Spray Drone Technology – Applications and Considerations in Agronomic Crops

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(Content Contribution – Dr. Steve Li)

UNIVERSITY OF GEORGIA EXTENSION

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2023 – The year of Spray Drones

DJI T40 – 10.5 gallon tank, rotary atomizers, 36 ft swath…….

Hylio AG-272 – 18 gallon tank, 49 ft swath,……

Interest in Spray Drones

GPA, swath width, nozzle type, height, coverage, costs, regulations,…….???

Spray Drone Options

DJI

HYLIO

Drone Costs - $20,000 - $40,000

Registration & Certifications - $10,000

Maintenance - $2,500 - $8,000

XAG

Other brands

Spray Drone Specifications

Tank Size: 5 to 18 gallon

Spray System: low capacity pump & nozzle configuration (2, 4, 6 – 12) or rotary atomizers

Spray Volume: 1 to 5 gallons per acre (GPA)

Spray Swath: 15 to 40 feet (depends on height)

Spray Height: 5 to 15 feet

Battery Life: 5 to 10 minutes

Productivity: 10 to 40 acres per hour

Spray Drone Applications

- **Spot-spray herbicide applications** – where it is efficient and economical to treat with a drone sprayer. *(e.g. treating weed escapes)*

- **Fungicide applications** – when a timely fungicide application with a ground sprayer or crop duster is not feasible. *(e.g. field too wet or crop duster not* available)

- **Awkward acres or small fields –** fields or parts of the fields that makes applications with ground and/or crop duster challenging. *(e.g. parts of the field inaccessible to ground & manned aerial applicator)*

Operational Considerations

- Most drone manufacturers provide general specifications (tank size, spray volume, etc.) but it is up to the operator to select application parameters (GPA, swath, speed, etc.)
- Spray volume (GPA) is selected based on battery life and size of the tank
- Short battery life and multiple refills requires to have a system for quick charging on-site and mixing products
- This re-charging and refill system would also need to be moved around to save battery life

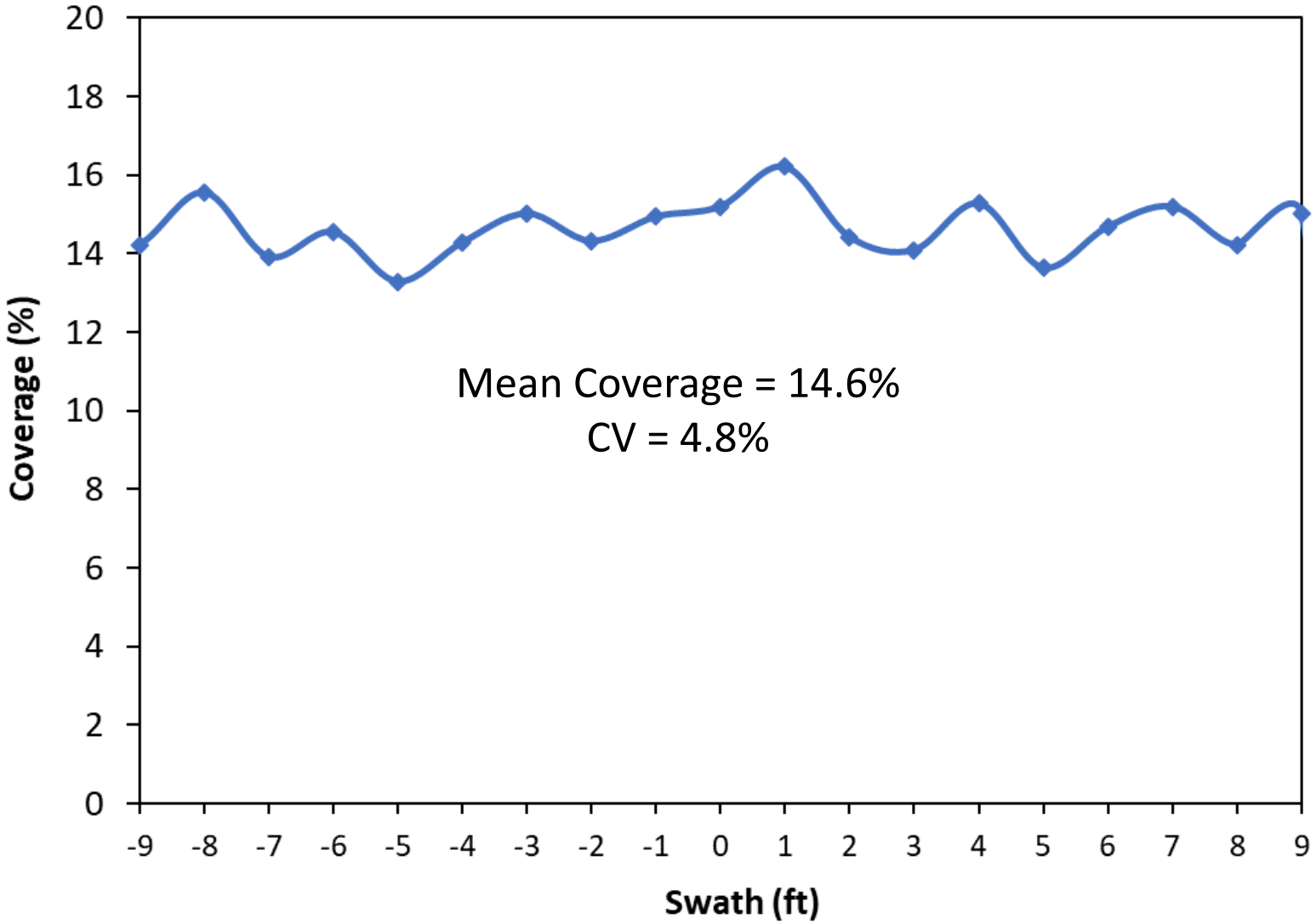
Application Performance

Spray Parameters

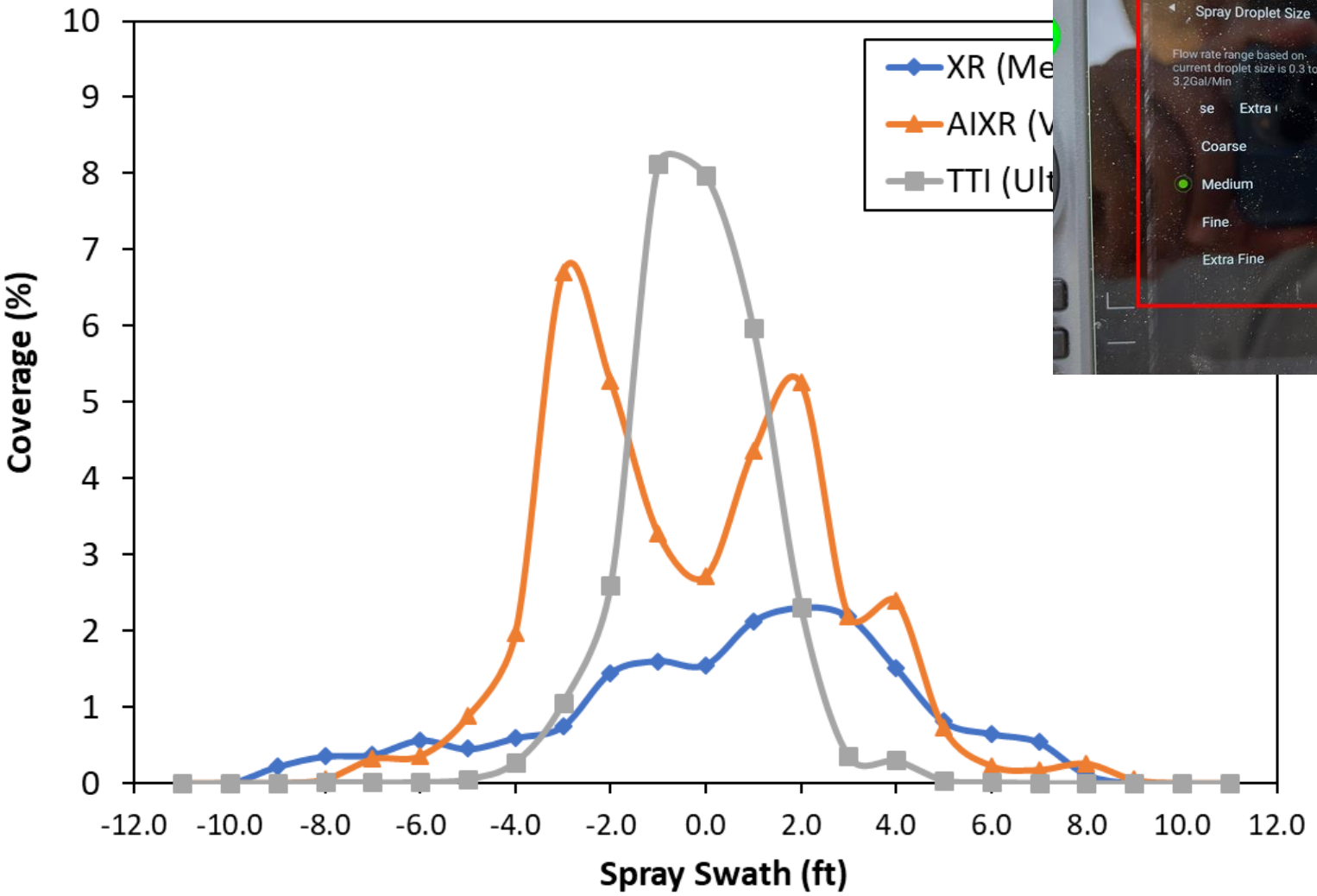
Within Crop Canopy

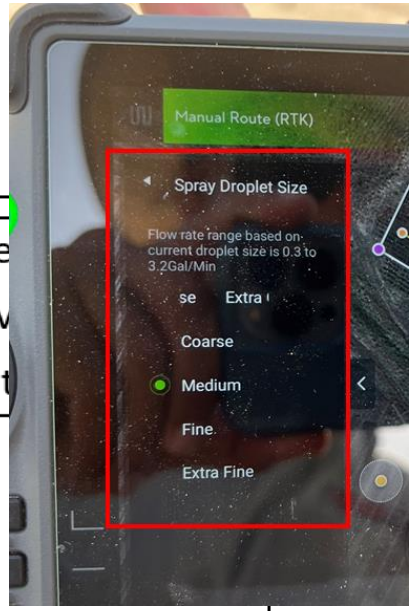
Product Efficacy

Ground (Boom) Sprayer Application

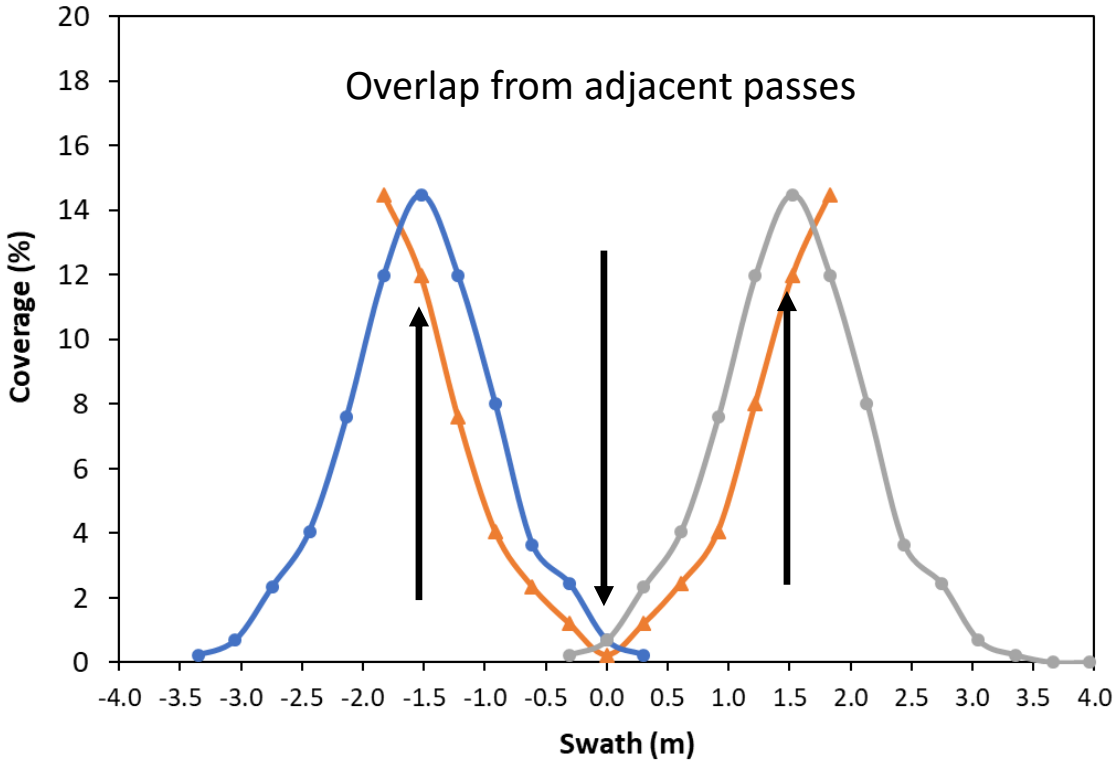


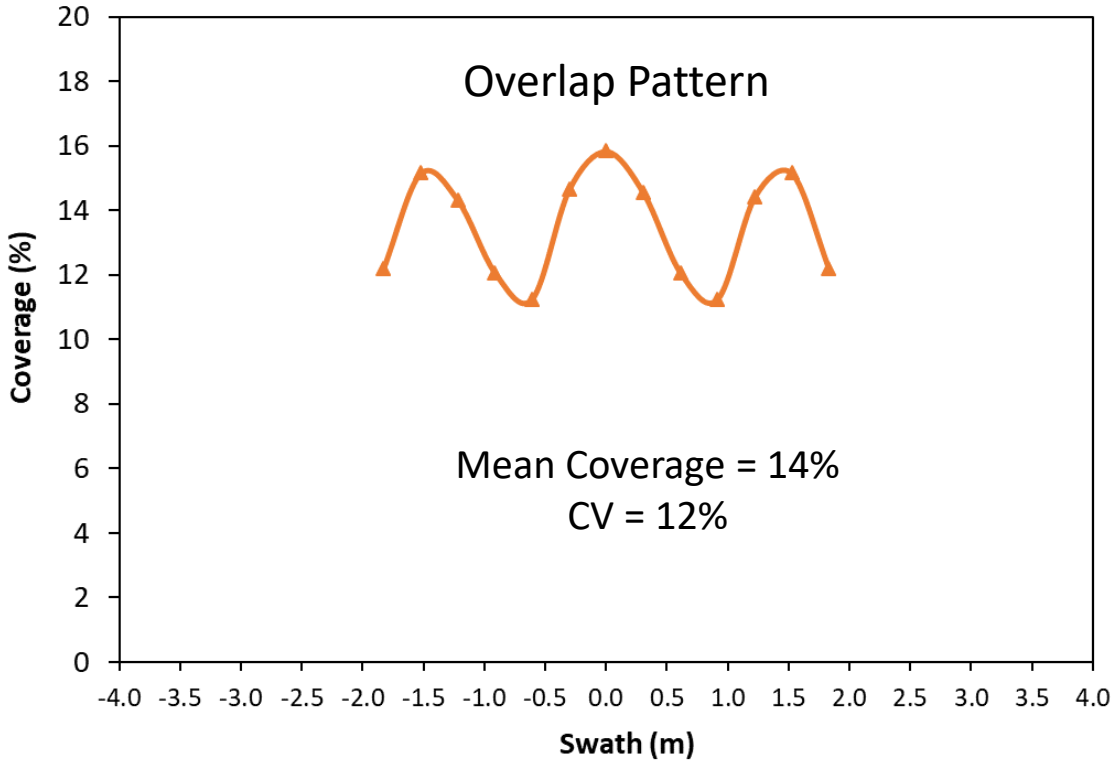
Spray Parameters





Spray Drone - Effective Swath Consideration





Some sort of swath testing must be done to determine effective swath and application uniformity

Spot-Spray Herbicide Applications

Targeting weed escapes early or late in the season

Spot-Spray Herbicide Applications

Challenging weeds late in the season/before harvest

(Content credit – Dr. Steve Li)

Corn Fungicide Application – Drone, Airplane and Ground Sprayer

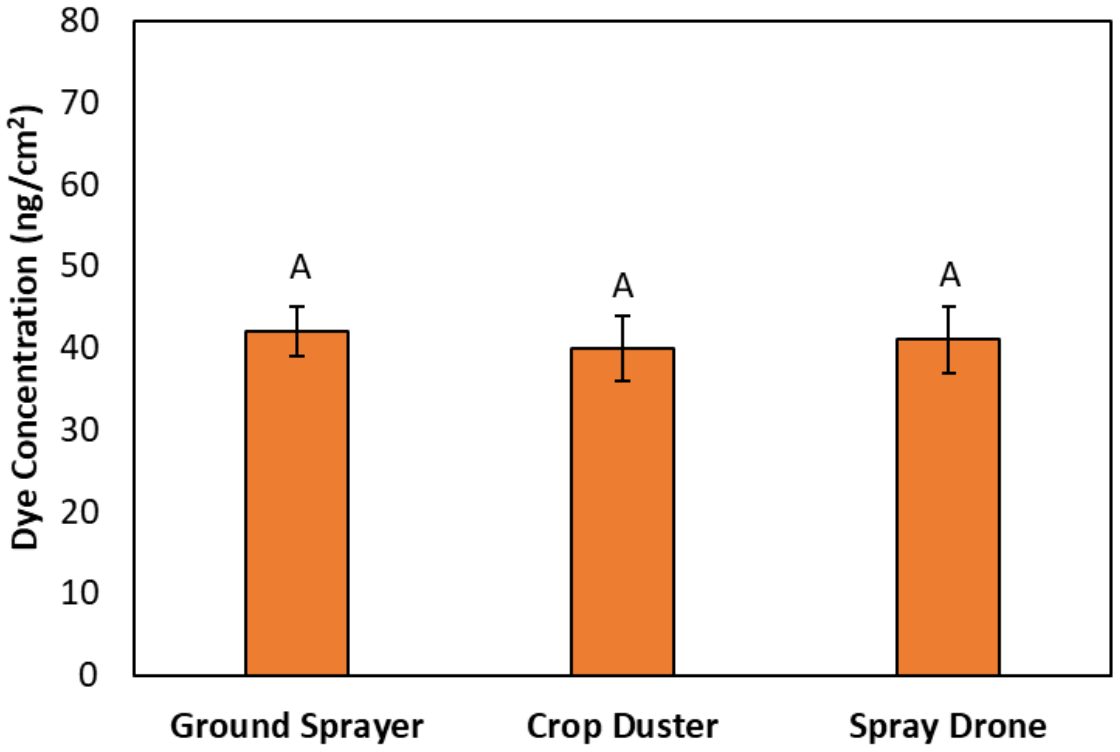
Location	Application type	Parameters	Nozzle Type
Blakely, Georgia	Drone	20 ft swath | 12 ft Height	Green Leaf AIRMIX 11001
	Airplane	70 ft swath | 10 ft Height	Standard
	Ground Sprayer	72 ft swath	TeeJet TJ-80 11004

Fungicide Application with Spray Drone

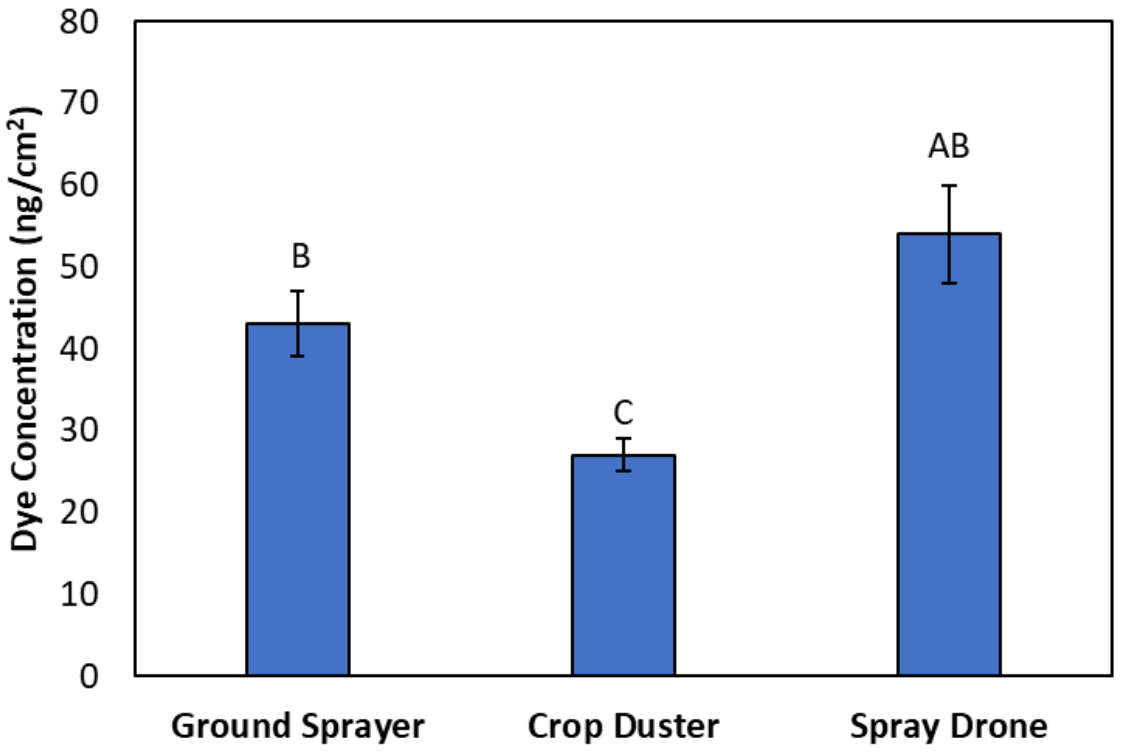
Fungicide Application Comparison

(Ground sprayer, airplane and Spray drone)

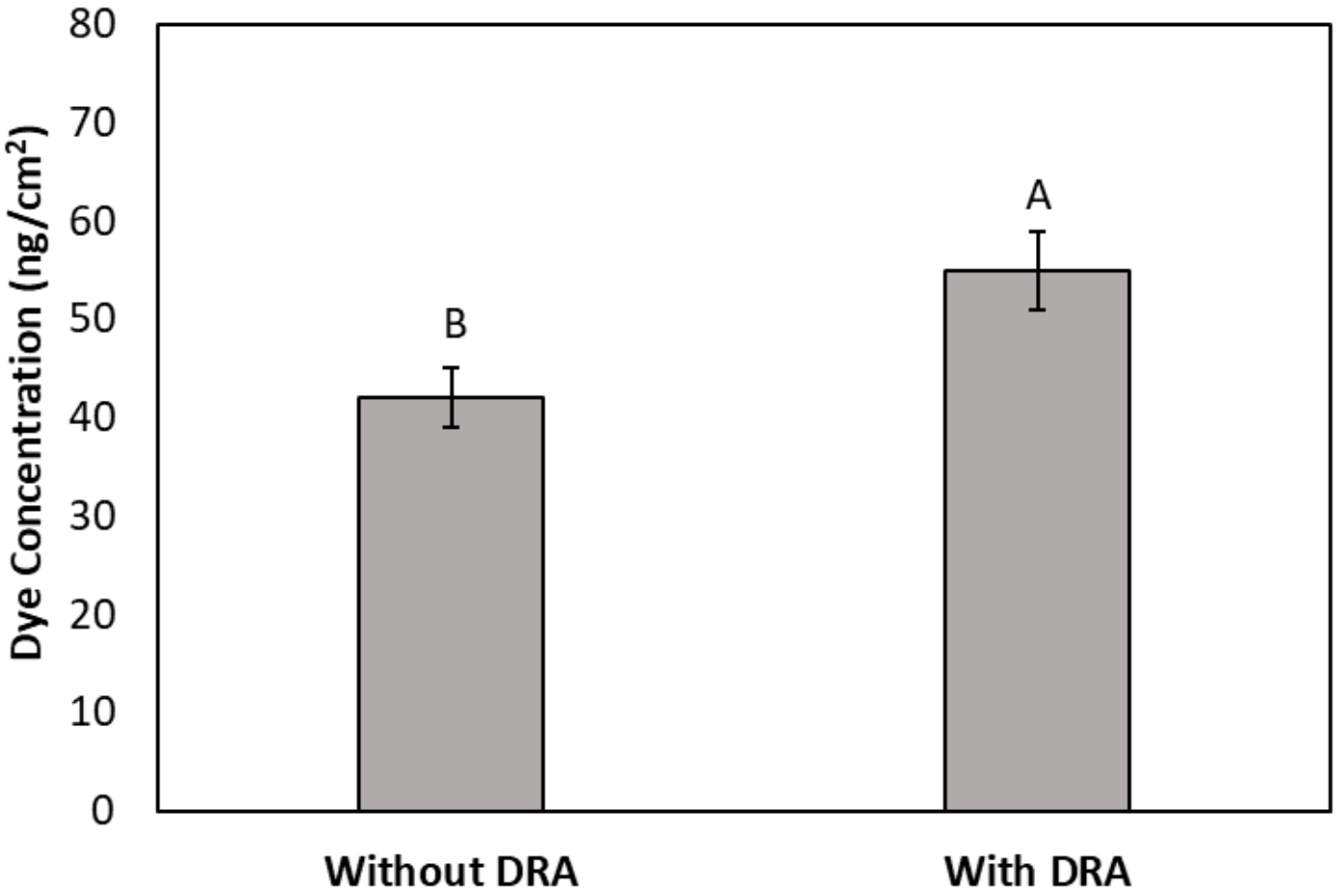
Upper Leaf



Ear Leaf



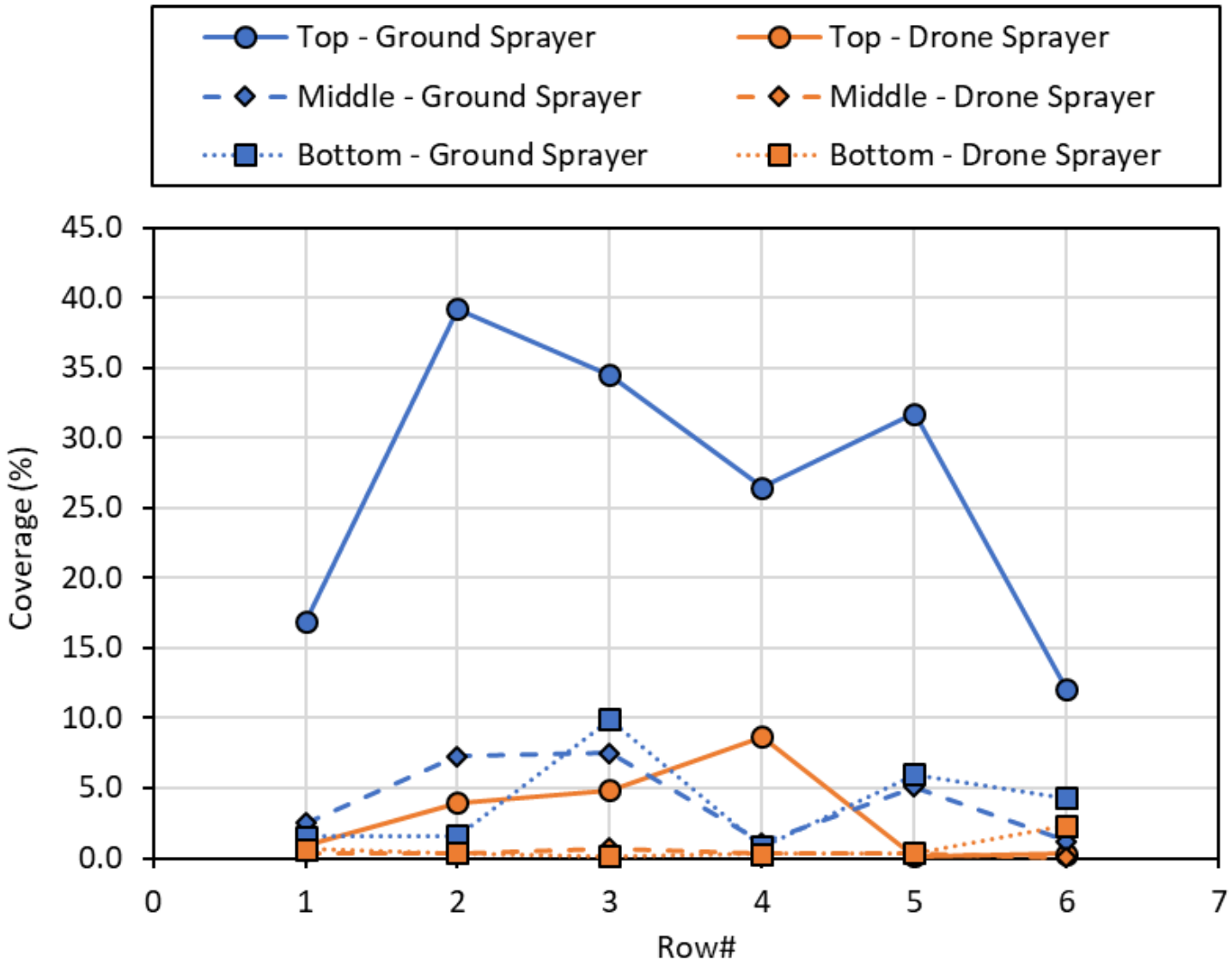
Fungicide Application Comparison
(Spray drone – DRA vs No DRA)



Peanut & Cotton Fungicide Applications

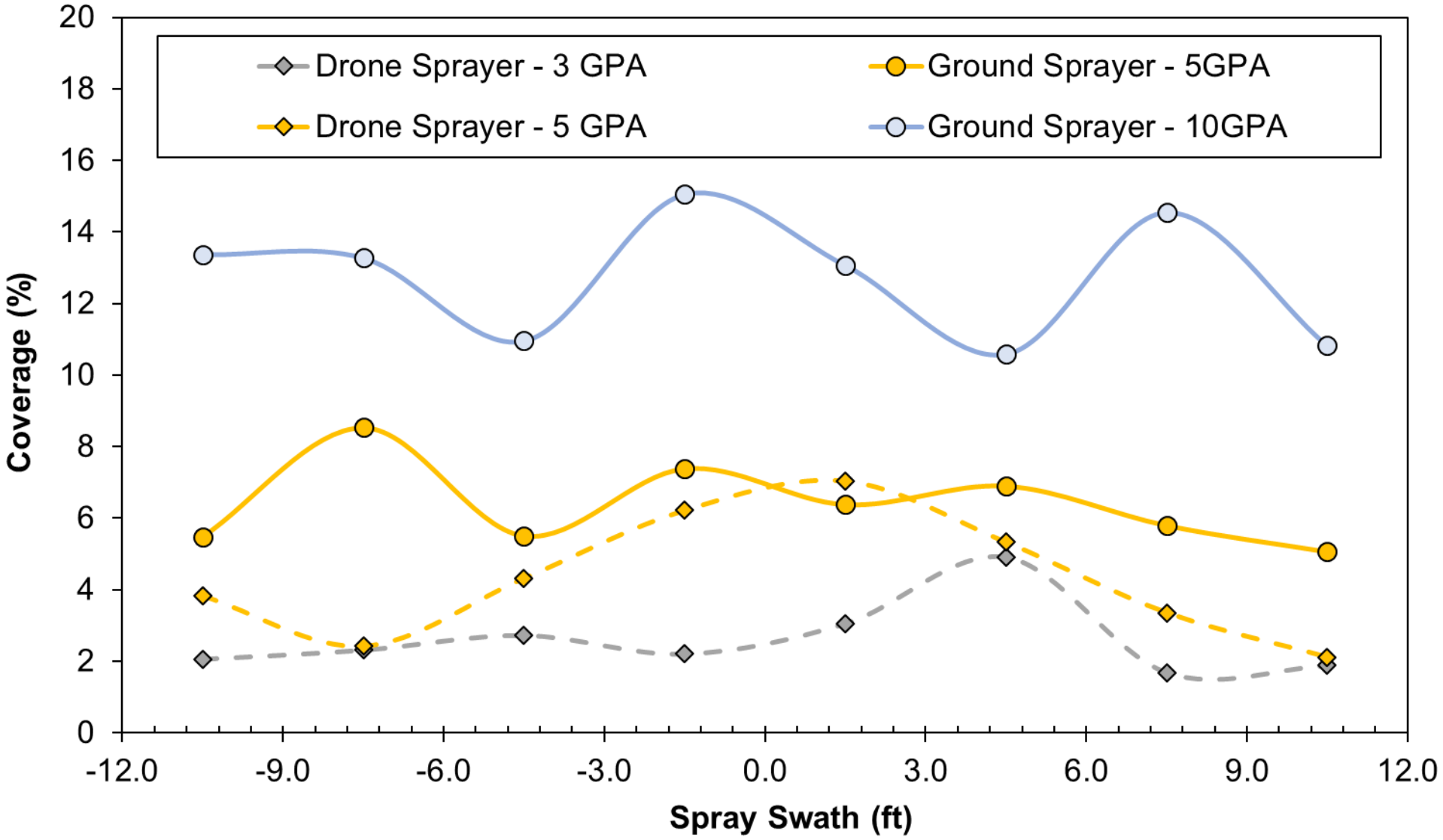
Cotton Fungicide Application

- Two application methods: *Spray drone (2 GPA) and ground sprayer (15 GPA)*
- Fungicide used was Revytek @ 10 oz/A
- Fungicides applied 3rd week of bloom
- Cotton Variety – DynaGro 3799 B3XF
- Three positions within the cotton canopy: *Top, Middle and Bottom*

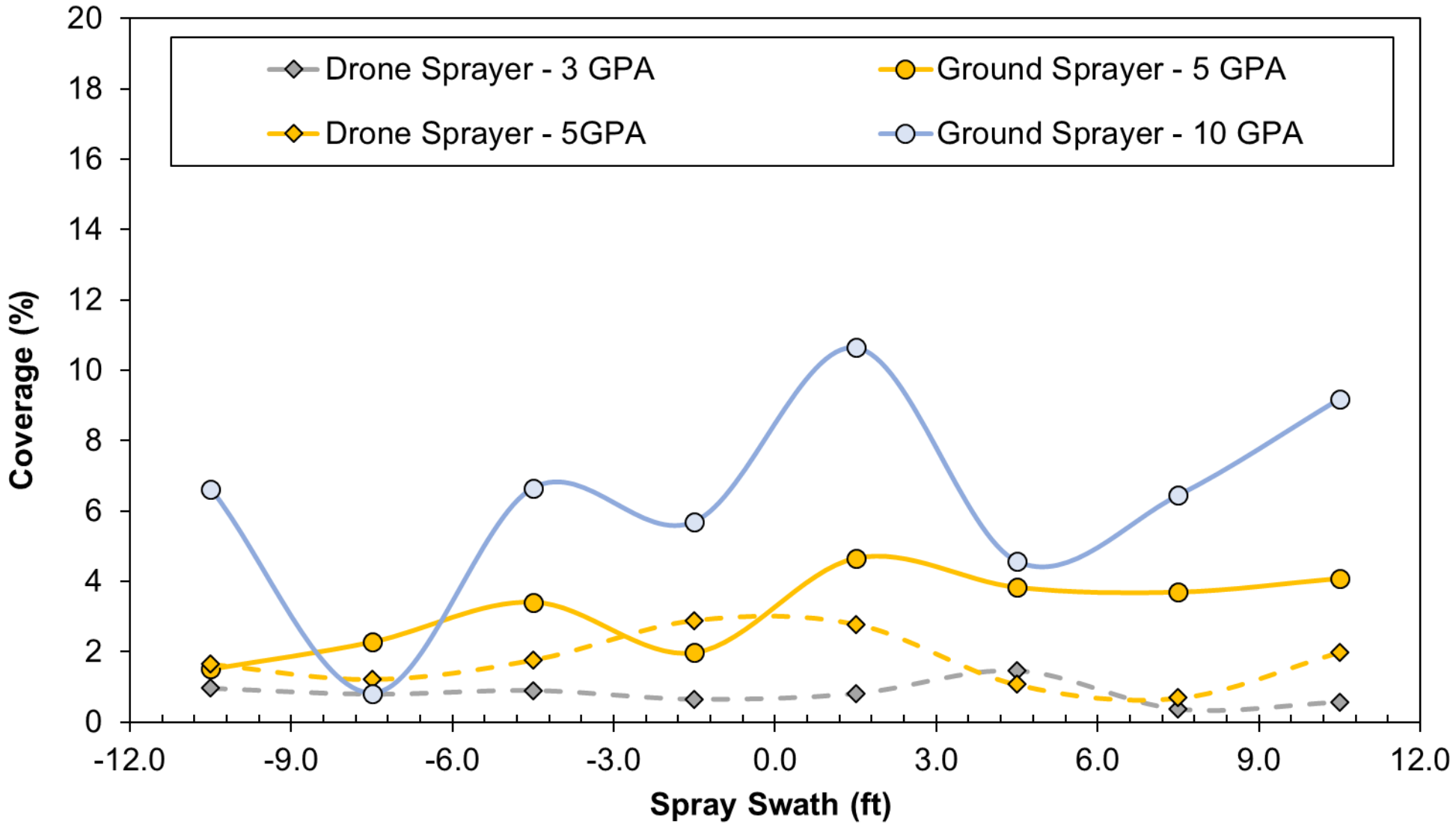


Cotton Defoliation

Spray Deposition – Top Canopy



Spray Deposition – Middle Canopy



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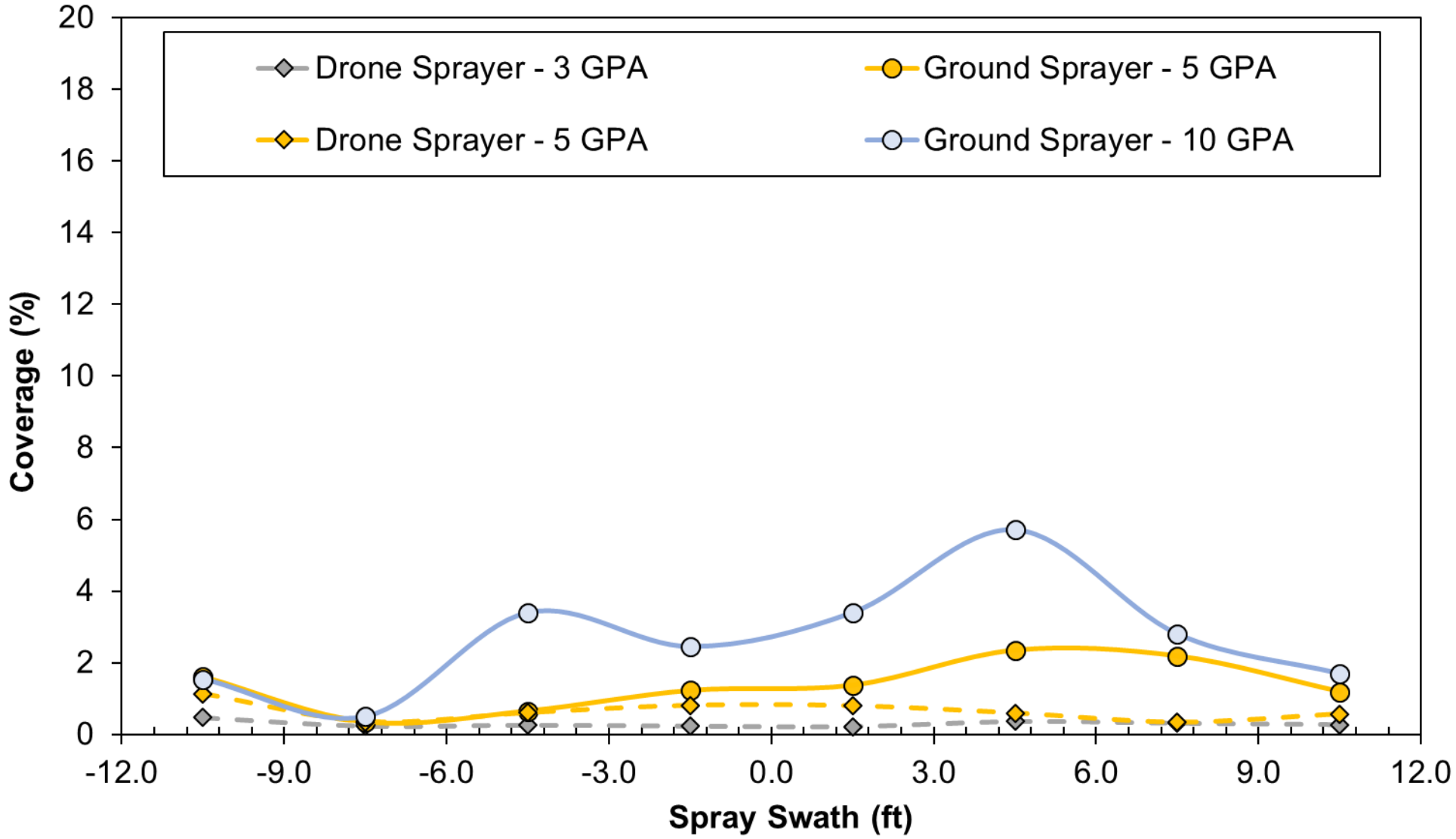
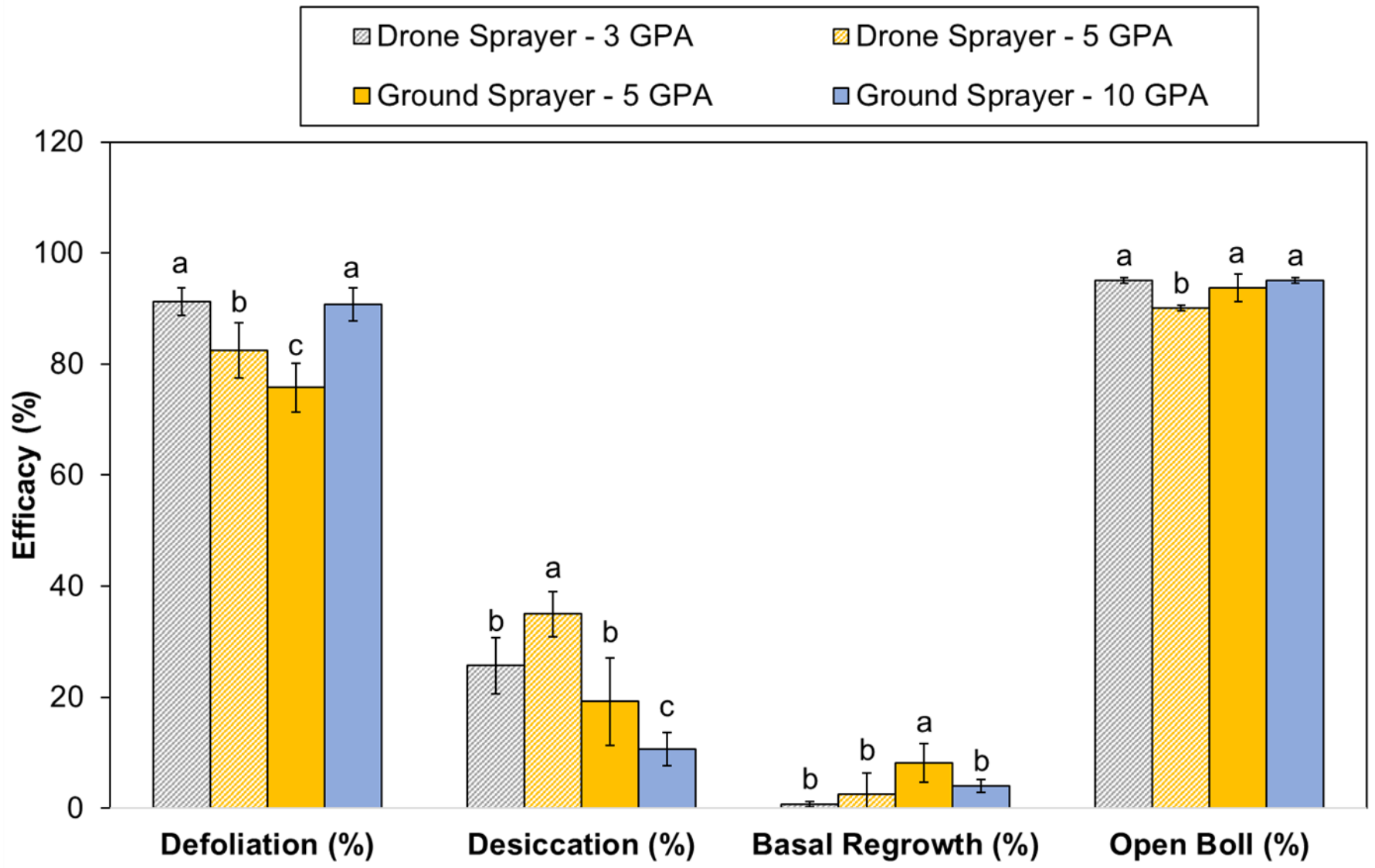
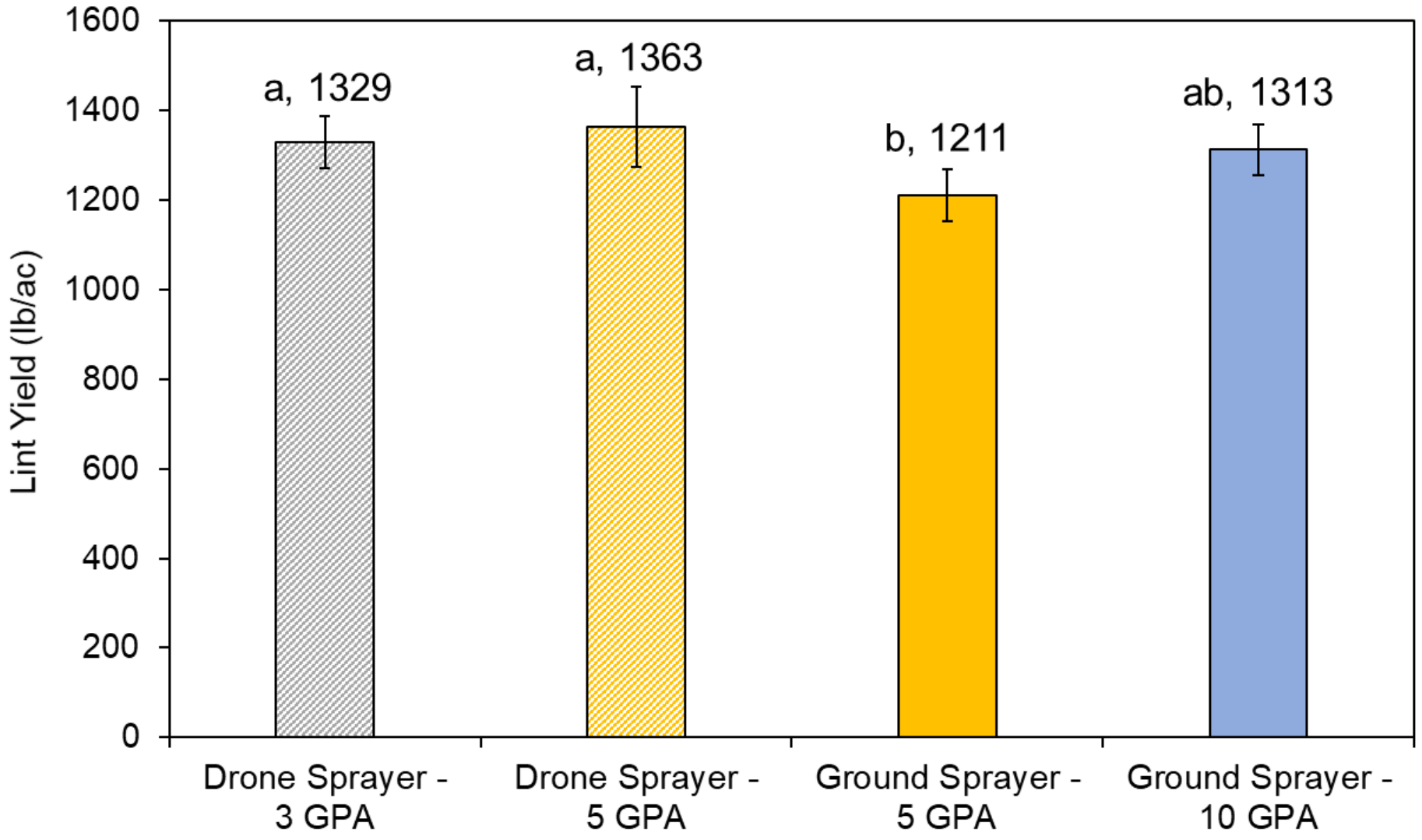


Defoliation Efficacy



Cotton Yield



What about Spray Drift from Spray Drones?

Drone Seeding

Thanks!

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Application Considerations

- **Good Coverage** – proper flight settings and application under favorable conditions
- **Application parameters** – spray volume (≥ 2GPA) and effective spray swath (determine through testing)
- **Efficacy** – proper product/chemistry selection. Use of surfactants and DRA's to improve efficacy.
- **Follow BMPs** – follow best practices for judicious pesticide and drone usage

FAA Rules & Regulations

Applying pesticides with spray drones require special licenses and permissions that fall under two categories:

- If the spray drone (including solution) weighs less than 55 pounds –
  - Part 107 remote pilot certification for operating drones weighing less than 55 lbs
  - Require exemption from part 107.36 (carriage of hazardous material)
  - Part 137 certification for dispensing chemicals and agricultural products with drones *(or request exemption)*
  - Private or commercial pesticide applicator license

Rules & Regulations (FAA)

Applying pesticides with spray drones require special licenses and permissions that basically fall under two categories:

- If the spray drone (including solution) weighs 55 pounds or more –
  - Private or commercial pesticide applicator license
  - Require special permissions from the FAA including several exemptions for Part 61, 91 and 137

https://www.faa.gov/uas/advanced_operations/dispensing_chemicals

Rules & Regulations (FAA)

Overview

Getting Started

Recreational Flyers & Community-Based Organizations

Certificated Remote Pilots including Commercial Operators

Public Safety and Government

Dispensing Chemicals and Agricultural Products (Part 137) with UAS

The regulation for operating drones to dispense or spray substances (including disinfectants) is 14 CFR Part 137, Agricultural Aircraft Operations.

Not all substances fall under this regulation, so you should first check to see if your proposed operation meets the FAA's criteria for part 137. If the substance you plan to dispense does meet this criteria (part 137.3), refer to Certification Process for Agricultural Aircraft Operators for guidance on the requirements you must meet before dispensing it.