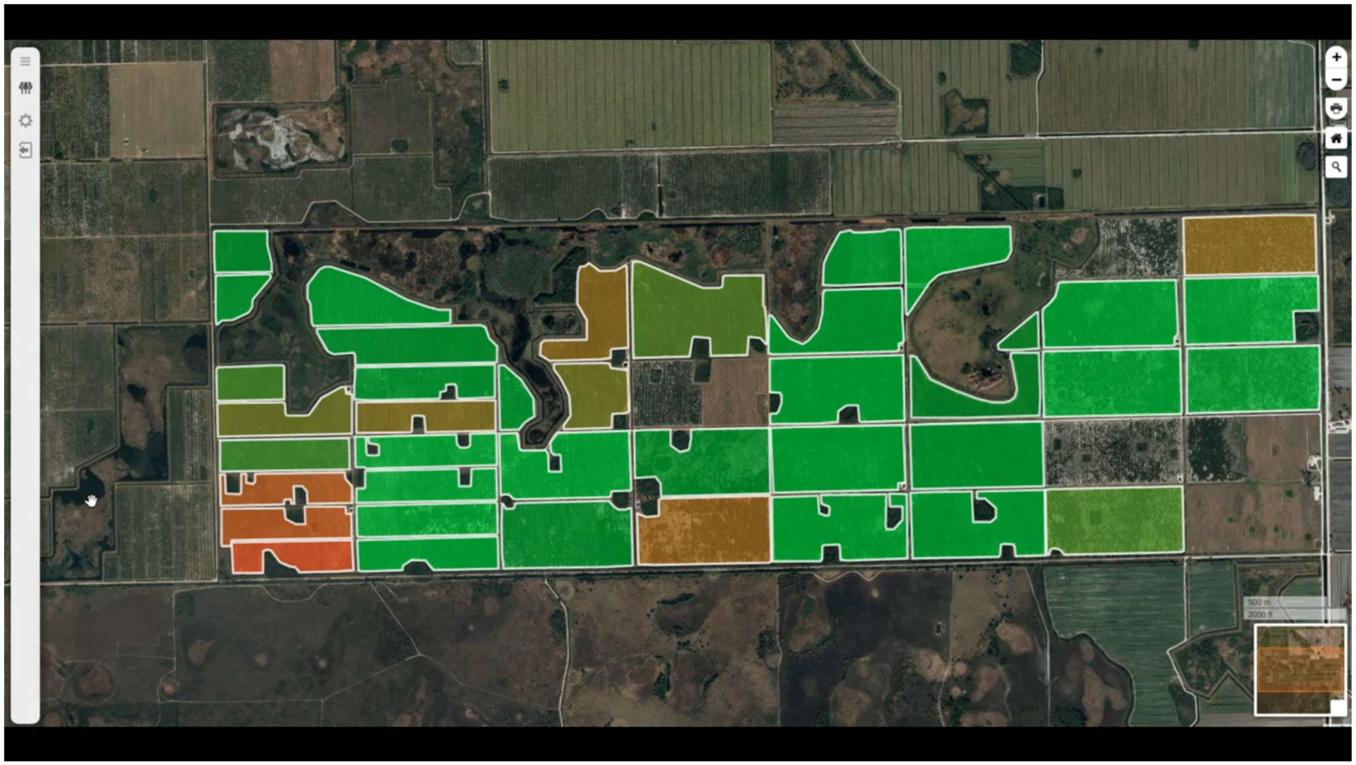
- Ampatzidis Y., Partel V., Costa L., 2020. Agroview: Cloud-based application to process, analyze and visualize UAV-collected data for precision agriculture applications utilizing artificial intelligence. *Computers and Electronics in Agriculture*, 174(July), 105157, doi.org/10.1016/j.compag.2020.105457.
- Costa L., Nunes L., Ampatzidis Y., 2020. A new visible band index (vNDVI) for estimating NDVI values on RGB images utilizing genetic algorithms. *Computers and Electronics in Agriculture*, 172 (May), 105334.

Agroview – field analytics



- ➢ UAV and ground-based high throughput phenotyping in citrus utilizing artificial intelligence. Huanglongbing Multi-Agency Coordination (MAC) Group. Duration: 8/1/2019 – 7/31/2021.
- ➢ UAV-based high throughput phenotyping in specialty crops utilizing artificial intelligence. Florida Specialty Crop Block Grant Program - Farm Bill (SCBGP-FB). Duration: 1/1/2020 – 8/31/2022.

Cloud-based application to process, analyze, and to visualize UAV collected data



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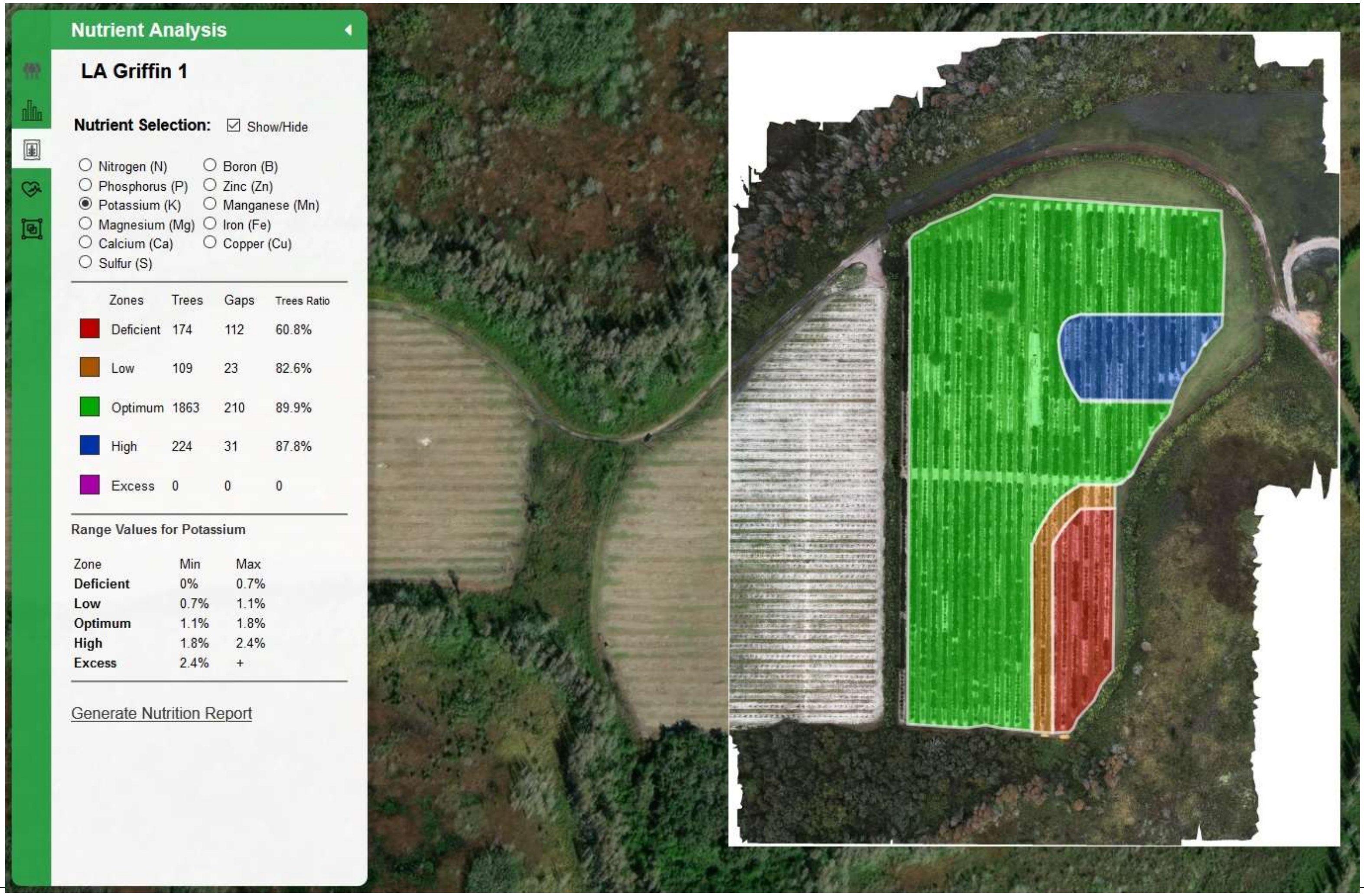
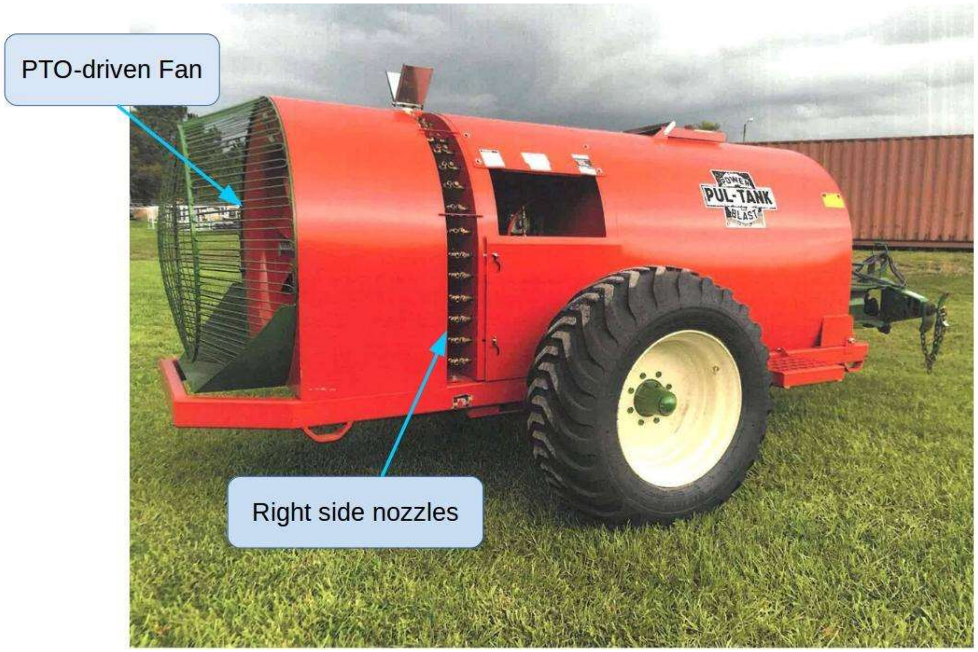
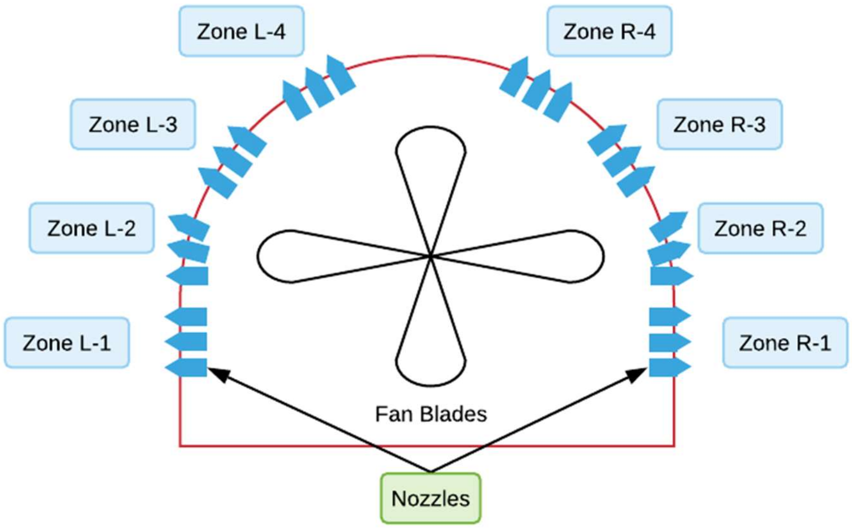
Best Management Practices
Agroview - Nutrient Management



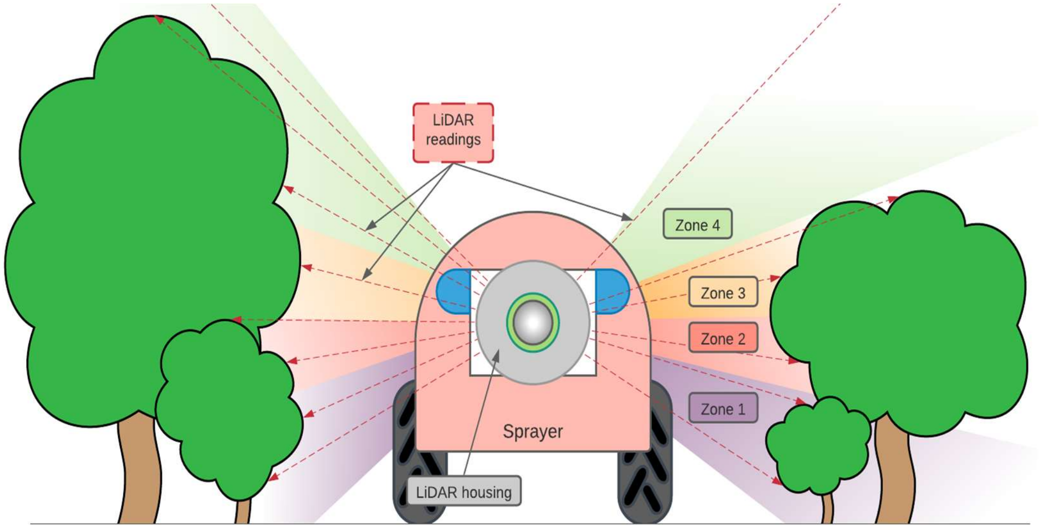
Novel Smart Tree Crop Sprayer

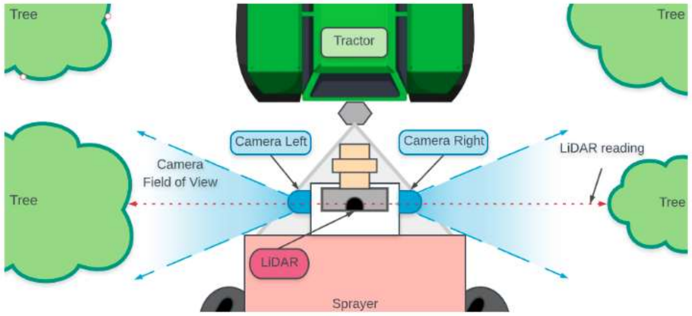




Smart and precision sprayer for tree crops. Florida Specialty Crop Block Grant Program - Farm Bill (SCBGP-FB). Duration: 1/1/2021 – 12/31/2022.

Novel Smart Tree Crop Sprayer



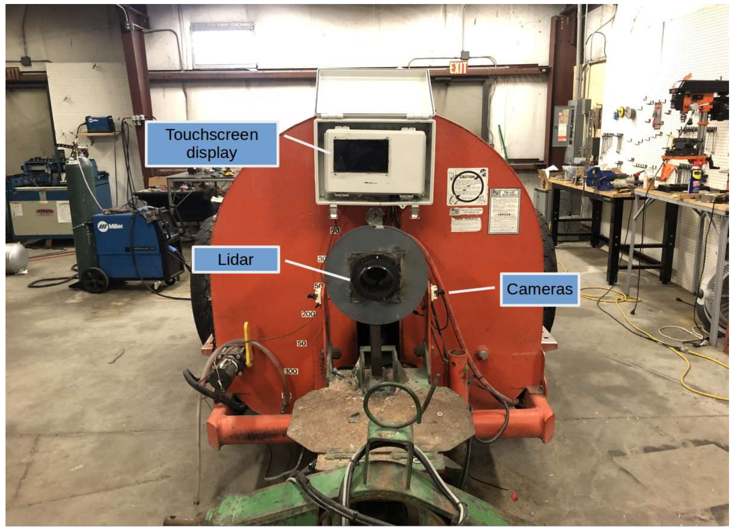


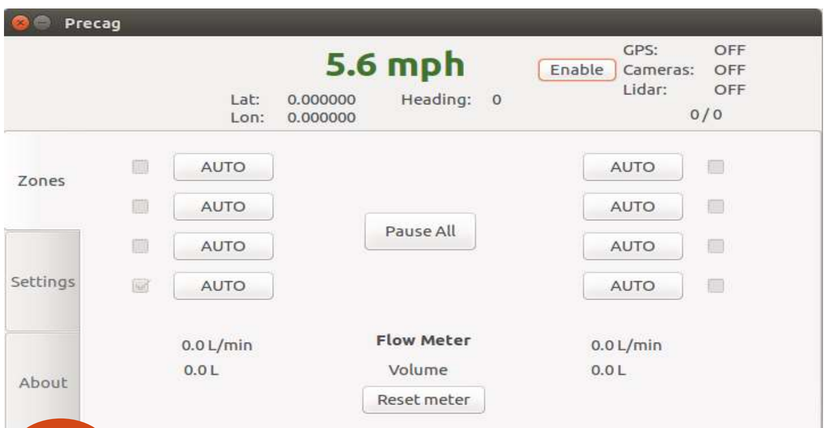
a) b)

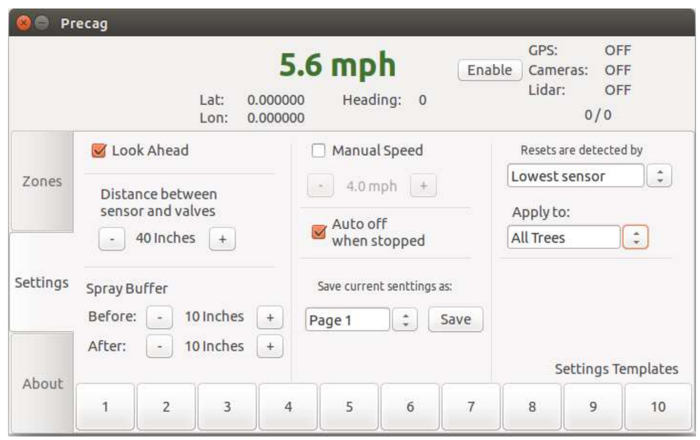
a) RGB camera installed on the sprayer, b) top view of the schematic of the positioning of cameras and LiDAR on the sprayer

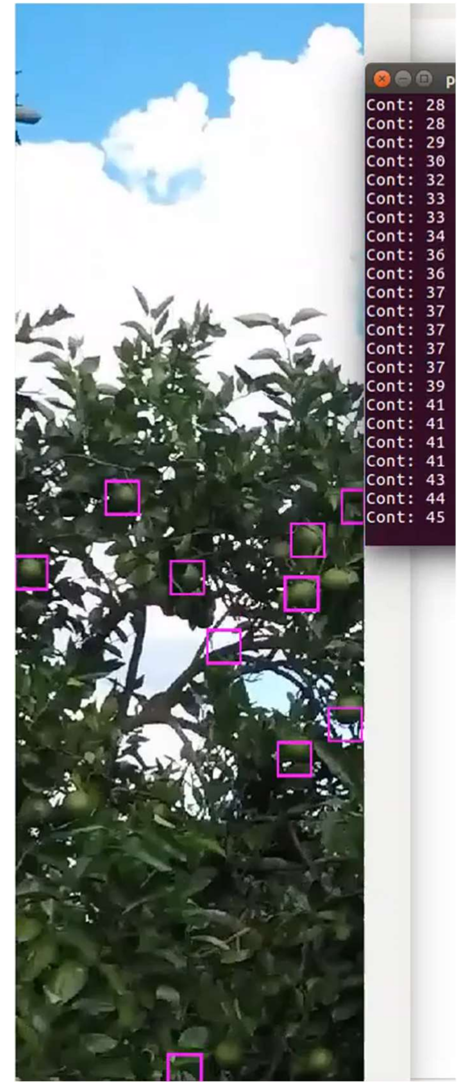
Smart Tree Sprayer using Artificial Intelligence (AI)

NVIDIA Applied Research Accelerator Award







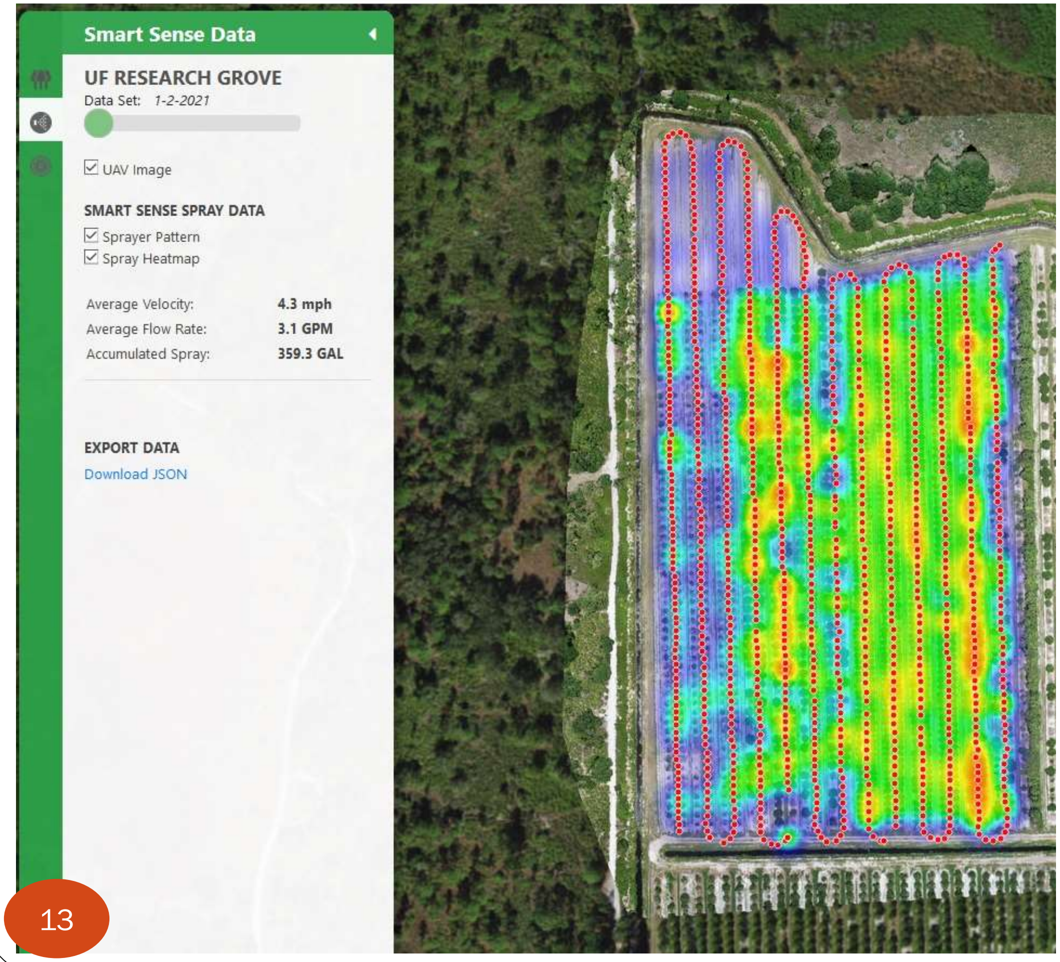


https://twitter.com/i/status/1042058065481269248

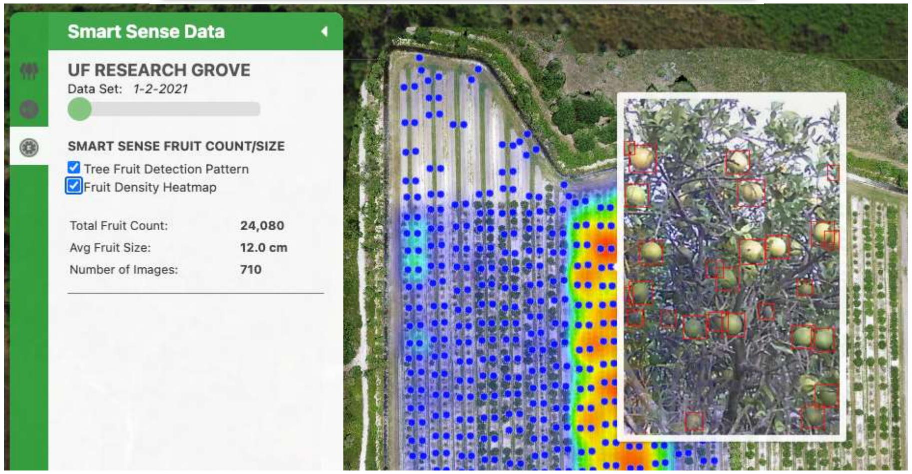
Smart Tree Sprayer using Artificial Intelligence (AI)

Smart Tree Sprayer using Artificial Intelligence (AI)

Spray path and spraying heat-map

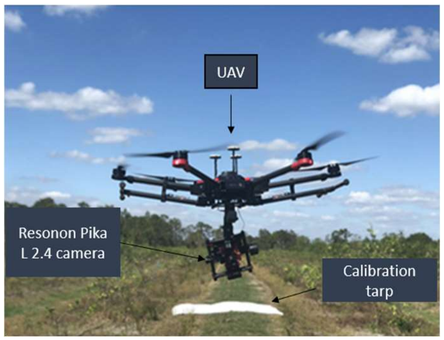


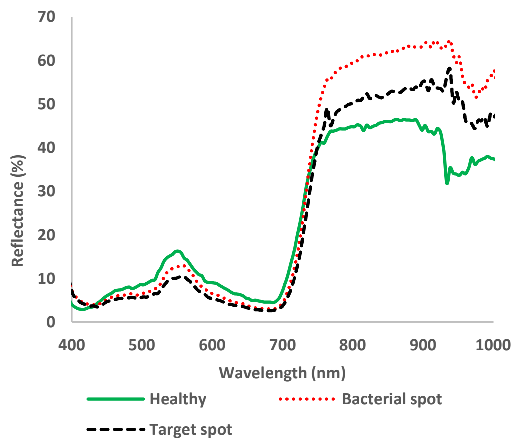
Fruit detection and fruit heat-map

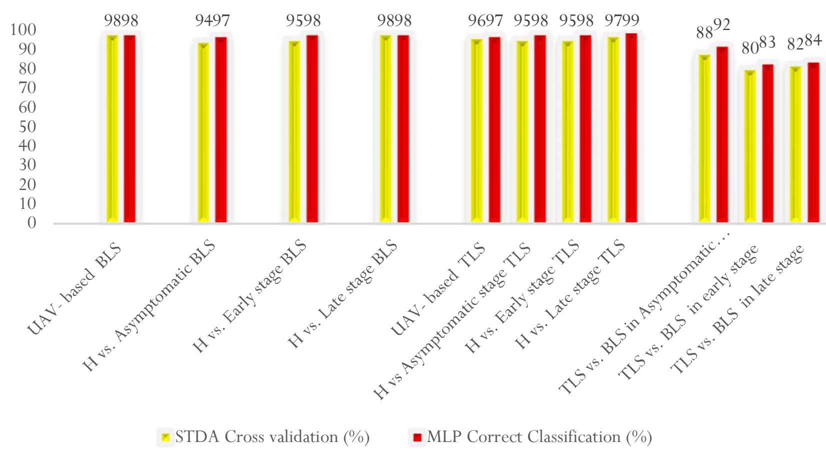


Detection of crop diseases utilizing UAV-based hyperspectral imaging and AI

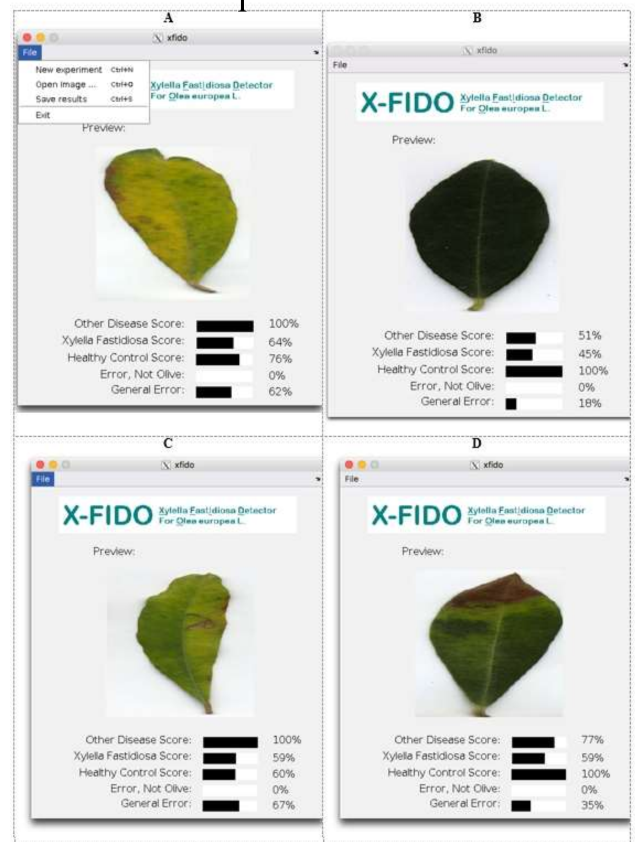
Collaborators:
Dr. Roberts
Dr. Batuman
Dr. Qureshi



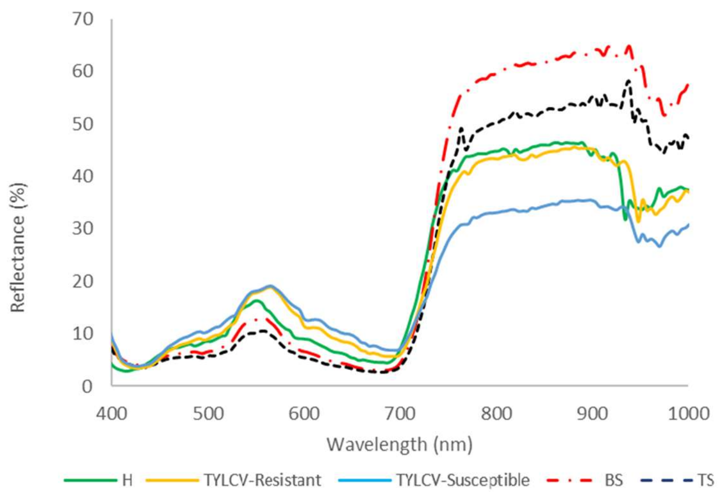




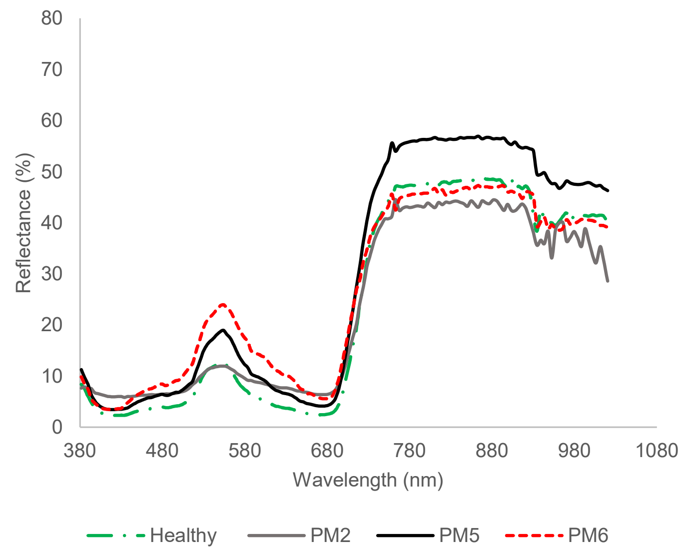
Application for detecting symptoms of plant diseases



UAV-based Disease Detection utilizing Hyperspectral Imaging and AI



Spectral reflectance signatures of *Tomato yellow leaf curl virus* (TYLCV, on susceptible and resistant tomato varieties), Bacterial Spot (BS), and Target Spot (TS) infected tomato plants.



Spectral reflectance signatures of healthy squash plants and Powdery Mildew (PM) infected plants in different disease development stages (asymptomatic, early and late stages).

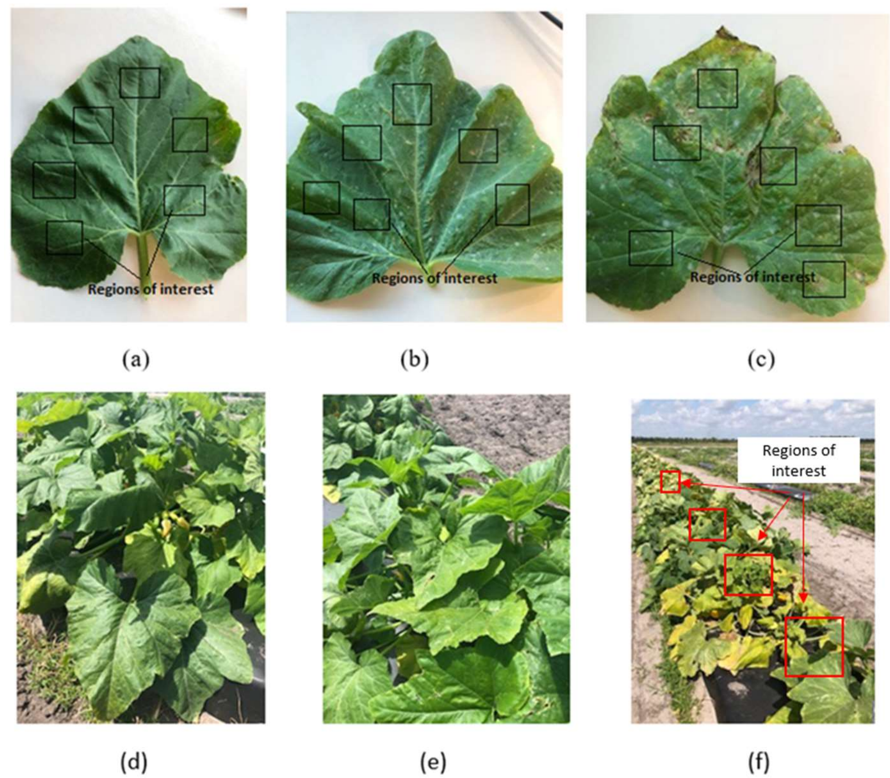
- Abdulridha J., Ampatzidis Y., Roberts P., Kakarla S.C., 2020. Detecting powdery mildew disease in squash at different stages using UAV-based hyperspectral imaging and artificial intelligence. *Biosystems Engineering*, 135-148; doi.org/10.1016/j.biosystemseng.2020.07.001.
- Abdulridha J., Ampatzidis Y., Kakarla S.C., Roberts P., 2019. Detection of target spot and bacterial spot diseases in tomato using UAV-based and benchtop-based hyperspectral imaging techniques. *Precision Agriculture,* (November) 1-24.

UAV-based Disease Detection utilizing Hyperspectral Imaging and AI

Squash plants in different development stages of the powdery mildew disease.

The indoor pictures with regions of interest are: a) healthy leaf (prior to any disease detection in field), b) early symptoms (low disease severity), and c) late stage (high disease severity).

Outdoor data collection in different disease development stages are d) asymptomatic plants, e) initial symptomatic stage (low disease severity), and f) the late PM symptomatic stage (high disease severity).



➢ Abdulridha J., Ampatzidis Y., Roberts P., Kakarla S.C., 2020. Detecting powdery mildew disease in squash at different stages using UAV-based hyperspectral imaging and artificial intelligence. *Biosystems Engineering*, 135-148; doi.org/10.1016/j.biosystemseng.2020.07.001.

UAV-based Disease Detection utilizing Hyperspectral Imaging and AI

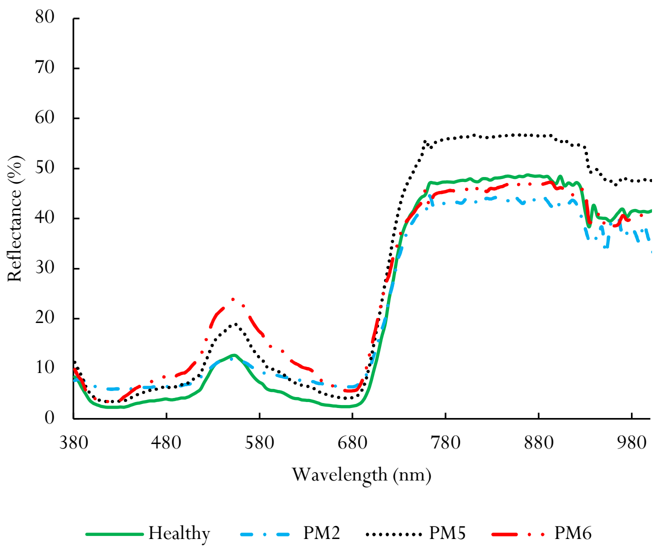
Laboratory spectral measurements of squash leaves using a benchtop hyperspectral imaging system.

UAV-based imaging data collection with a hyperspectral Resonon camera

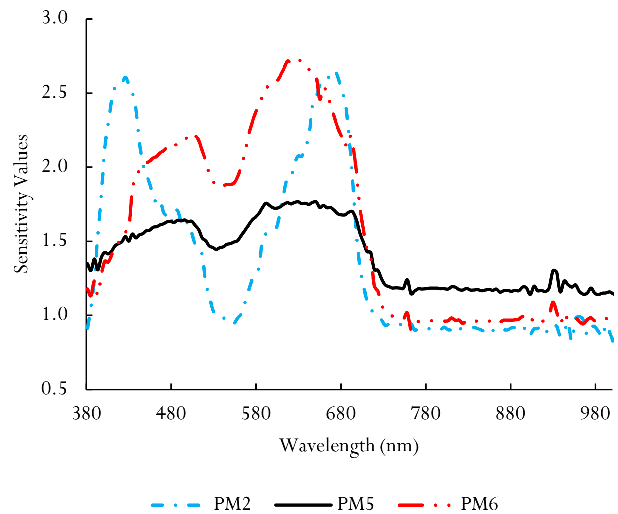
➢ Abdulridha J., Ampatzidis Y., Roberts P., Kakarla S.C., 2020. Detecting powdery mildew disease in squash at different stages using UAV-based hyperspectral imaging and artificial intelligence. *Biosystems Engineering*, 135-148; doi.org/10.1016/j.biosystemseng.2020.07.001.

UAV-based Disease Detection utilizing Hyperspectral Imaging and AI

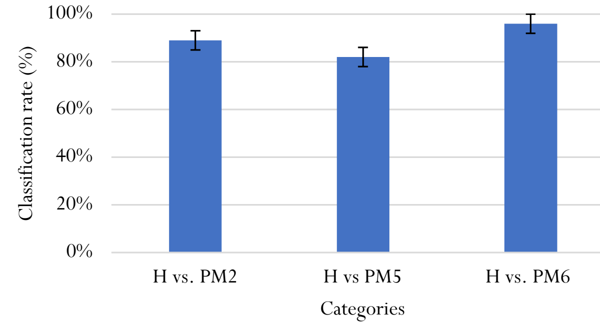
UAV-based Analysis



UAV-based spectral reflectance signatures of healthy squash plants and PM-infected plants in different disease development stages (asymptomatic, early and late stages).



UAV-based analysis: sensitivity values of PM-infected squash plants.



Classification results and standard error (RBF method).

- Abdulridha J., Ampatzidis Y., Roberts P., Kakarla S.C., 2020. Detecting powdery mildew disease in squash at different stages using UAV-based hyperspectral imaging and artificial intelligence. *Biosystems Engineering*, 135-148; doi.org/10.1016/j.biosystemseng.2020.07.001.

UAV-based EDIS Documentation

- Kakarla S.C., and Ampatzidis Y., 2018. ***Instructions on the Use of Unmanned Aerial Vehicles (UAVs) for Agricultural Applications***. EDIS, University of Florida, IFAS Extension.
- Kakarla S.C., De Morais L., and Ampatzidis Y., 2019. ***Pre-Flight and Flight Instructions on the Use of Unmanned Aerial Vehicles (UAVs) for Agricultural Applications***. EDIS, University of Florida, IFAS Extension.
- Kakarla S.C., and Ampatzidis Y., 2019. ***Post-Flight Data Processing Instructions on the Use of Unmanned Aerial Vehicles (UAVs) for Agricultural Applications***. EDIS, University of Florida, IFAS Extension.
- Ampatzidis Y., 2018. ***Applications of Artificial Intelligence for Precision Agriculture***. EDIS, University of Florida, IFAS Extension.

Thanks for your attention!

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UNIVERSITY of FLORIDA

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