Photo: SWFREC Vegetable farm, Field 6

Crop Safe Weed Management

in Vegetable Plasticulture Production

Ramdas Kanissery

Assistant Professor – Weed Scientist

Southwest Florida Research and Education Center
Immokalee, FL

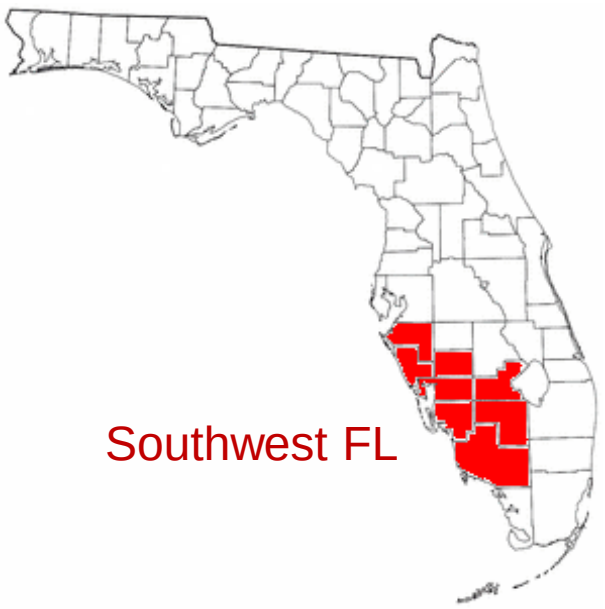
UF IFAS UNIVERSITY of FLORIDA

Horticultural Sciences

Horticulture production in SW Florida

- Warm humid climate
- Frequent rainfall

"Weed management is one of the main challenges faced by producers"



Weed management is one of the main challenges faced by producers

- Nutsedge infestation in plasticulture production

Yellow Nutsedge taking over the plastic beds
Immokalee, FL

Weed management in vegetable production

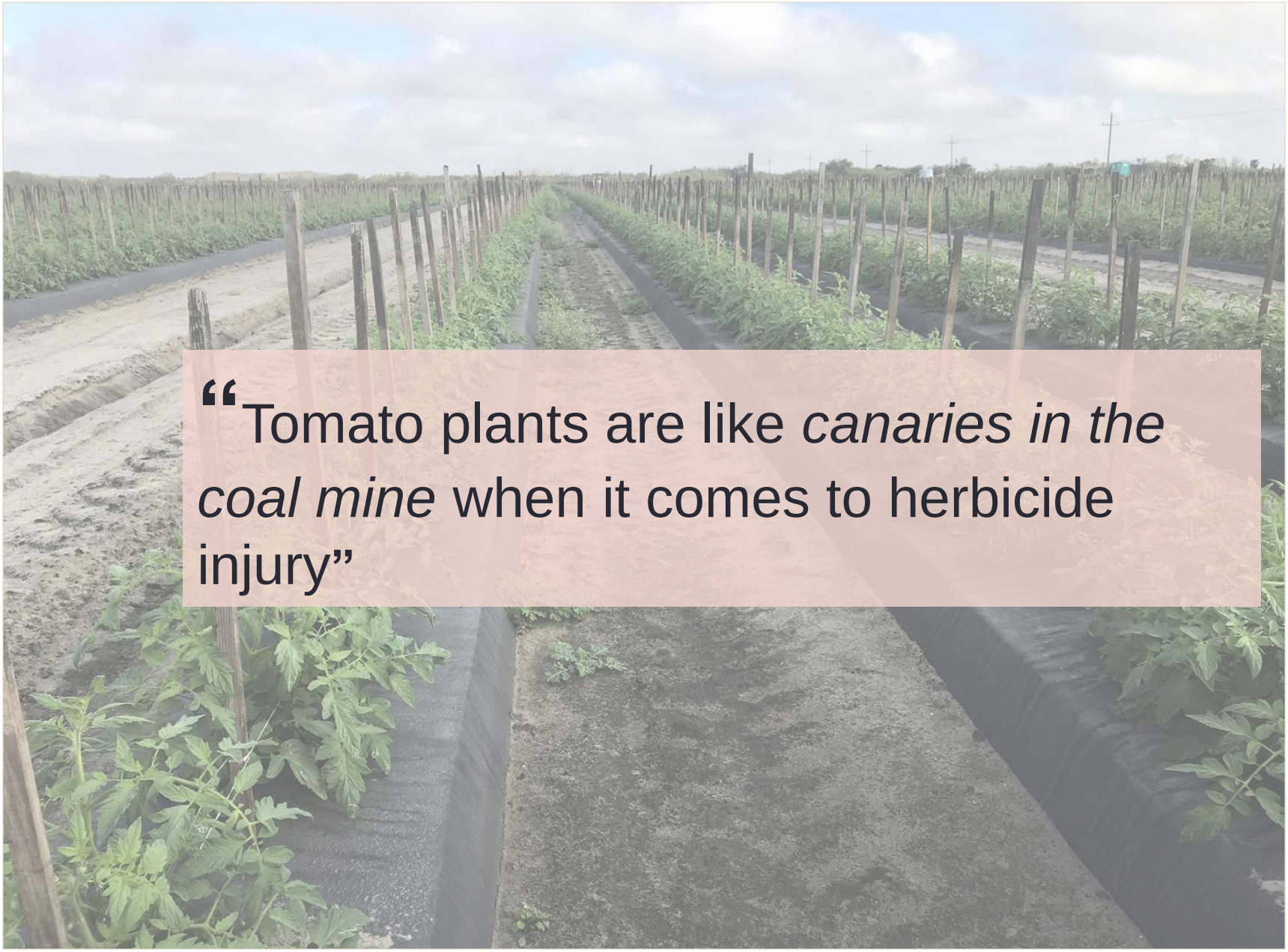
Weed Management tool box

- Prevention & Cultural
- Mechanical
- Biological
- Chemical
  - **Utilizing herbicides**

Weed management in vegetable production

Risk

- Impacts of herbicides on crop health and yield



"Tomato plants are like *canaries in the coal mine* when it comes to herbicide injury"

Weed management in vegetable production

Risk

- Impacts of herbicides on crop health and yield
  - **Off-target herbicide injury**
  - **Herbicide persistence**

Southwest Florida – diverse crop production

Herbicide spraying in pasture land for summer weed control

- **Citrus groves**
- **Pasture lands**
- **Vegetable farms**

Image credits: Dr. Joe Paschal, Texas AgriLife Extension Service

Southwest Florida – diverse crop production

Herbicide spraying in pasture land for summer weed control

- **Citrus groves** – Glyphosate
- **Pasture lands** – 2,4-D
- **Vegetables** - susceptible to herbicide drift from neighboring citrus groves, pasture lands etc.

Image credits: Dr. Joe Paschal, Texas AgriLife Extension Service

Herbicide injury in tomato plants

- Even small amounts from drift will cause injury in tomatoes

Glyphosate injury on tomato

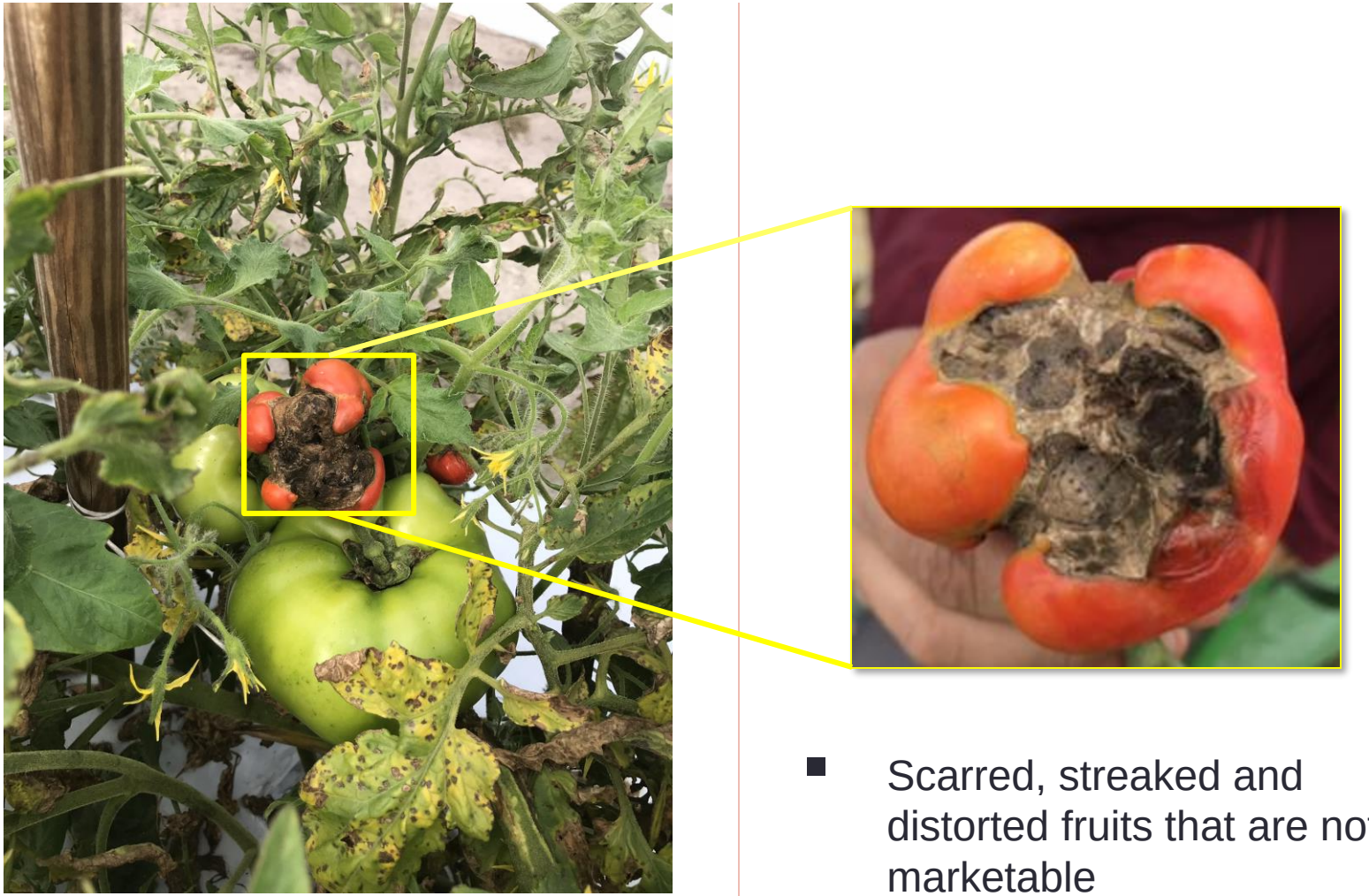
- Necrosis of growing leaves and shoots

Herbicide injury in tomato plants

2,4-D injury on tomato

- Twisting of shoots
- Cupping of leaves

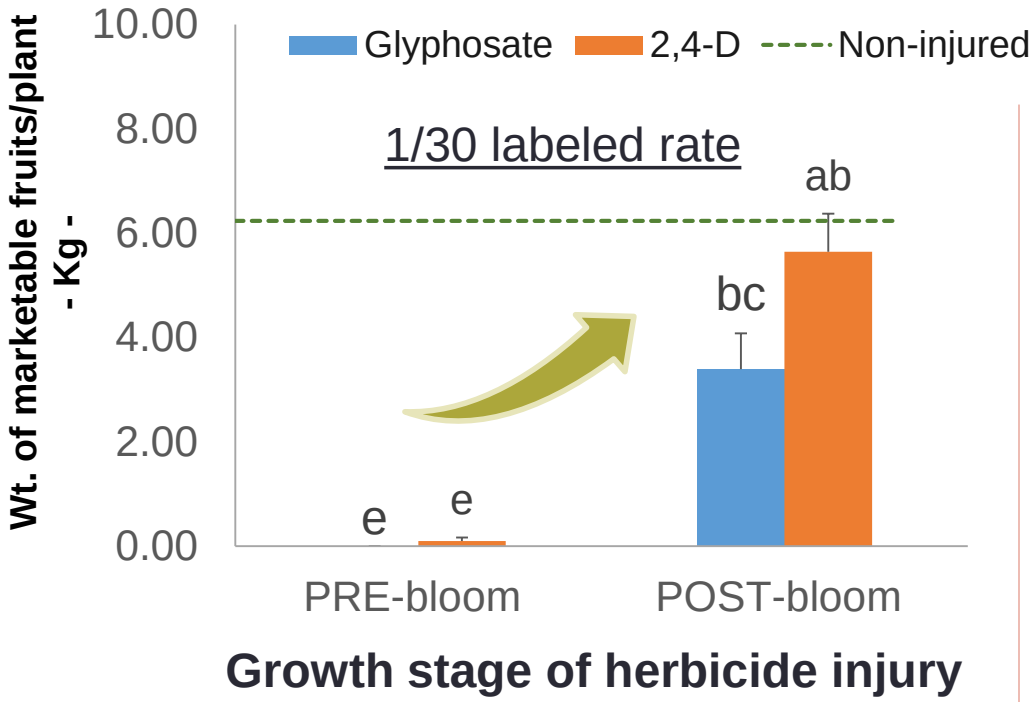
"Exposure to sub lethal doses of herbicide can potentially cause deformed fruits in tomato"



Example for Fruit deformity in tomato

- Scarred, streaked and distorted fruits that are not marketable

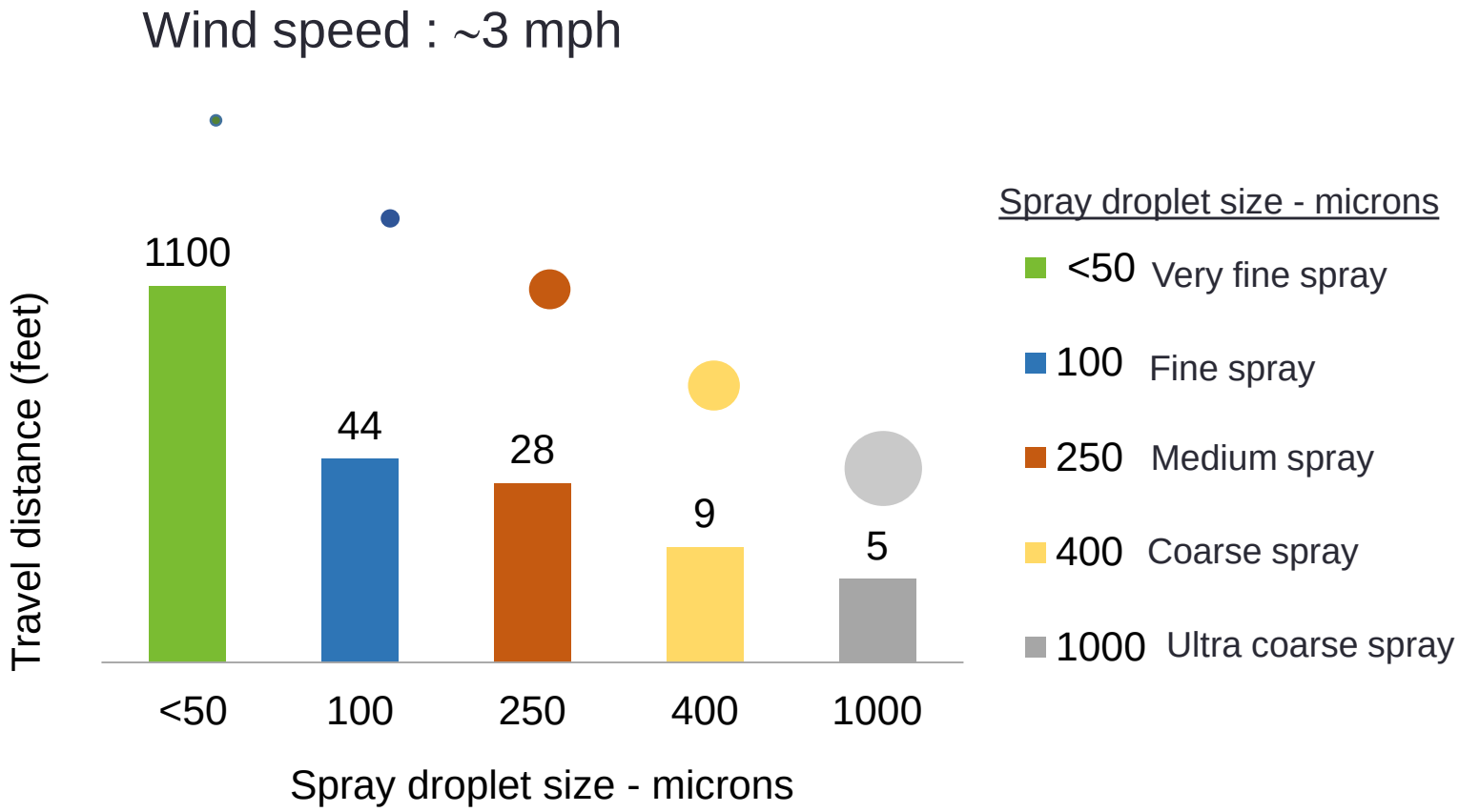
Effects of **growth stage of injury** on marketable yield in tomato plant exposed to sub-lethal herbicide dose



- Replication (n) = 5
- Mean comparison: Tukey's hsd (α 0.05)

The plants were able to produce marketable fruits when injury was occurred in an advanced growth stage i.e., after bloom

Lateral travel distance spray droplets travel



Smaller droplets can travel up to 3 miles!

Modified from Dexter, 1993, NDSU extension

Chances of drift will be MORE, at…

Herbicide drift increasing factors

- **Smaller SPRAY DROPLETS**
- **Higher SPRAY PRESSURE**
- **Smaller NOZZLE SIZE**
- **Higher WIND SPEED**
- **Lower HUMIDITY**
- **Using VOLATILE HERBICIDE PRODUCTS**

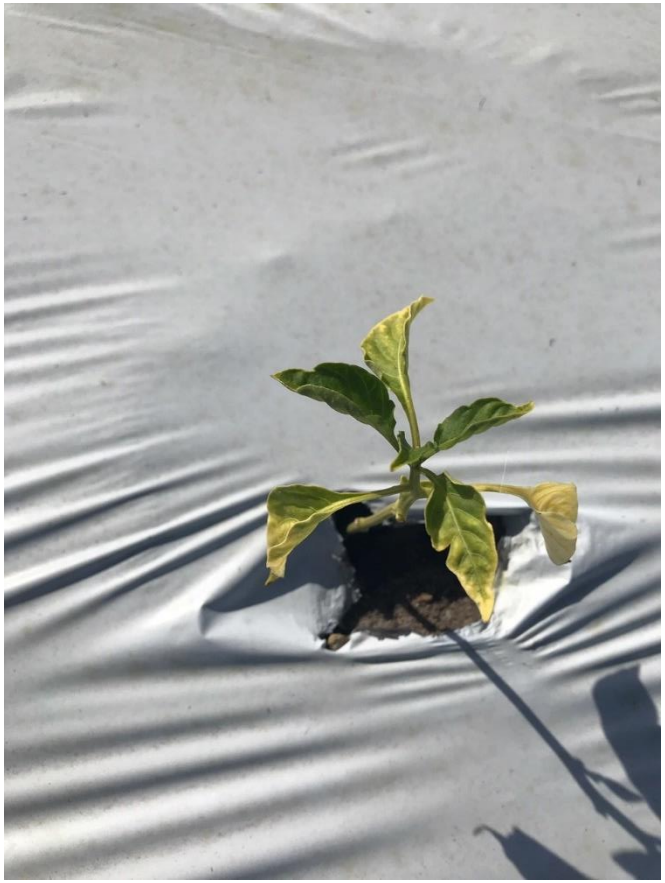
Weed management in vegetable production

Risk

- Impacts of herbicides on crop health and yield
  - Off-target herbicide injury
  - **Herbicide persistence**

Residual herbicide persistence in vegetables is a great concern for growers

- **Metolachlor** sprays on beds manage nutsedge effectively
- But, potentially injure the transplants

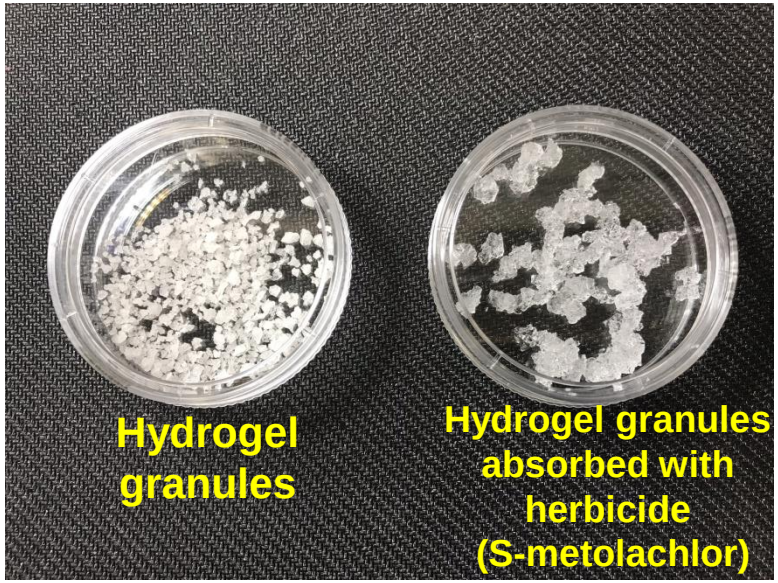


S-metolachlor (Dual Magnum): injured tomato transplant from metolachlor application under the plastic beds

Ongoing project at SWFREC

Reducing the crop-adverse effects of herbicides used under the plastic mulch

Utilizing **hydrogel technology** for slow-releasing herbicide under the plastic



Ongoing project at SWFREC

Hydrogels based herbicide application under the plastic in pepper production
Immokalee, FL

Ongoing project at SWFREC

Pre-emergent herbicide with hydrogel applied on bed under plastic

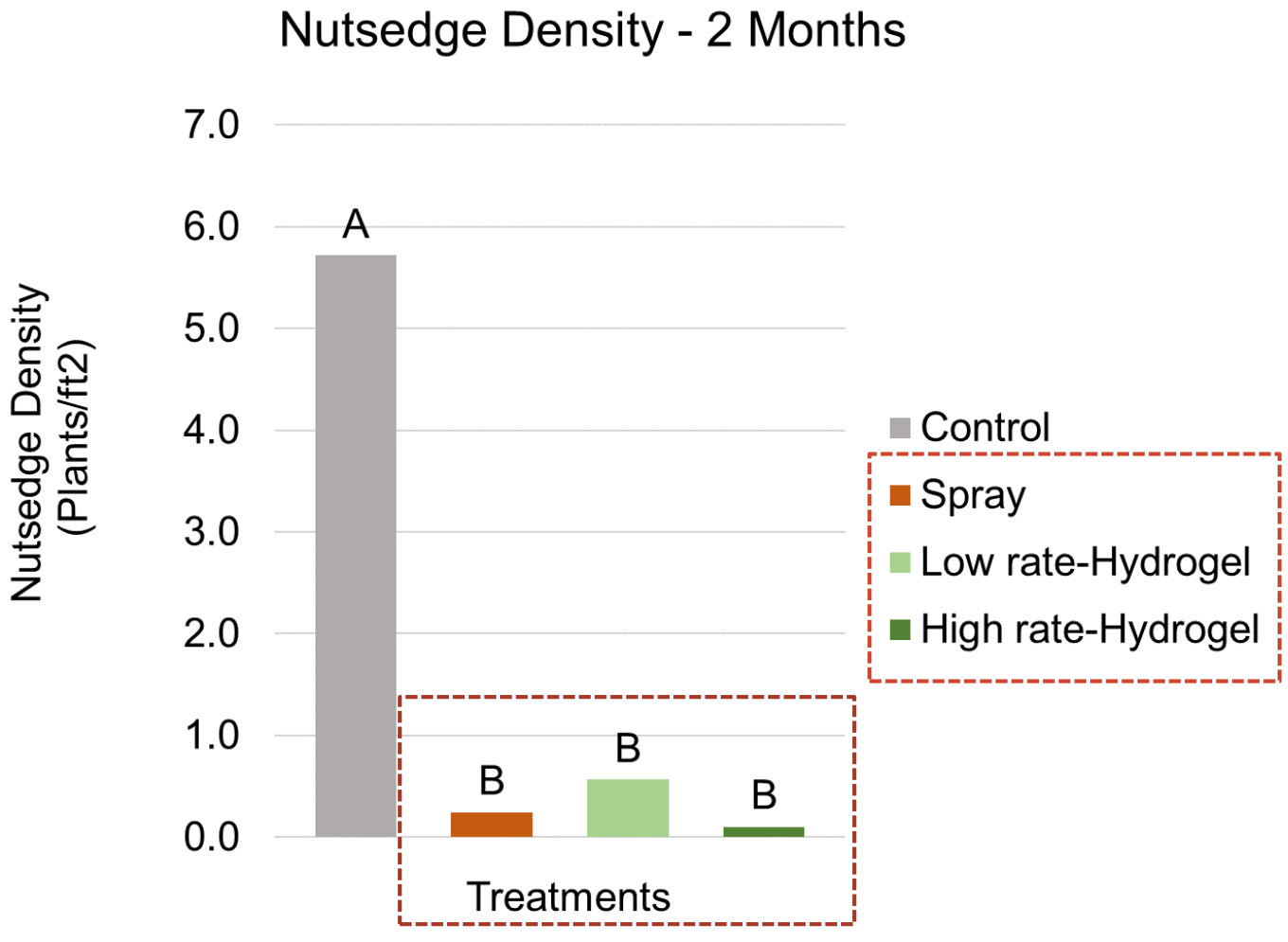
Untreated control

Ongoing project at SWFREC

Hydrogel as herbicide carriers in vegetable plasticulture

- Prelim results

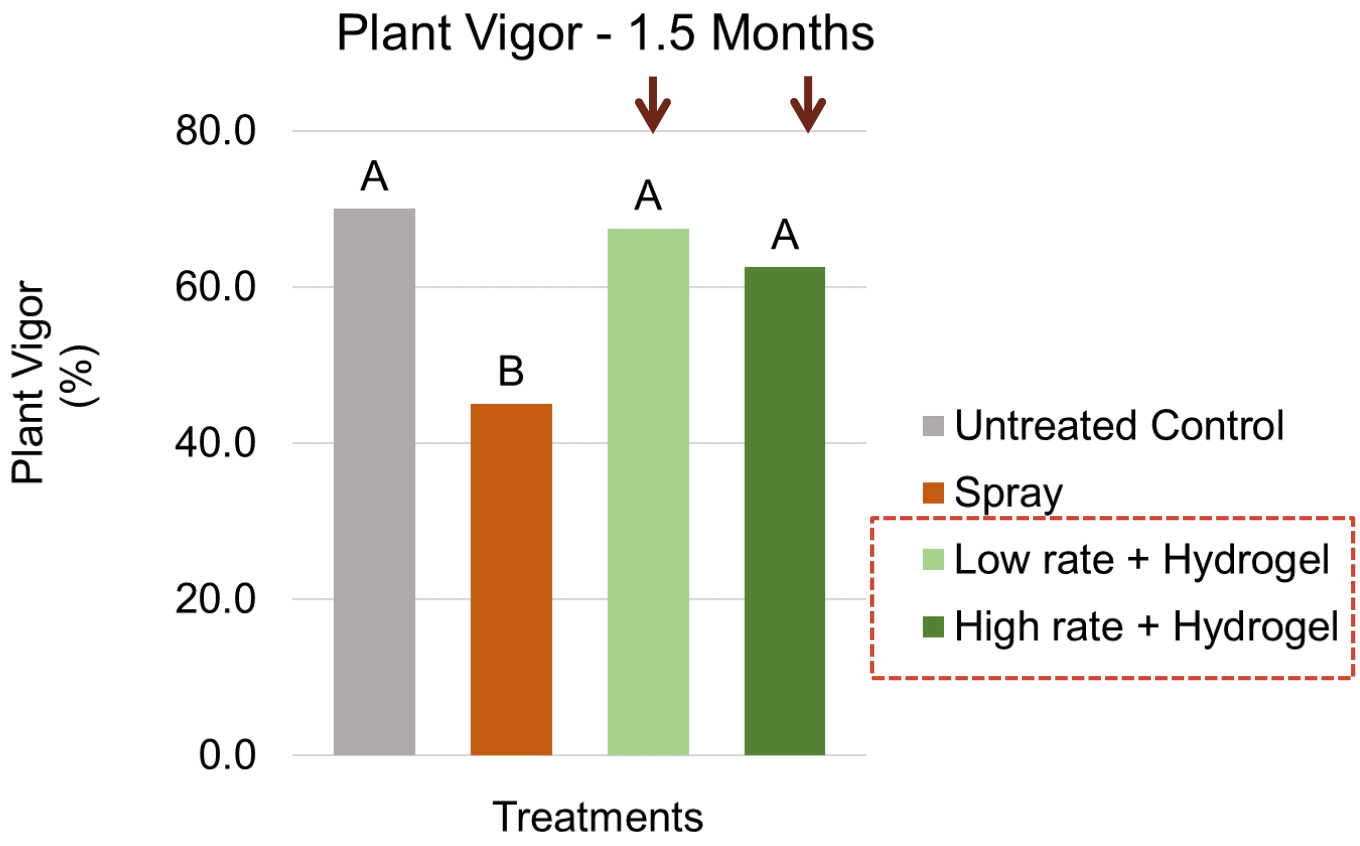
Both spraying and hydrogel based treatments were effective in suppressing Nutsedge



Hydrogel as herbicide carriers in vegetable plasticulture

- Prelim results

Hydrogel based treatments had better plant vigor



Technology assistance for informed weed management decisions in vegetable production

Weed management in vegetable production

Challenge

- Managing problematic weeds

Parthenium weed

- *Parthenium hysterophorus*
- False Ragweed, Whitetop weed

- Non responsive to many herbicides including glyphosate or paraquat

- Heavy seed setter

Parthenium weed

- *Parthenium hysterophorus*
- False Ragweed, Whitetop weed

- Non responsive to many herbicides including glyphosate or paraquat

Parthenium

Ragweed

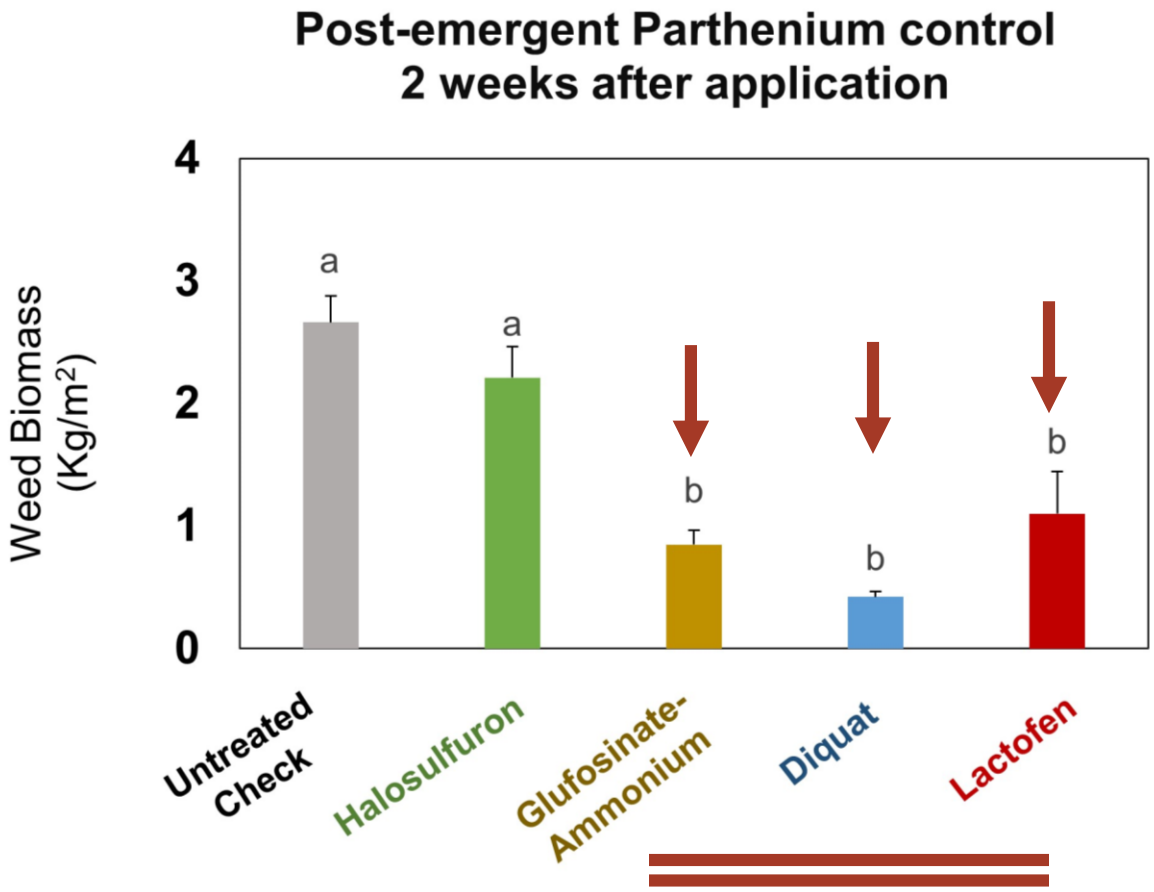
Sweet clover

Parthenium weed

Heavy parthenium infestation in vegetable farm

Immokalee, FL

Potential herbicide options studied for effective post-emergent management of parthenium

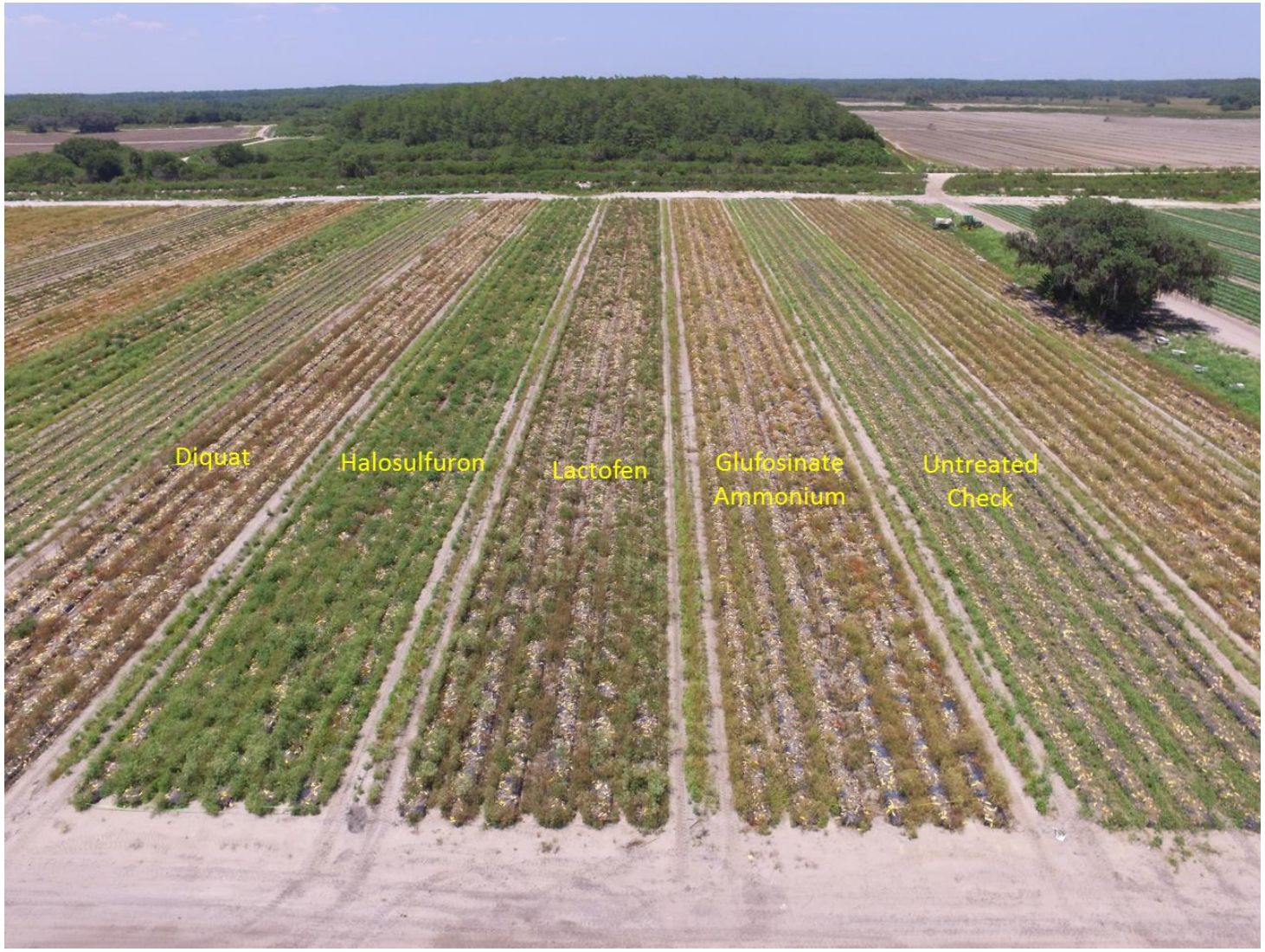


- Replication (n) = 5
- Mean comparison: Tukey's hsd (α 0.05)

Collaborators
Dr. Dittmar (HOS)
Dr. Boyd (HOS)

Managing problematic weeds in farms with large parcels of land

"A major challenge in assessing the efficacy of herbicide program in farms with large parcels of land - is to get a totality view of the treated area that would be very difficult to get from the ground"



Aerial view of parthenium weed control study in vegetable - Immokalee, FL - 2017

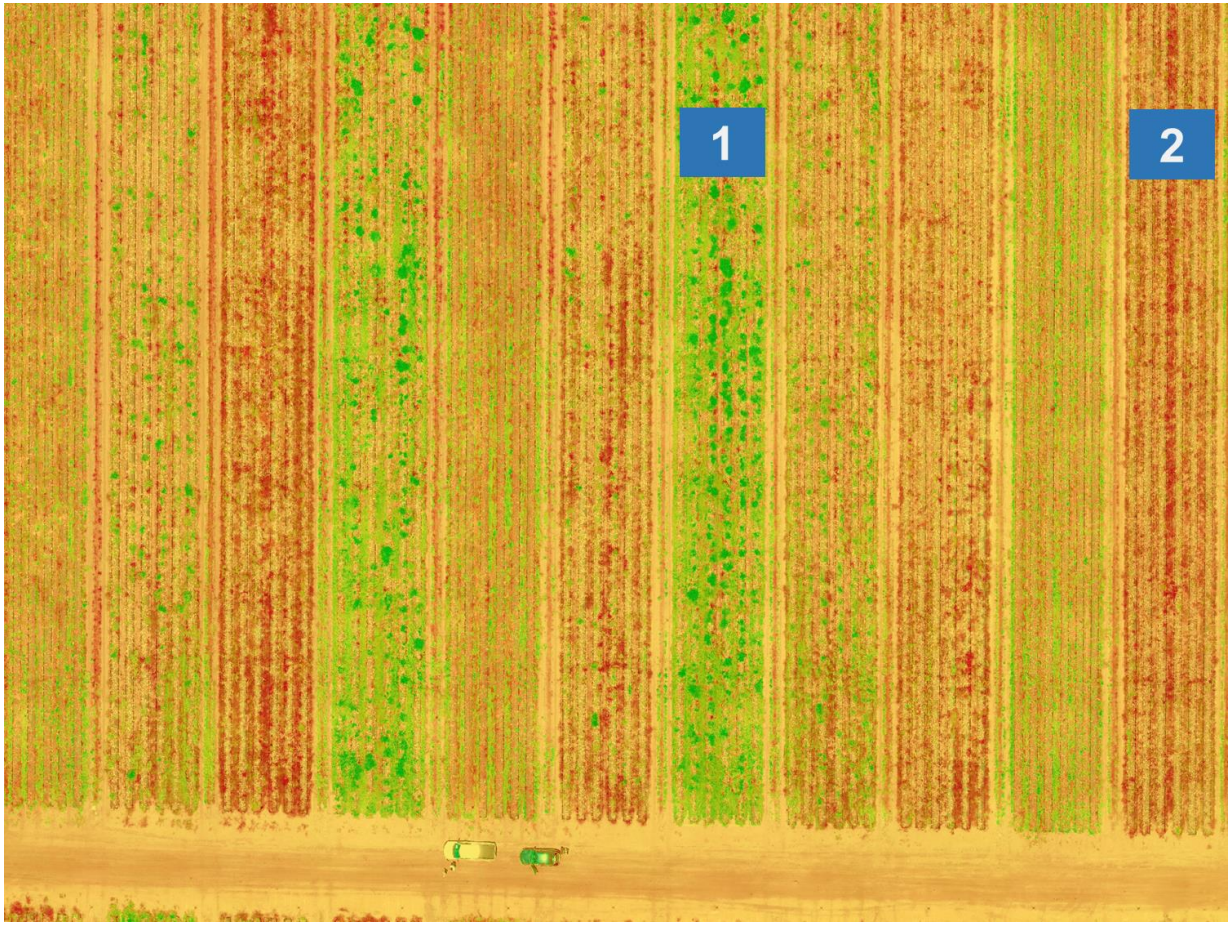
Unmanned **A**erial **S**ystem (UAS) based model to quantify herbicide efficacy

Visual Sensor: Drone image showing the efficacy of herbicide treatments

Unmanned **A**erial **S**ystem (UAS) based model to quantify herbicide efficacy

1 high weed activity

2 low or no activity



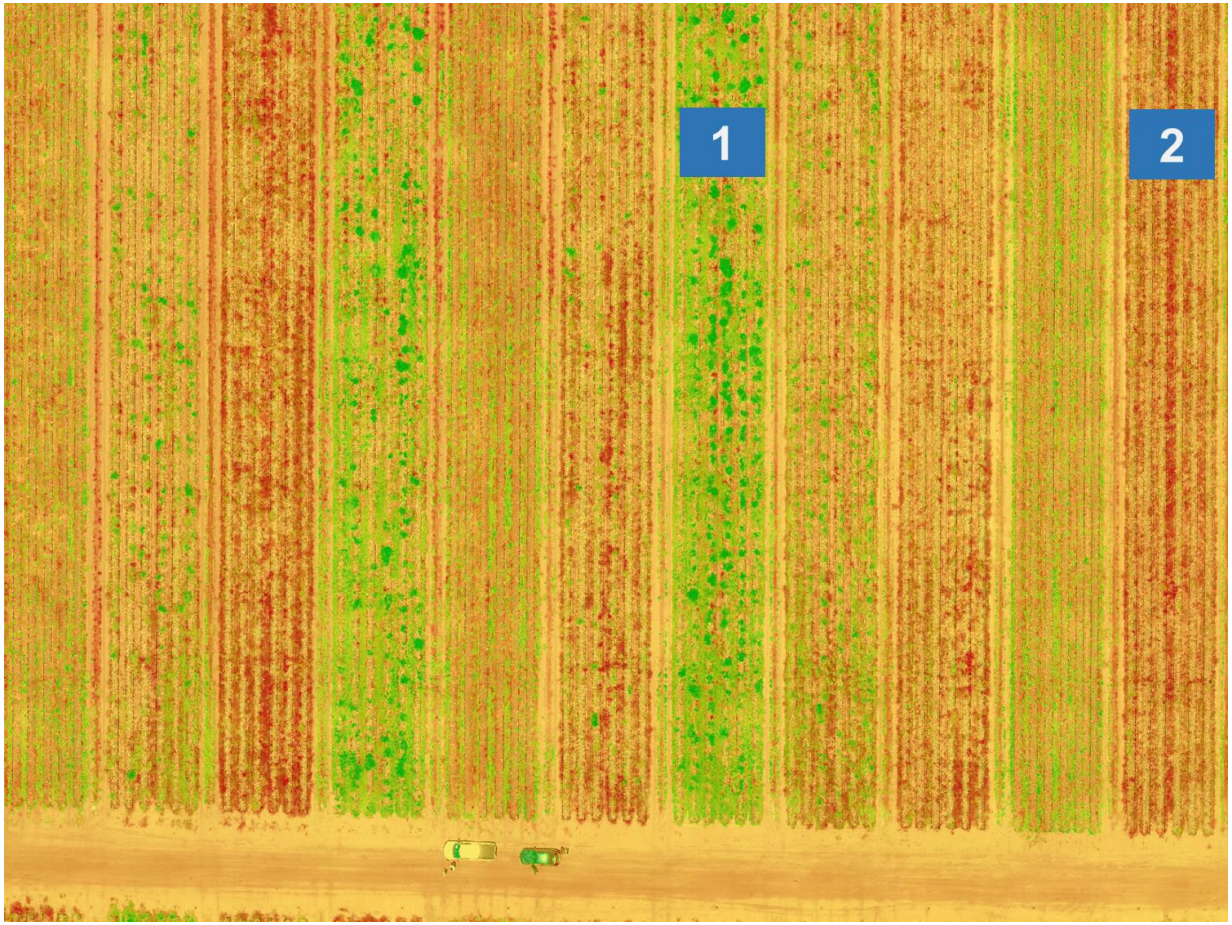
Multispectral Sensor shows photosynthetic activity of weeds

Unmanned **A**erial **S**ystem (UAS) based model to quantify herbicide efficacy

Vegetation vigor

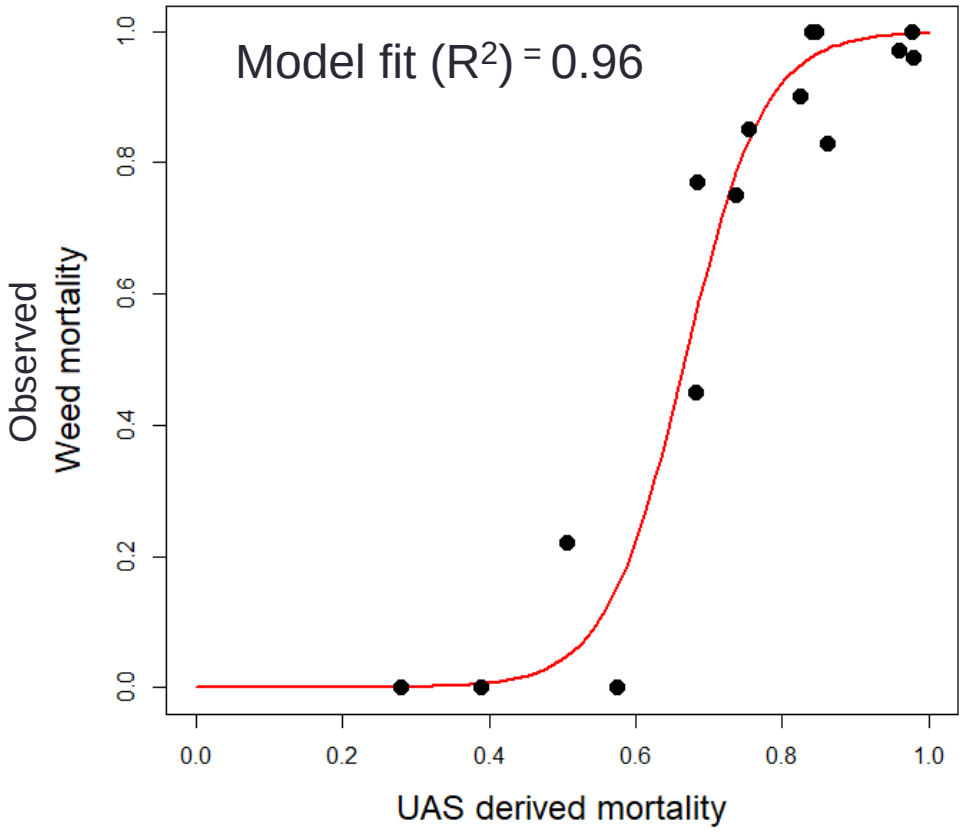
↓

Weed Mortality



Multispectral Sensor shows photosynthetic activity of weeds

Unmanned **A**erial **S**ystem (UAS) based model to quantify herbicide efficacy

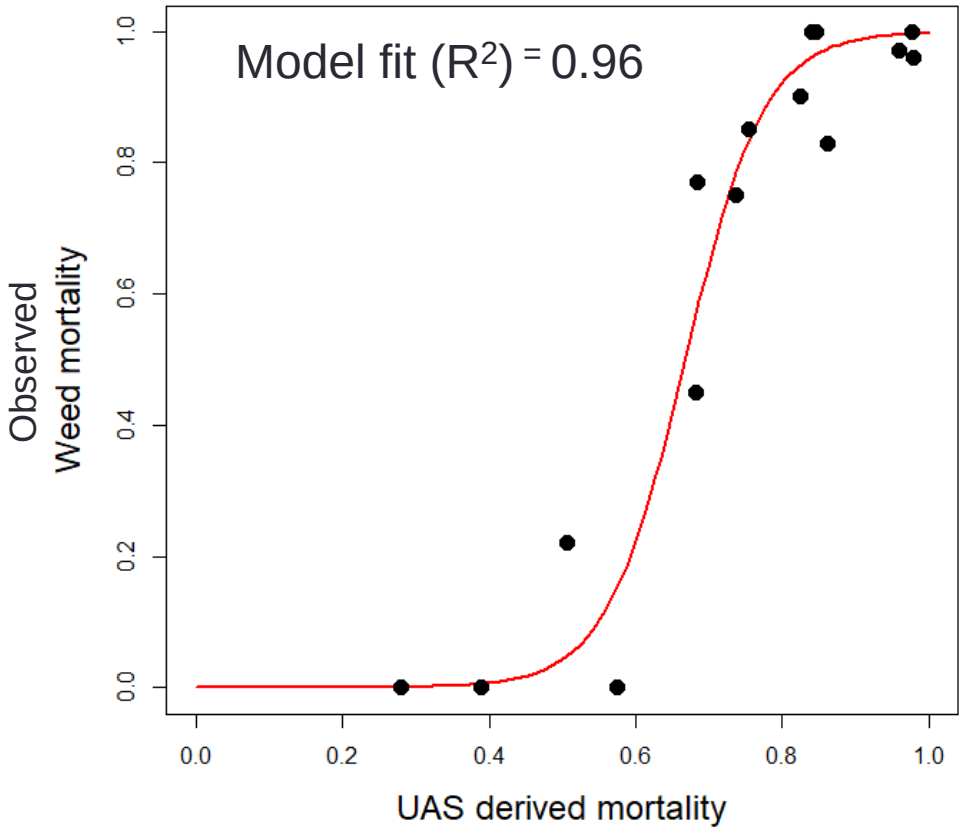


Kanissery, Singh and Fletcher, 2018

- To help growers optimally schedule their spray applications
- To avoid any redundant follow-up herbicide application in areas where weed control has been achieved to a large degree.

Collaborators
Dr. Singh (ABE)
Mr. Fletcher (ABE)

Unmanned **A**erial **S**ystem (UAS) based model to quantify herbicide efficacy



Kanissery, Singh and Fletcher, 2018

Pros

- Evaluating herbicide injury
- Calculating spray thresholds,
- Planning site-specific application of herbicide

Cons

- Work with large data sets
- Hardware & Software knowhow

Collaborators
Dr. Singh (ABE)
Mr. Fletcher (ABE)

Summary

Risks associated with herbicide use in vegetables

- Herbicide drift and persistence can potentially reduce yield and vigor in vegetables
- Understand the factors causing drift
- Hydrogel technology –as herbicide carriers in plasticulture production

Summary

Technology assistance for weed management

- Drone images – for quantifying herbicide efficacy in vegetable farms
- Pros: Help farmers to take informed decisions in weed management.
- Cons**:** Large data sets and technology know how

Thank you…

SWFREC weed science team

From left: ***Shea Teems, Biwek Gairhe, Robert Riefer, Ramdas Kanissery***

In set: ***Cami McAvoy, Maria Martinez***

Contact

Ramdas Kanissery

UF/IFAS SWFREC
2685 State Road N
Immokalee, FL

Phone: (239) 658-3455
rkanissery@ufl.edu