Dr. Juan Landivar

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Physiologist, next generation can combine data collection and analysis with classical physiology. Leads remote sensing program in Corpus Christi.

Current research focus?

Wheat, cotton, potatoes… etc.

Potato in collaboration with Thiago Marconi

Dr. Landivar presented some results from the potato experiments

Experimental details:

2 planting dates, multiple varieties replicated 4X two planting dates, RCBD,

Used:

DJI Phantom4 Pro drone

RGB sensor

13 flight dates

Data collected

Excess Green Index (ExGI) which can be used as a NDVI surrogate

Canopy cover

Plant height

Canopy volume (3D)

Conclusions from study:

1. Late productivity led to higher yields.
2. Yield correlated with canopy volume

Q: How often do you collect ground truth data?

Plot level data… corn… weekly, ground truth biweekly, yield at the end. 6 plants per plot…

Landivar found that drones are more consistent and reliable than technicians…

Q: What are the major applications in Texas…

1. Measurement throughout the season…
2. Crop management, fungicide treatment in cotton for example
3. Yield training models
4. Marketing data
5. In season management for producers, growth regulators, harvest time,
6. Precision agriculture for cotton.

Phenotyping to support researchers and breeders

* How do genotypes responding to inputs…
* Some idea of biomass volume,
* Canopy light interception,
* Water loss as it relates to
  + canopy cover,
  + NEED efficiency terms
    - Water use efficiency, Photosynthetic efficiency
* Growth curve data is useful
  + When does genotype reach asymptote?
    - Extract 1st derivative.. rate.. when is inflection point, when does it reach maximum,
  + When does senescence occur?
* Rate at which canopy growth slows… growth or efficiency.. highly related to yield!!

Q: How valuable is UAV for research? Are there applications where value is greater? What are some applications where UAV has not provided the expected benefit?

Smart irrigation system development… Canopy cover, efficiency term that effects canopy covariate

2 terms

1. Energy, driving force for water loss
2. Decay term

Field based management zones for water use…

2 different locations, Lubbock Corpus

Light use efficiency

Water use efficiency

Adjusted rate of water loss … 10 x 10 grids… 1000 square feet of field

Great to be able to take temporal over entire field

Q: What drones and sensors do you use most in you program?

DJI Phantom 4 has been the workhorse

Now they use DJI Phantom 4 RTK -- multispectral

Program also has a DJI Matrice 100 and 200 for larger sensors

Phantom Pro is the best value now

Q: What are some considerations for field design?

1. Weed control is the main problem they face
2. Clean alleys
3. Clear separation between plots
4. Georeference in the beginning
5. Keep trials close in proximity (easier if data for multiple trials can be collected in 1 flight)

Q: How do you georeference your data?

Bhandari

RTK, GCP… tell me a bit about how you set up GCPs…

GCPs still used even with RTK

9 GCPs 3 sides 3 in the middle. Or 5, four on the corners and 1 in the middle

Not sure what instrument they use

VMAP

?? Not sure w

Q: What sensors are the most broadly applicable? RGB vs. Multispec

Bhandari

RGB is a good place to start…

Issue with mulispectral is radiometric calibration…

Landivar

Program has both.. multispectral need calibration..

Excess Green Index (ExGI) does a good job for most traits… many indices that you can use from RGB…

RGB is generally good enough

Easier to use, extraction more dependable

Q: What software do you use to generate orthomosaics?

Agisoft Metashape. They like this because it is easy to deploy on computer clusters

Pix4D is good too but lacks that server capability in the base product

Q: What software do you use to extract plot level data:

Custom scripts written in Python

Q: What are the most common mistakes you see when non-experts try to use this technology? What are the current bottlenecks to adoption of this technology? What are the major challenges you foresee to install UAV methods in a new research program?

Lack of standard data collection procedures… changes based upon platforms, sensors, georeference system. So many different sensors… so many different platforms… no other standard materials…

Wheat cap has standard protocols… still get questions…

Collecting data is first step, most people are successful at it. Snapshots…

Bottleneck after data collection… georeferencing.. what to do with all the data?

Stage 3 how to use AI… meta-analysis… Big benefit of remote sensing is temporal element.

WheatHUB… centralized data repository… that data scientists can use to

Q: What resources are needed to get more folks to adopt UAV? What can funding agencies (USDA, NSF, etc.) do to help make your UAV research program even more successful?

2 huge things in data scientists….

Need to collect huge amounts of data.. every square meter…

Data scientists developing analytical tools

\*\* Land grant university need to develop ways to bridge biological science with data science

There are some people that have both skills…

Good communication between engineers and data scientists…

Need to link both areas of expertise!

We need to have a way of communicating

Grant opportunities for building these things…

$50,000 for bringing these communities together… Developing multidisciplinary forum

Work groups… Tell engineers our problems and having them help!!!