

# UAAS Test Protocol and Comparison of Commercially Available Systems

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# Program

- Background and Potential Applications
- Overview of small Unmanned Aerial Application Systems (sUAAS)
- Spray Study Setup
- Spray Test Results
- Synthesis

# Objectives

- Characterize the effect of application height and groundspeed on the effective swath, pattern uniformity and droplet spectra from different UAAS platforms.

# Materials and Methods

HSE V6A (5L)



# Materials and Methods

DJI Agras MG-1 (10L)



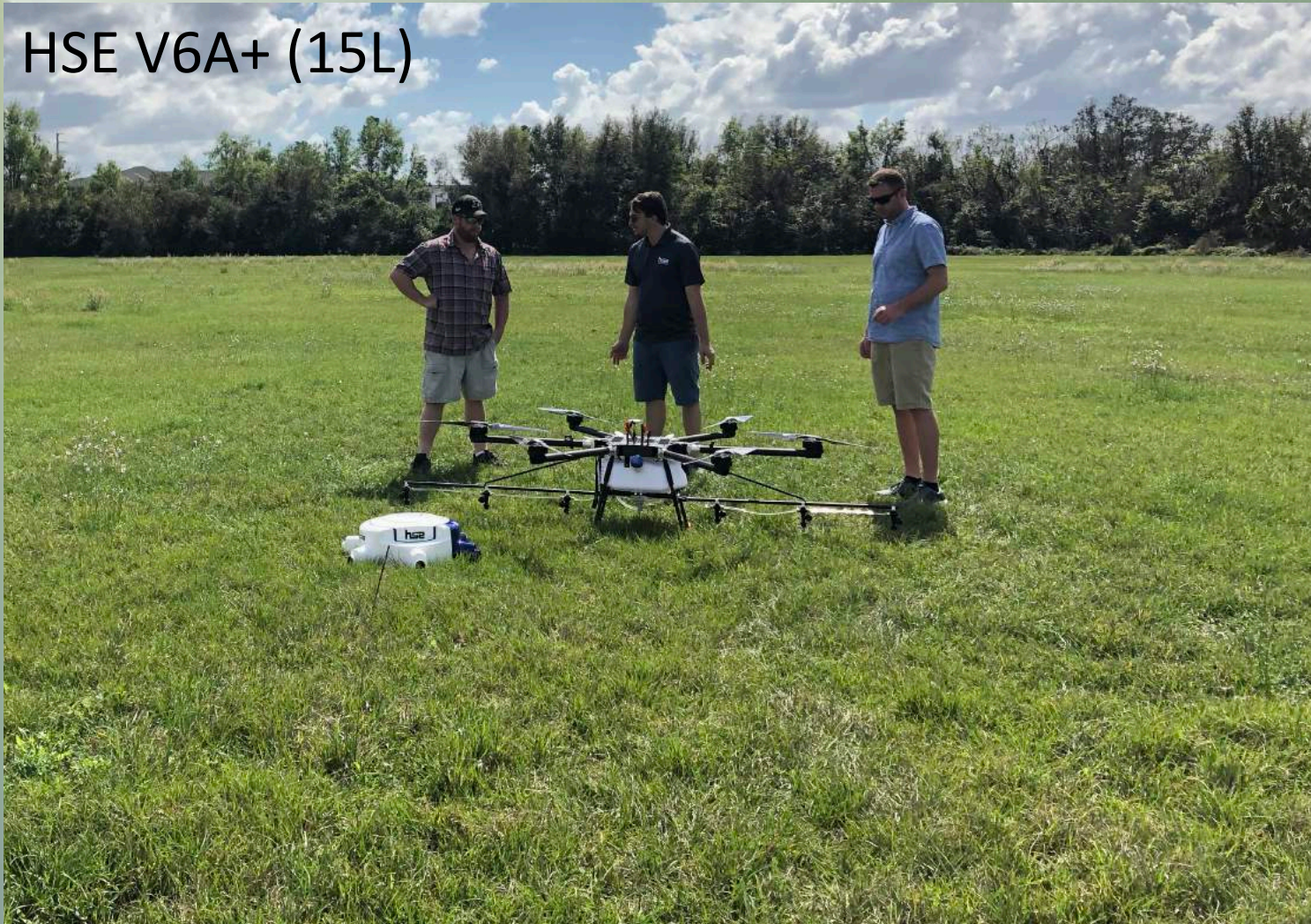
# Materials and Methods

HSE M6E (10L)



# Materials and Methods

HSE V6A+ (15L)



# Materials and Methods

HSE V8A+ (20L)





# Materials and Methods

## Calibration



# Materials and Methods

## Calibration



# Materials and Methods

## Calibration



# Materials and Methods



- 4 Nozzles
- Lechler CR80005
- 250 ml/min
- 72 psi



- 4 Nozzles
- Teejet XR11001
- 350 ml/min
- 33 psi

# Materials and Methods

Sampling Layout

Water + 20 ml/L Vision Pink Dye



# Materials and Methods

## Water Sensitive Papers



# Materials and Methods



- 3 Application Heights (2, 3 and 4 m)
- 4 Groundspeeds (1, 3, 5 and 7 m/s)
- 4 Replications





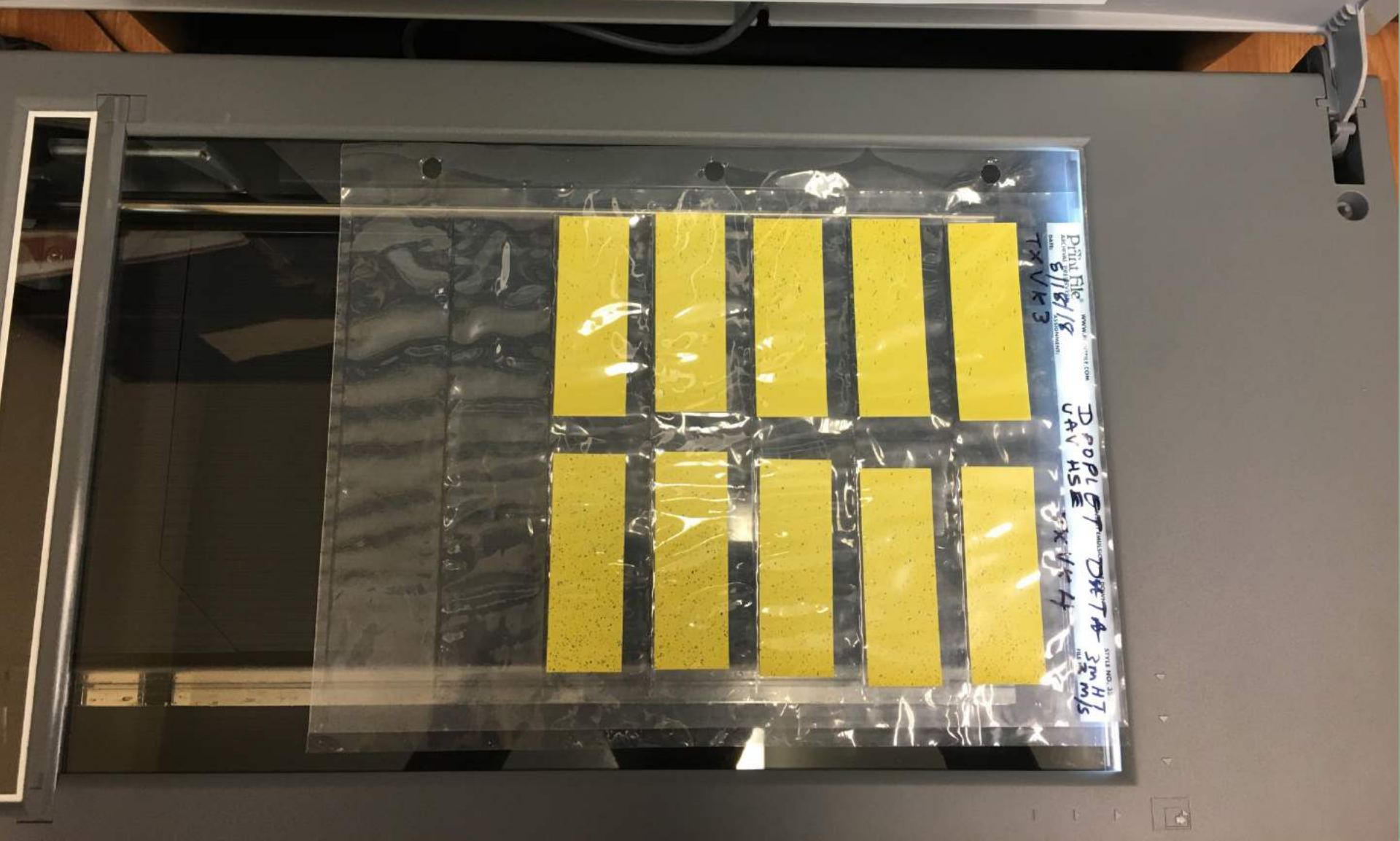
# String Analysis

## USDA Swath Analysis System

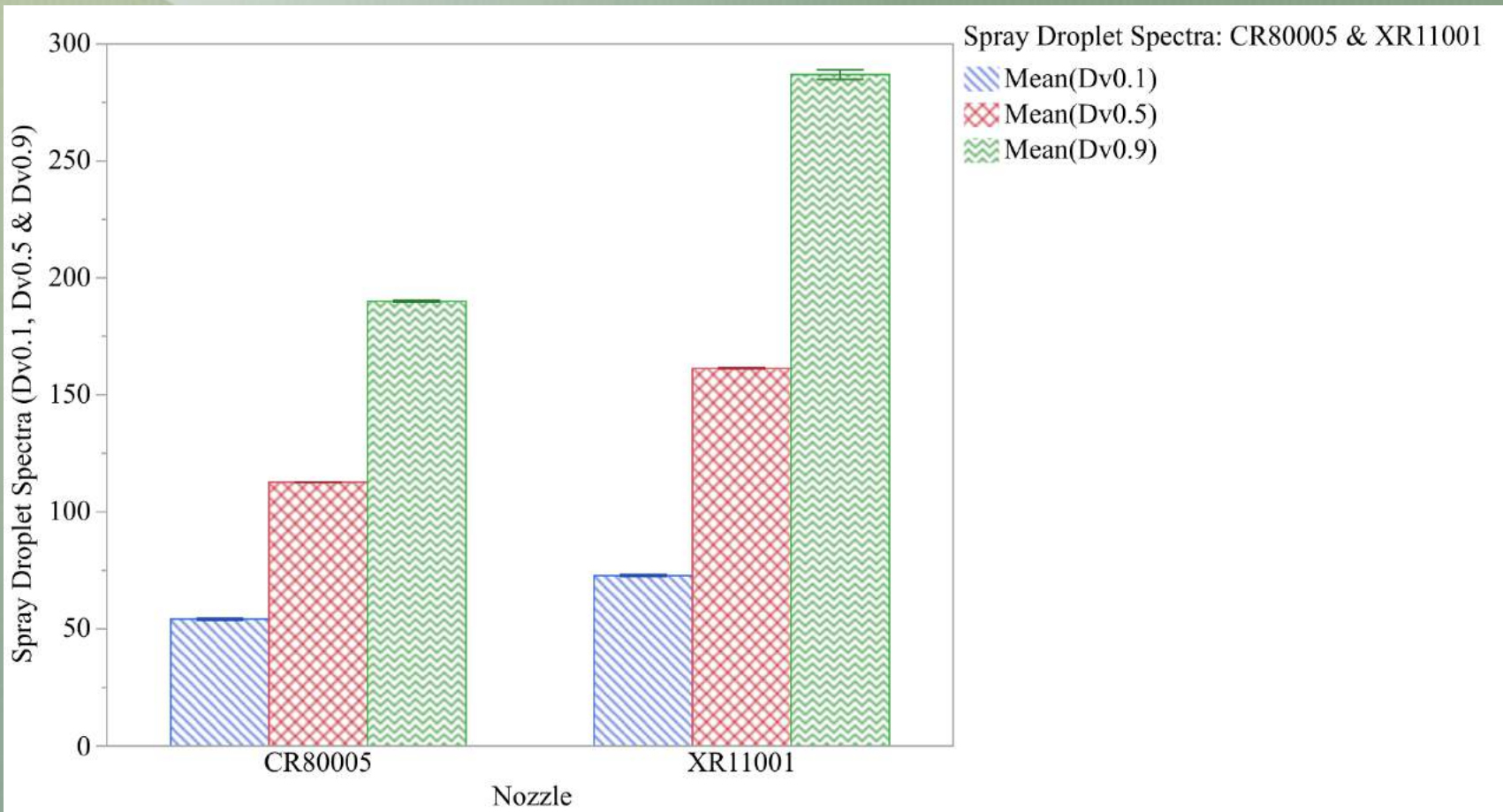


# WSP Analysis

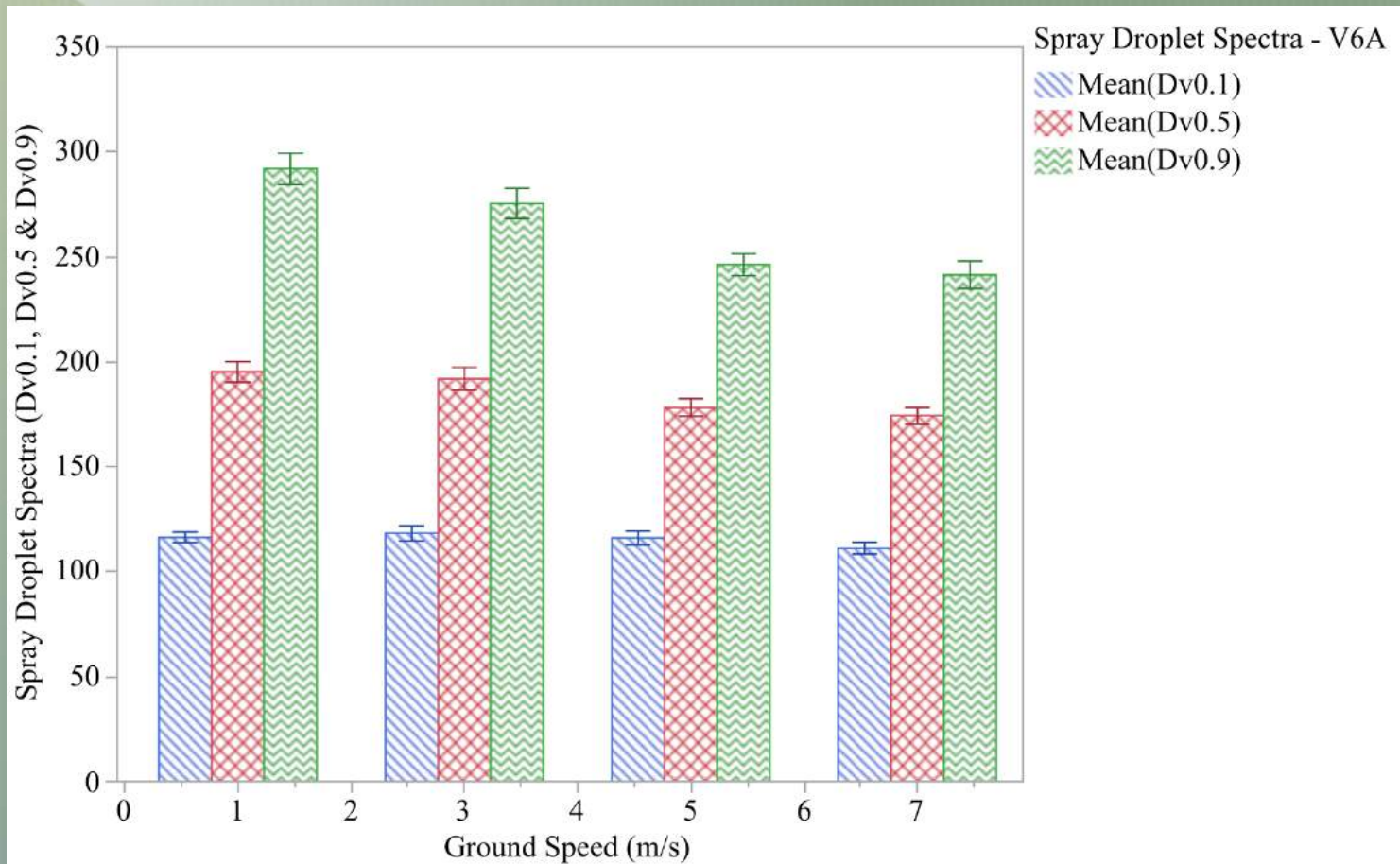
DropletScan



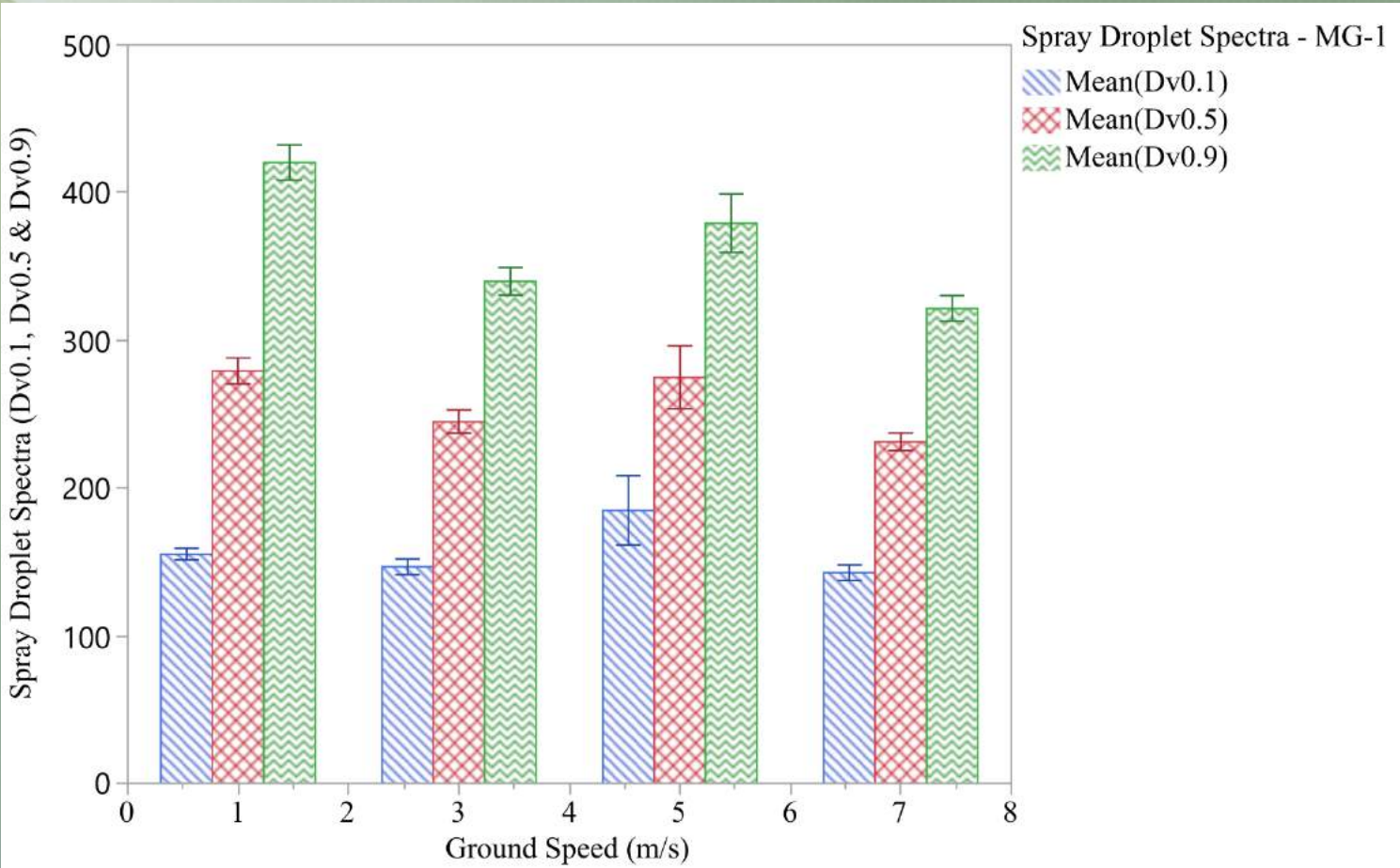
# Windtunnel Results



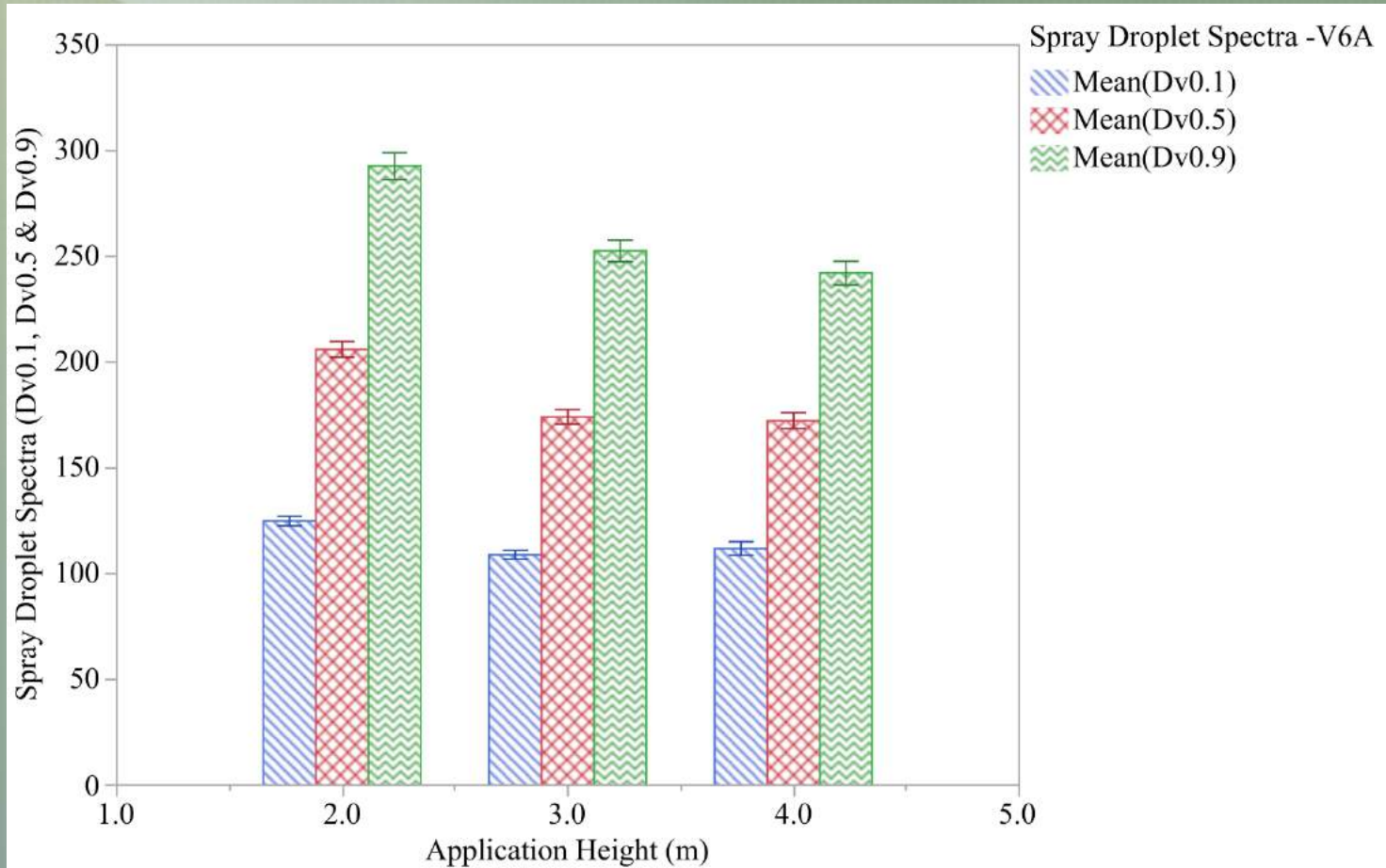
# WSP Results, Ground Speed – V6A (5L)



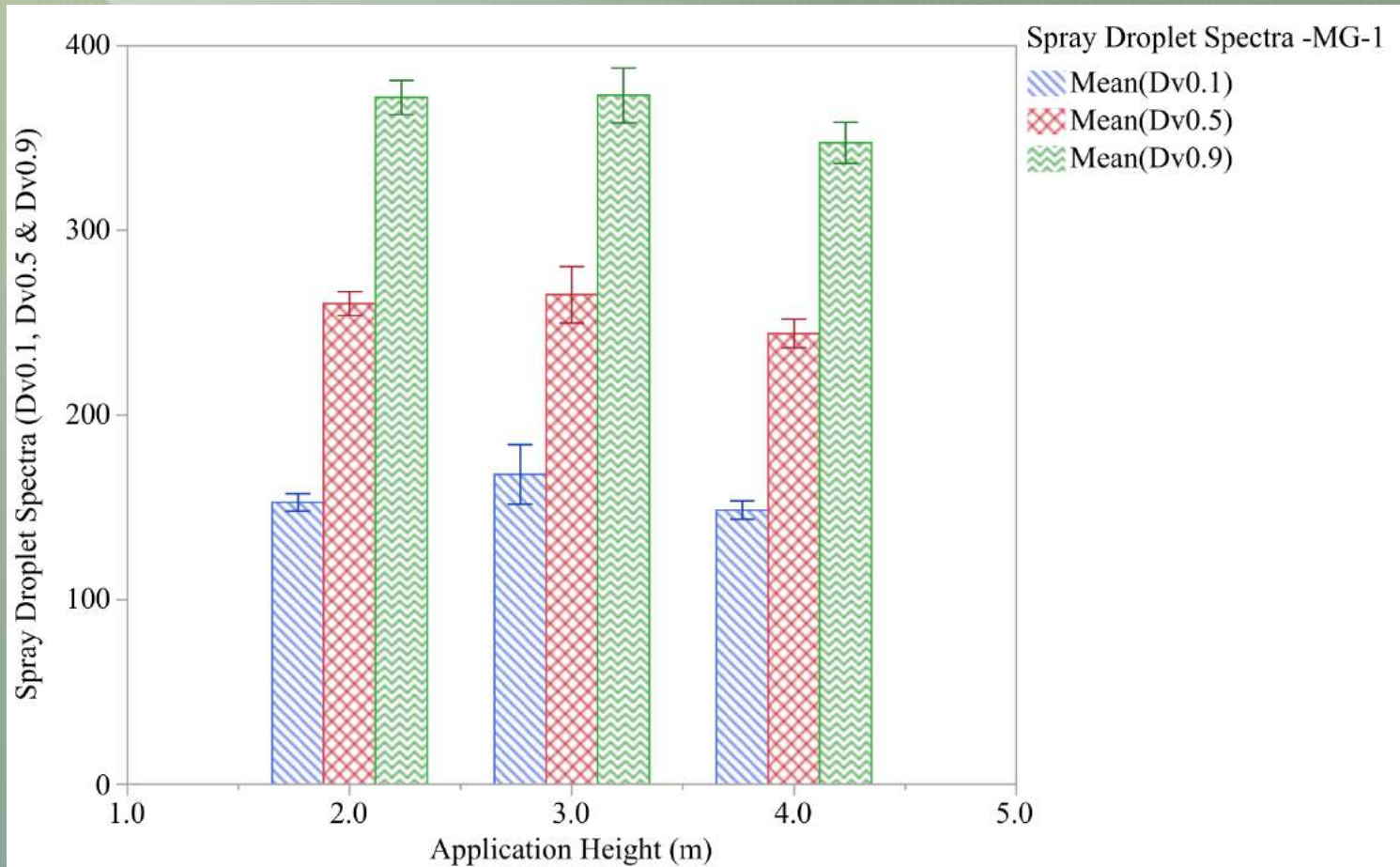
# WSP Results, Ground Speed – MG1 (10L)



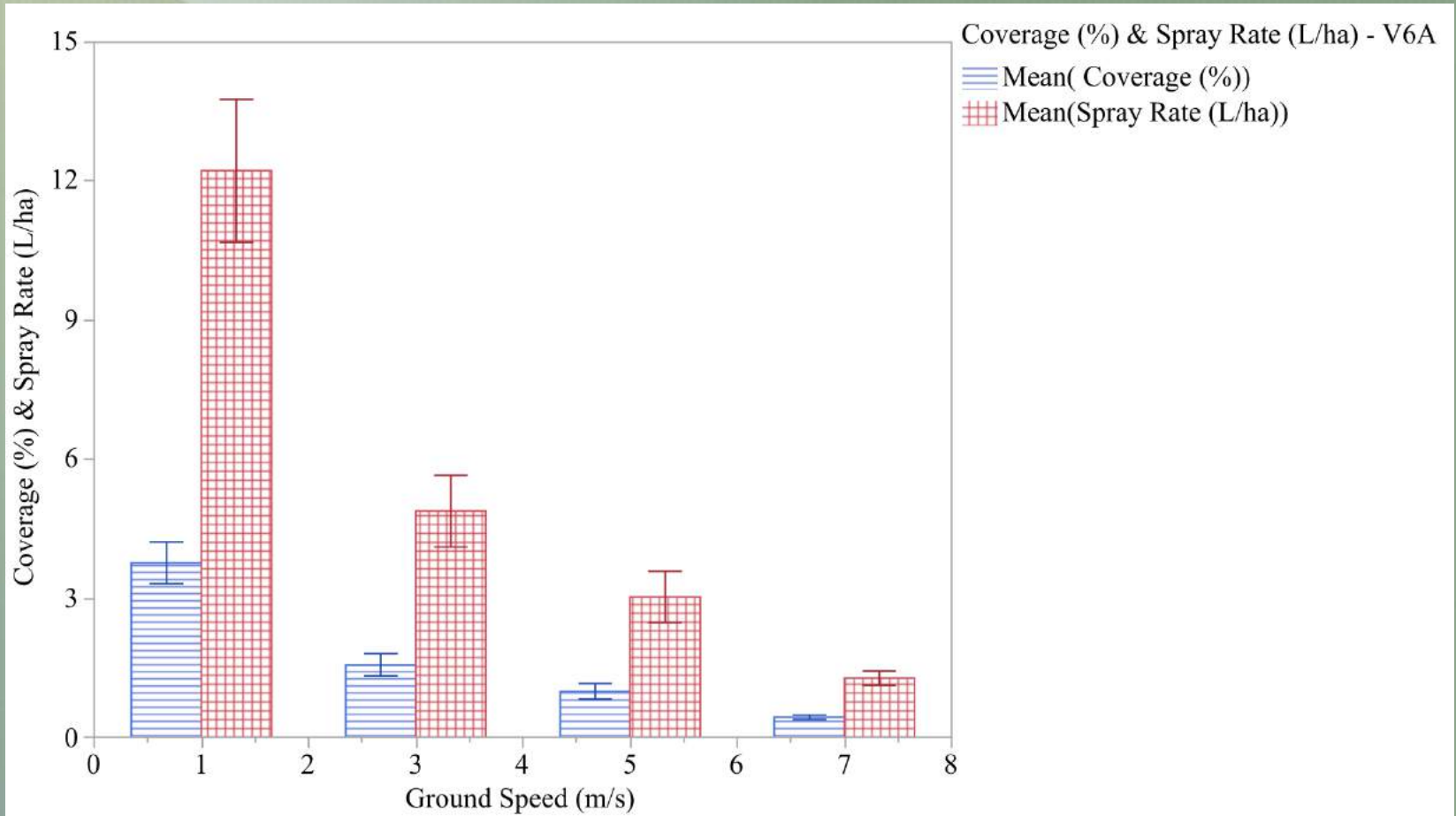
# WSP Results, Application Height – V6A (5L)



# WSP Results, Application Height – MG1 (10L)

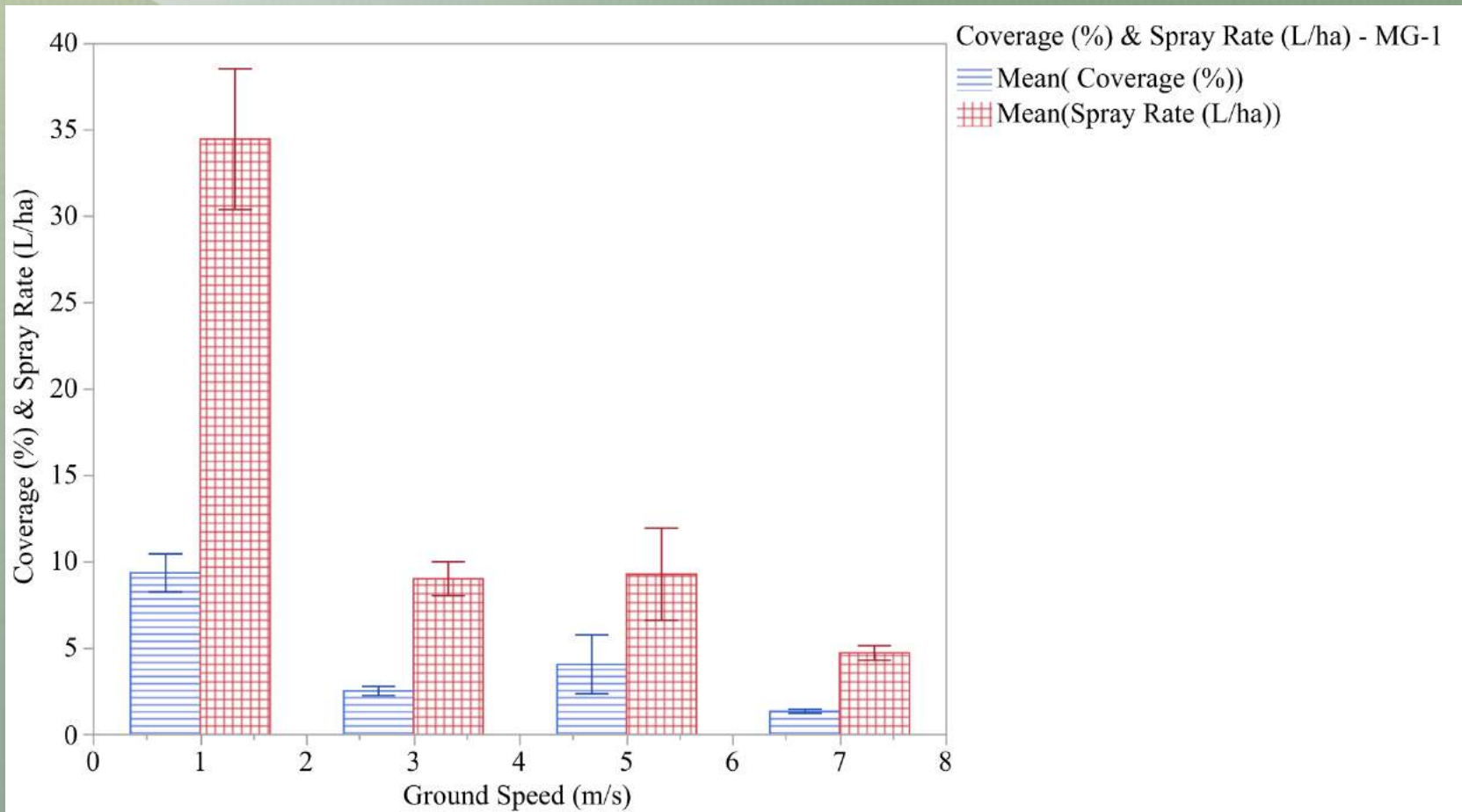


# WSP Results – V6A (5L)

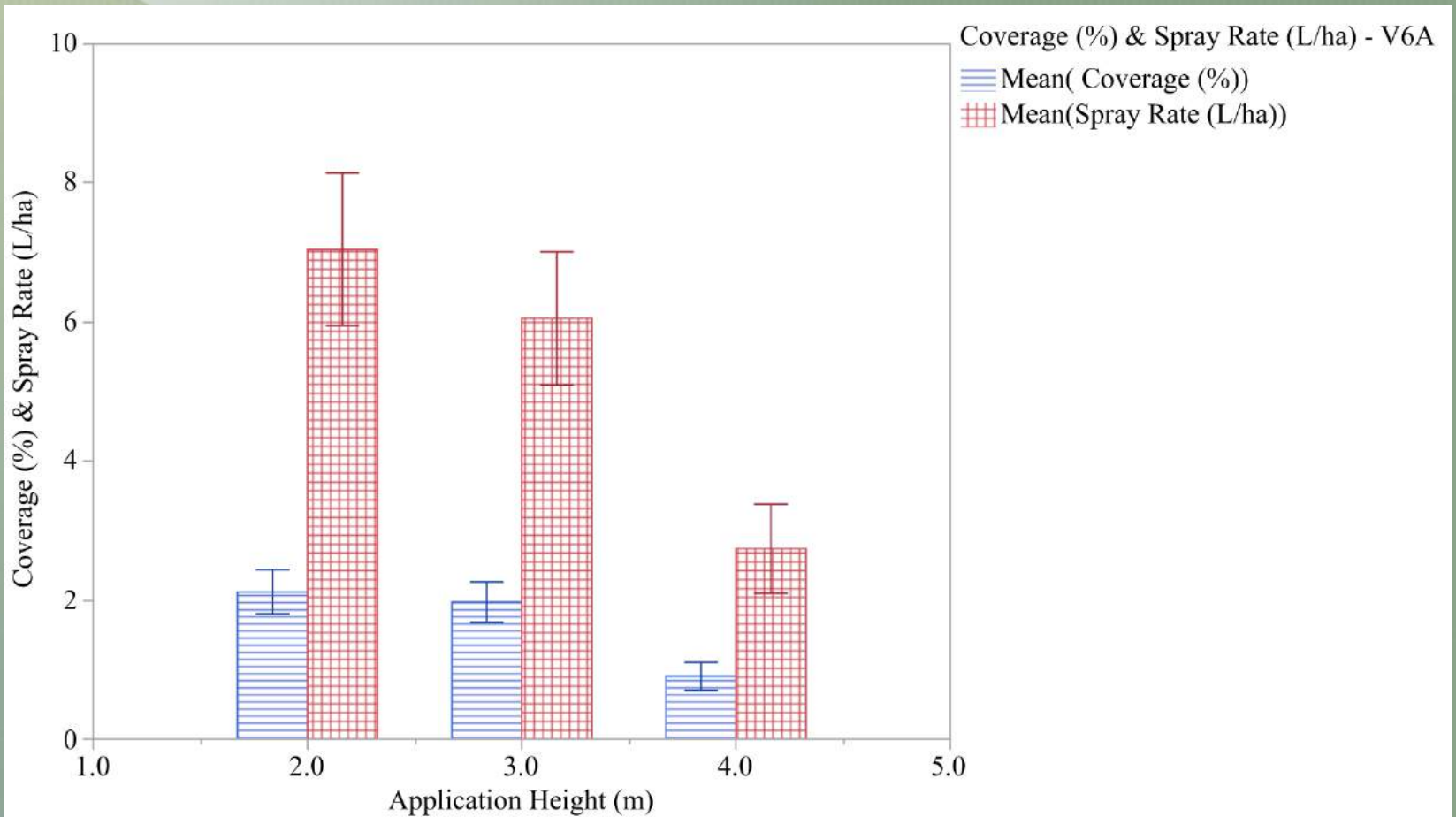




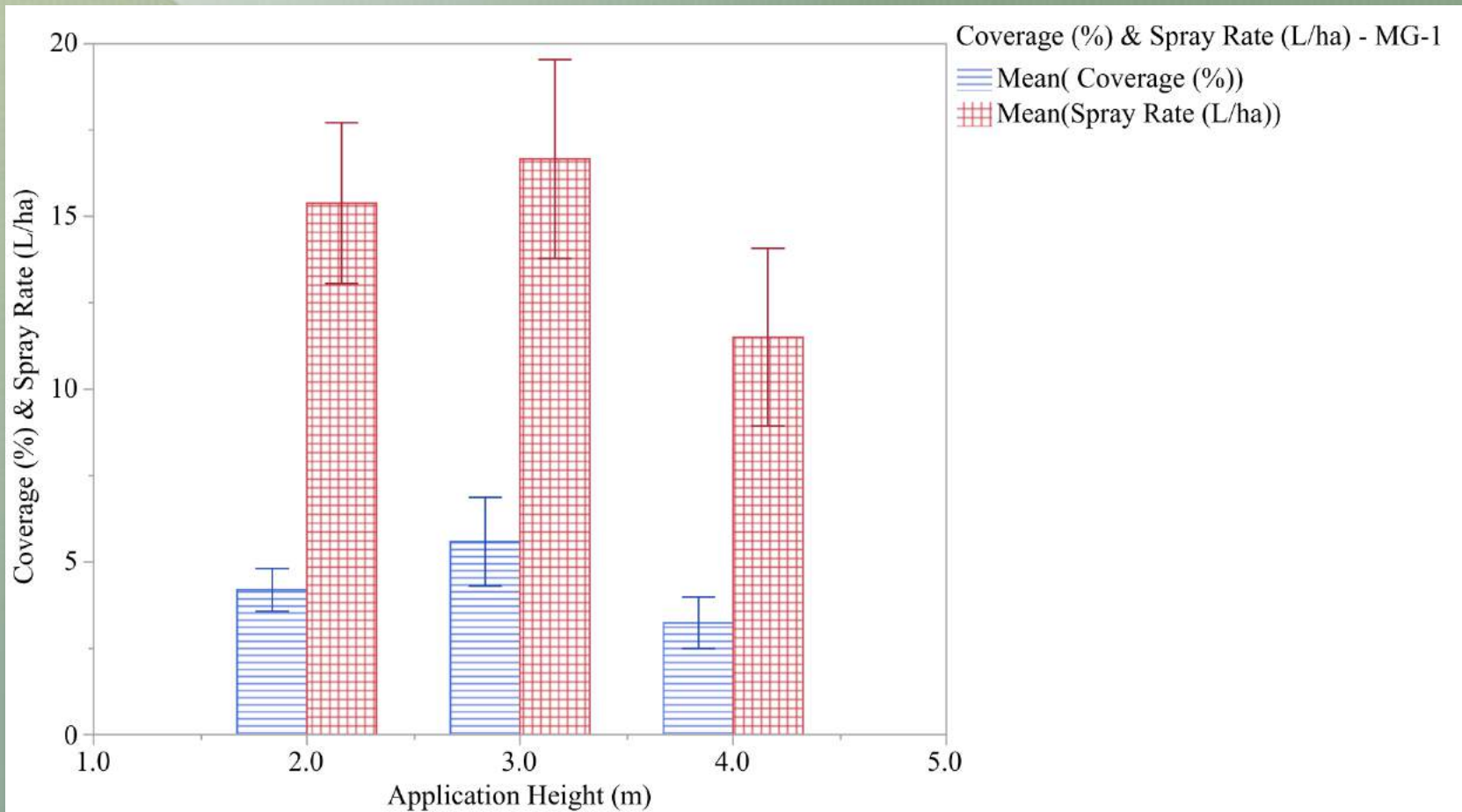
# WSP Results – MG1 (10L)



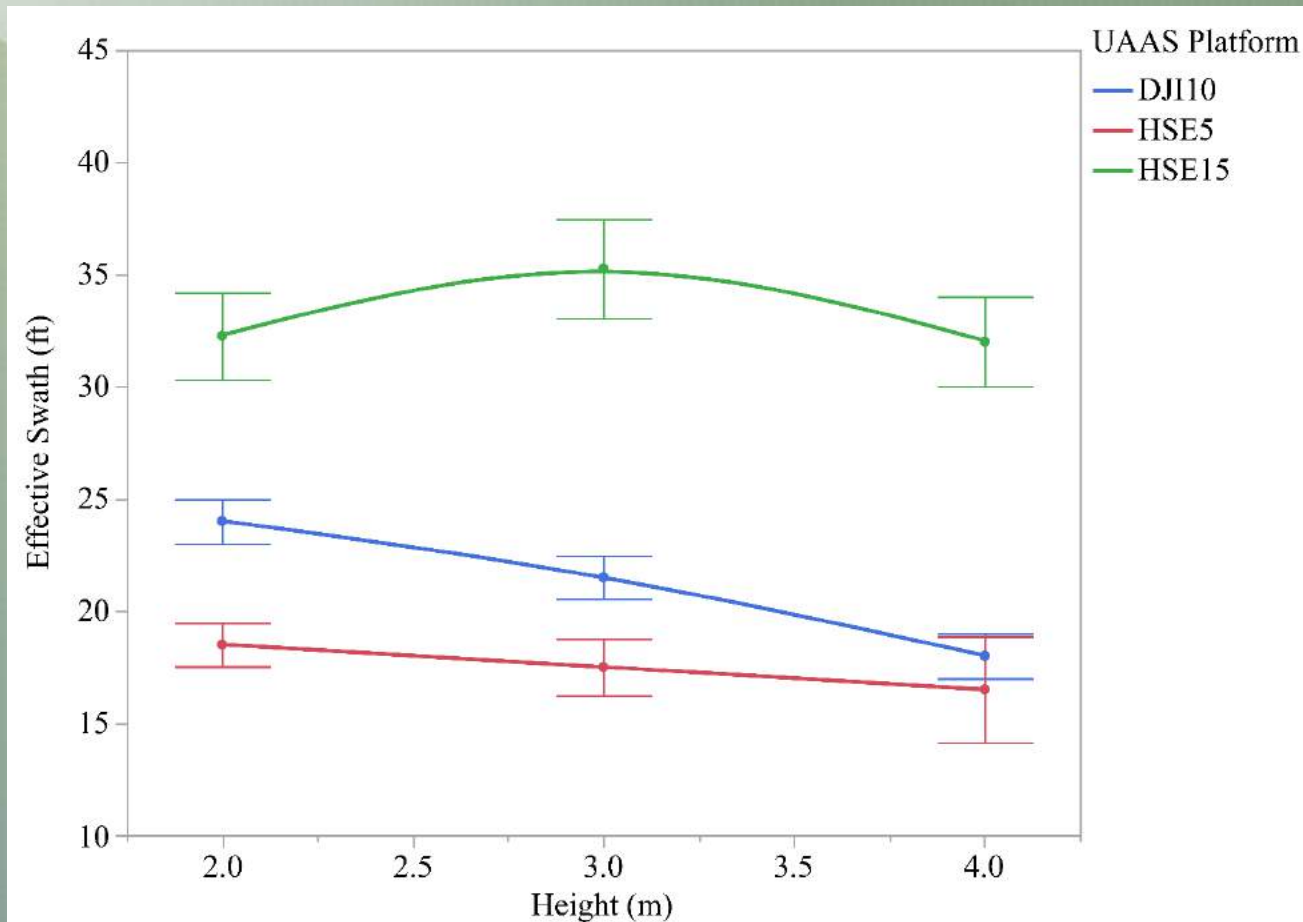
# WSP Results - V6A (5L)



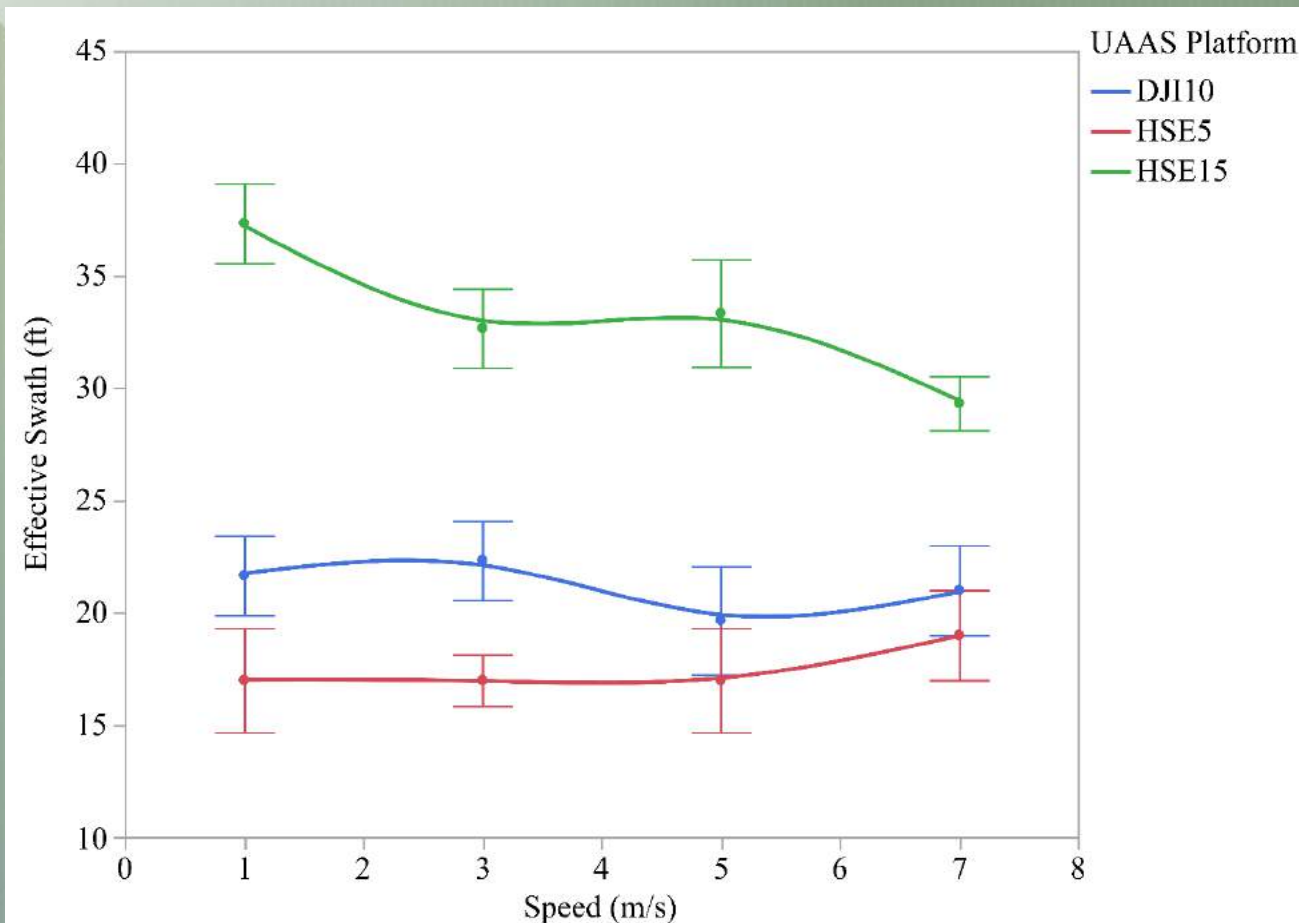
# WSP Results – MG1 (10L)



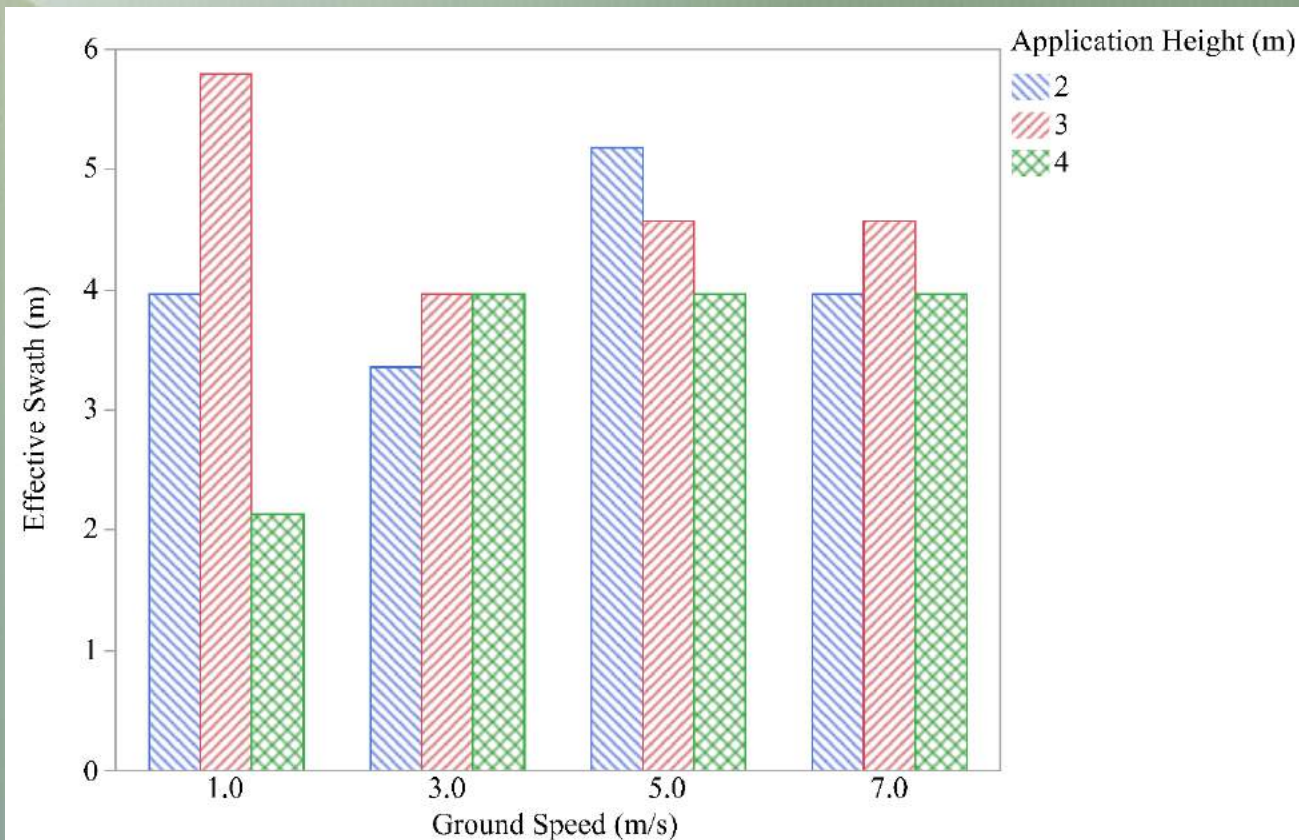
# Results: V6A+ (15L), MG1 (10L), V6A (5L)



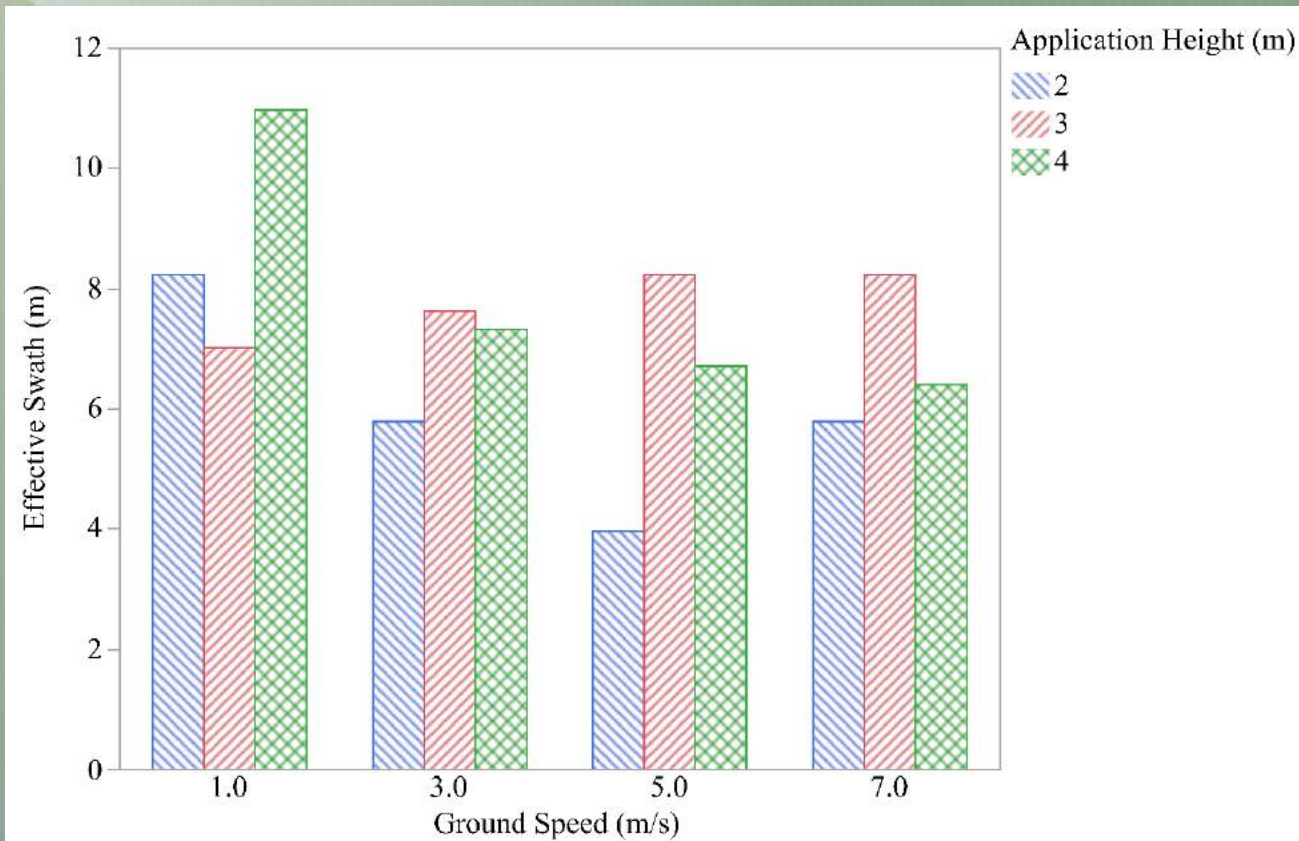
# Results: V6A+ (15L), MG1 (10L), V6A (5L)



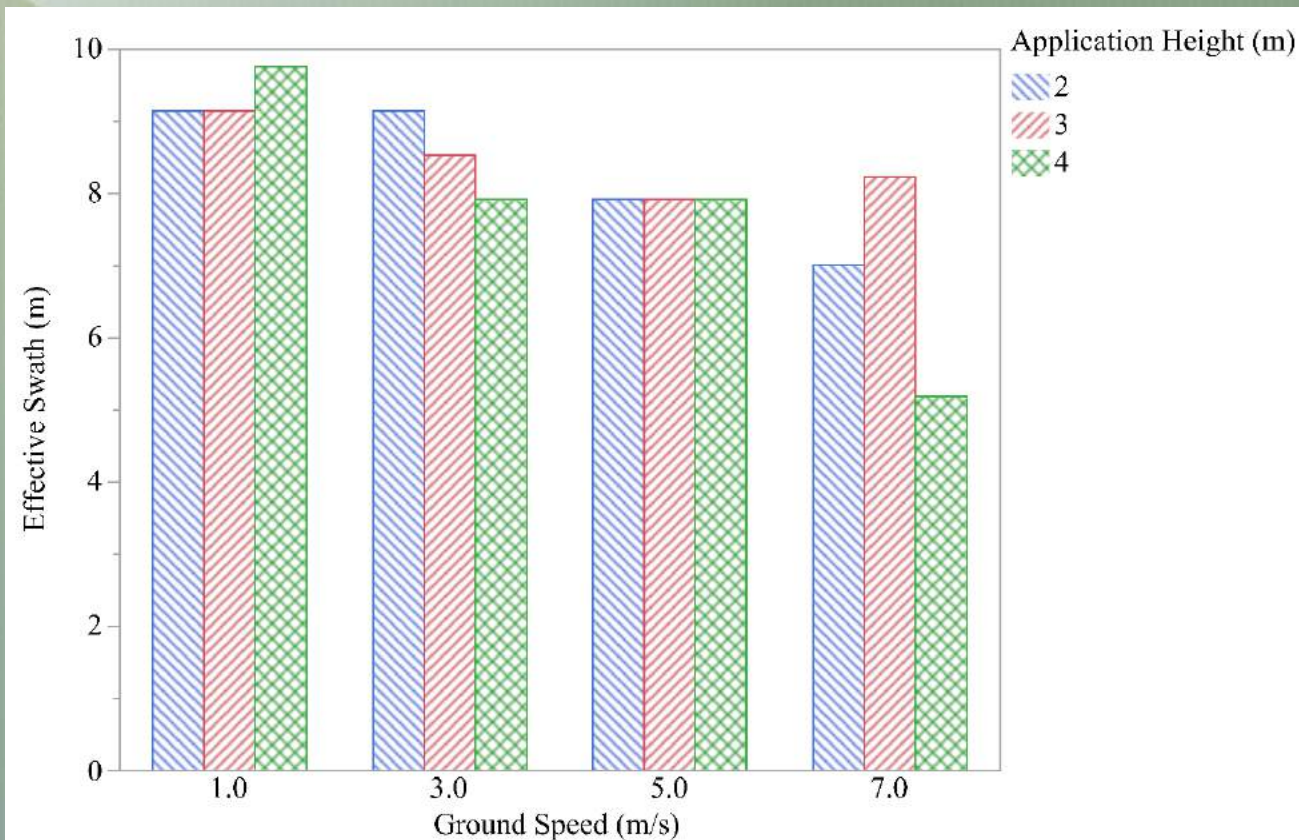
# Results – V6A (5L)



# Results – HSE M6E (10L)

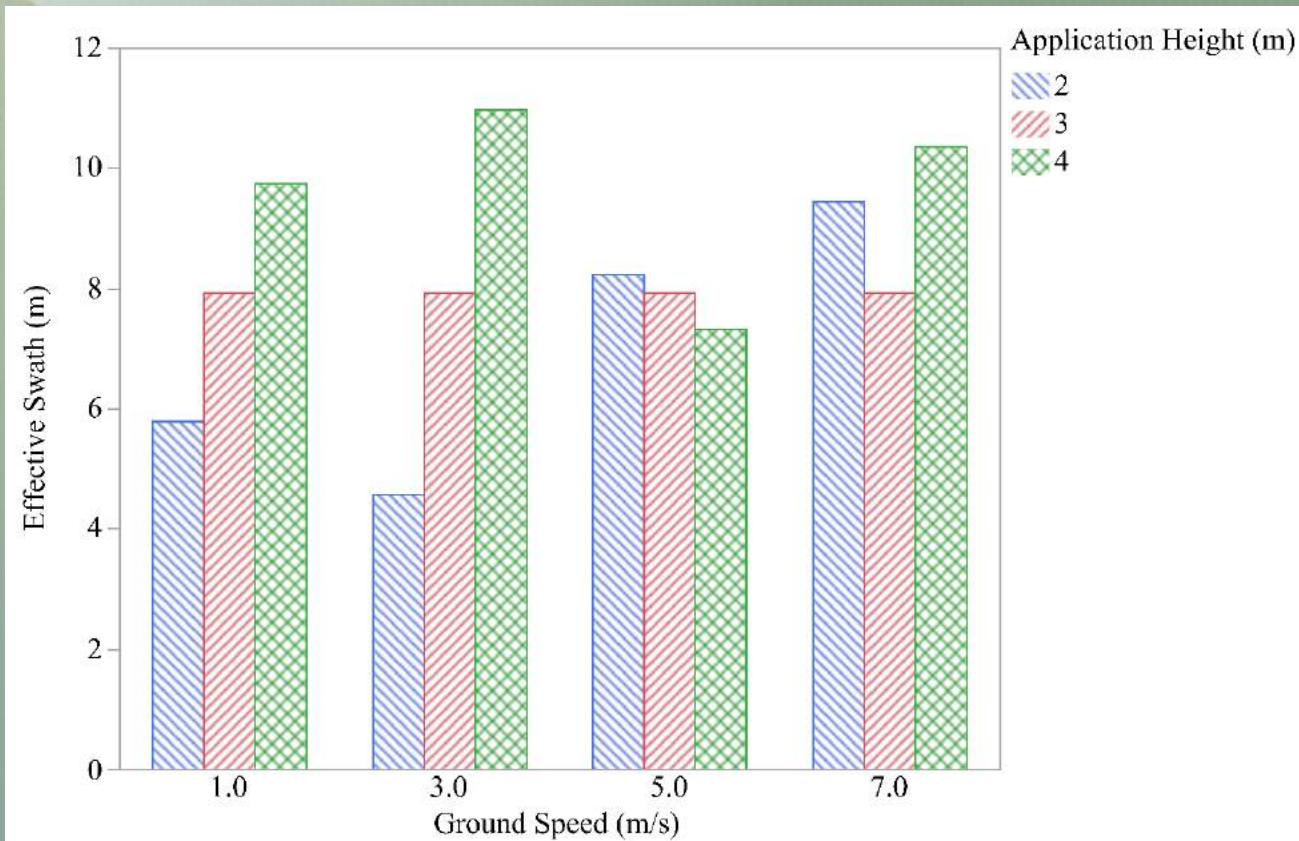


# Results – V6A+ (15L)





# Results – V8A+ (20L)



# Synthesis

- Emerging technology
- Potentially compelling applications
- Current Regulations introduce challenges
  - Will Part 137 pilots want to fly sUAAS sprayer ?
  - If not, who will fly the aircraft being sold ?
- If flights are outside regulations, is safety compromised ?
- Ideas & Solutions ?

# Support: USDA-ARS Aerial Application Technology UNL – Agricultural Research Division

