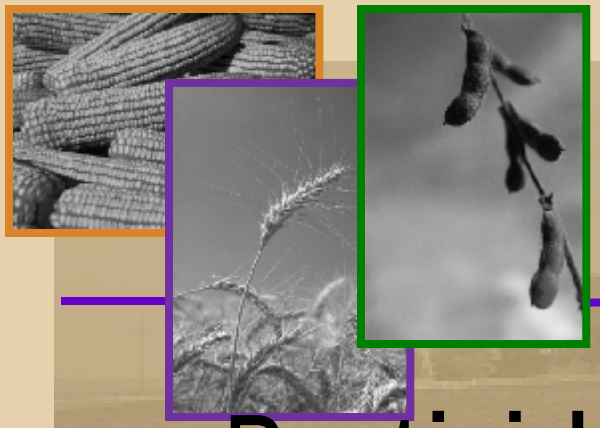

Pesticide Application Efficiency and Drift Potential from Aerial and Ground Sprayers

Roberto Barbosa

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Application Efficiency

- Objectives of an efficient application:
  - Deliver product on target, on a timely manner
  - Minimize drift
- Metrics:
  - Swath (ft), Speed (mph), Acres treated per minute (ATM),
  - Product efficacy (% kill, 0 disease presence, etc)
  - Zero drift claims

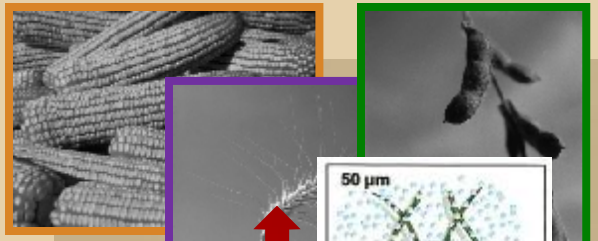
Application Efficiency

- Tools (for large-scale row crop ag.):
  - Airplane (Ex.: AT-502)
    - Swath: 66 ft (5 GPA)
    - Speed: 135 mph (200 fts)
    - ATM: 18
  - Self-propelled sprayer
    - Swath: 80 – 90 ft
    - Speed: 10 – 18 mph
    - ATM: 3

Application Efficiency

- Both tools have been criticized
  - Airplanes fly high off the
  - Ground sprayers t… …ize boom instability, c… …boom above recom…
  - …height tends to increase
  - …s of ground sprayer do not pay close a…tention to wind speed and direction

Any sprayer (air/ground) can be properly setup to minimize off-target drift. Pilots/operators can choose to spray only when conditions are optimal and drift potential is minimal.



Contact products, high coverage (drops/in), low GPA, insects/disease under canopy

Systemic products, high plant mobility, high GPA

Drift Risk

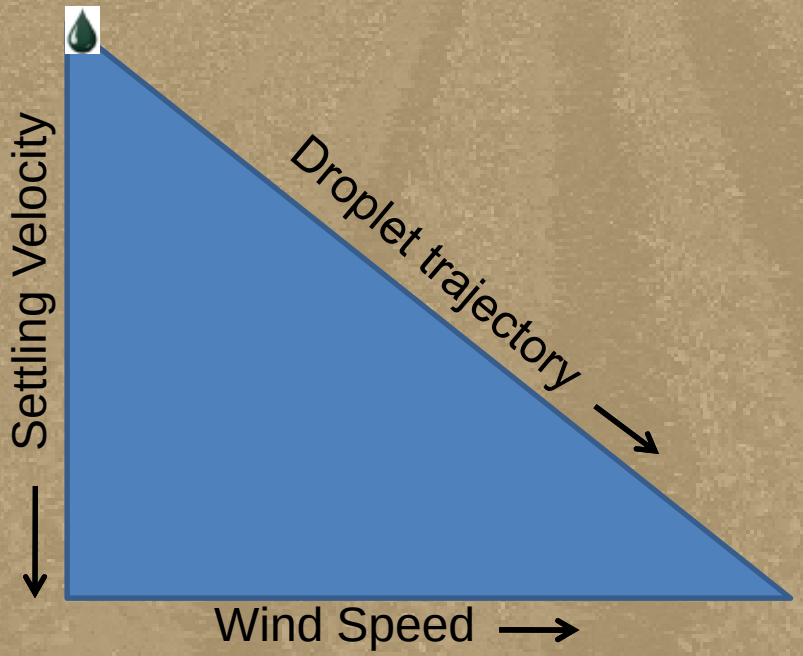
Coverage

Droplet Size

Adapted from Ozeki, Y. 2006. Manual de Aplicacao Aerea (in Portuguese).

Application Efficiency

– The greater the wind speed and application height, the greater is the potential for drift



$$D = \frac{H \times U}{V_s}$$

Minimize this

Maximize this

Effect of Droplet Size, Height and Wind

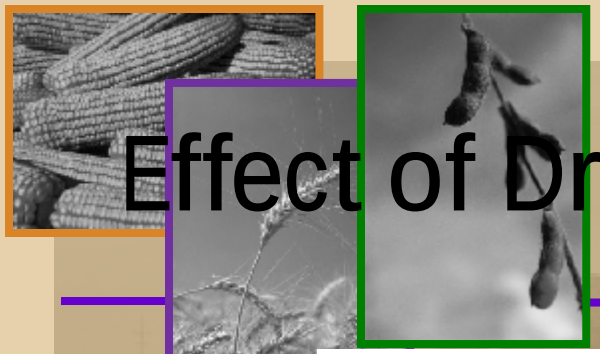


Table 8.5 Downwind displacement of different sized droplets for given *HU* products

HU Products distance downwind big droplets 100 µm and larger — *Neutral or stable lapse rate*

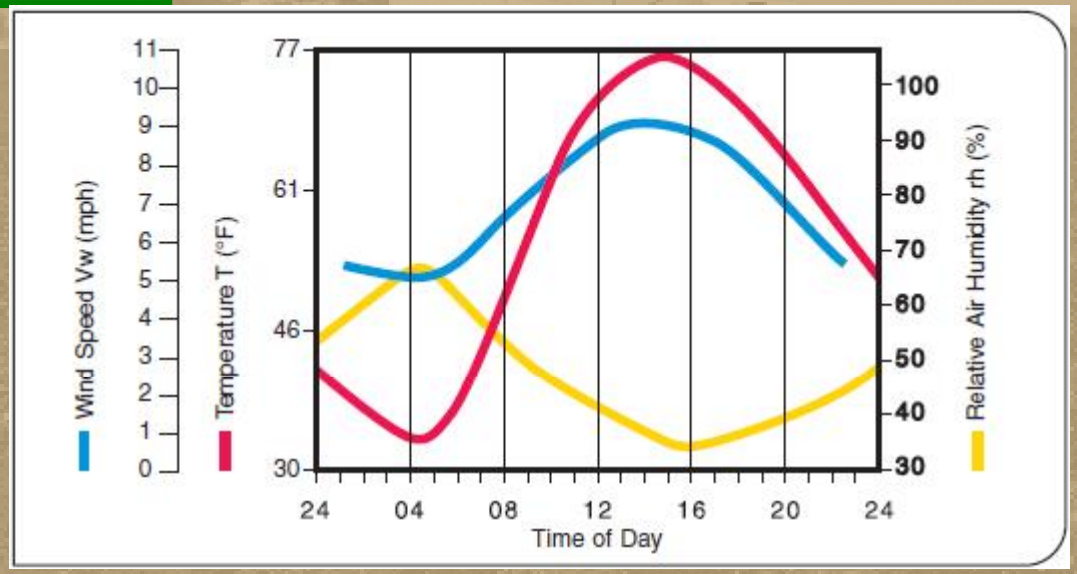
HU Products (m x ms^{-1})	Droplet diameter (µm)				
	100	150	200	300	400
1	3.7	2.0	1.4	0.9	0.6
2	7.4	4.1	2.8	1.7	1.2
5	18.5	10.2	7.1	4.3	3.0
10	37.0	20.5	14.2	8.7	6.1
20	74.1	40.9	28.4	17.4	12.3
30	111.1	61.5	42.6	26.1	18.4
40	148.1	81.9	56.7	34.8	24.5
50	185.2	102.4	70.9	43.5	30.7
60	222.2	122.9	85.1	52.2	36.8
70	259.2	143.4	99.3	60.9	42.9
80	296.3	163.9	113.5	69.6	49.0
90	333.3	184.4	127.6	78.3	55.2

Wind x height

Increasing droplet size will decrease downwind deposit

Increasing release height and/or wind speed will increase downwind deposition

Sprayer setup to minimize drift



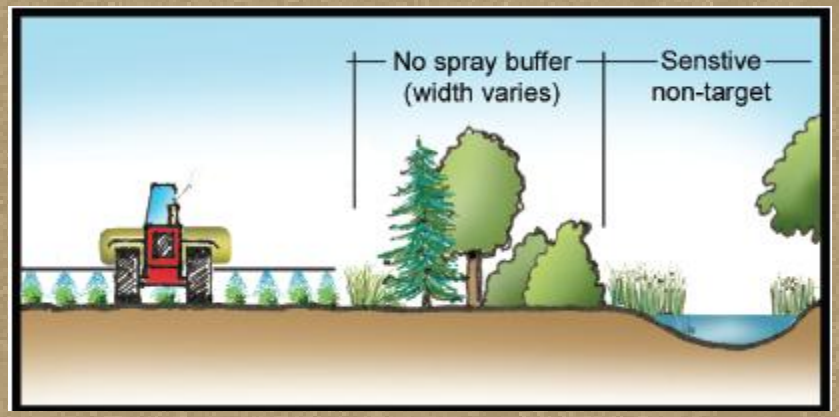
- Sprayer setup needs to take into account variations in wind speed throughout the day
- As wind speed increases during the day, pressure should be adjusted (lower) and nozzle orifice should be increased to produce larger droplets

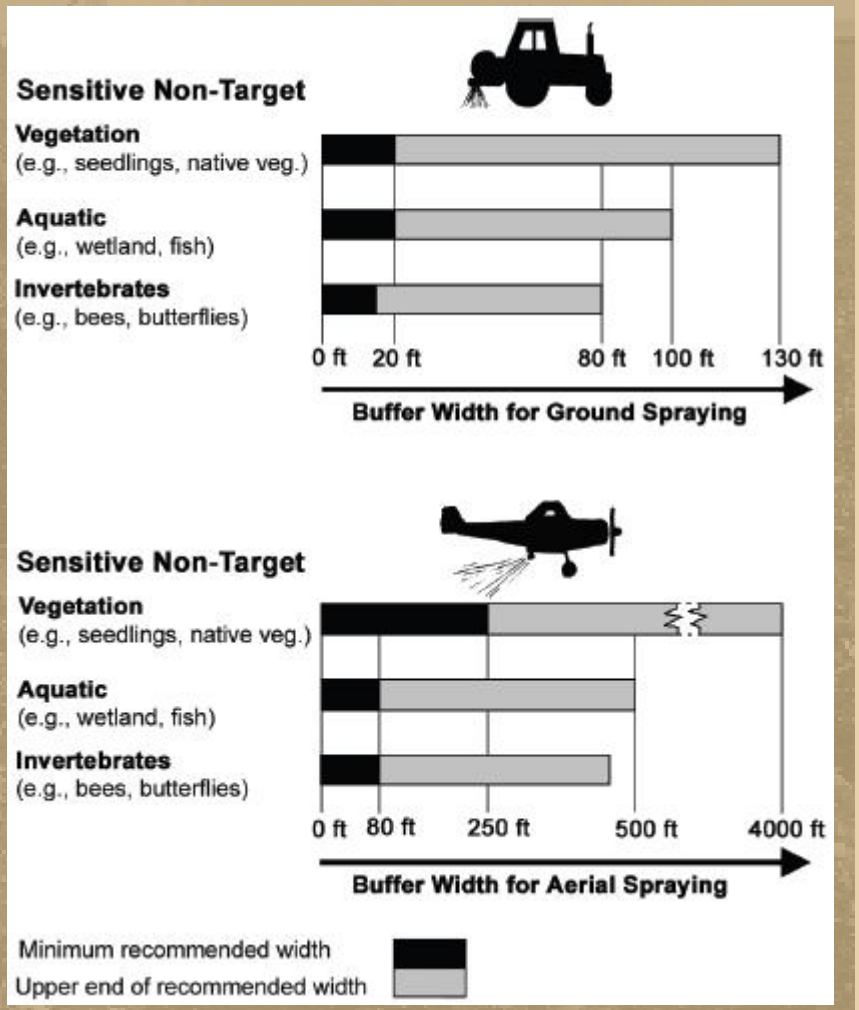
Recommendations

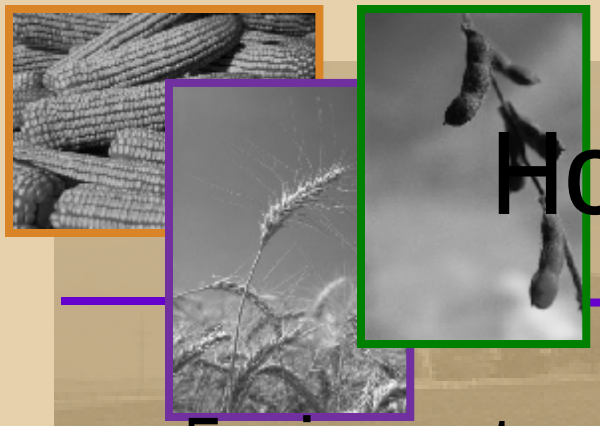
- Use a wind meter to measure and document wind speed
- Make sure wind is NOT blowing towards sensitive areas

Recommendations

- Use buffers, if possible







How to reduce drift

- Equipment- related
  - Nozzle type
  - Boom height
  - PSI
  - GPA
  - Boom length
  - Sprayer speed
- Additives (drift-reducing)
- Solution-related
  - Viscosity
  - Density
  - Surface tension
  - Vapor pressure
- Weather-related
  - Wind speed & direction
  - Air temperature, RH
- Application Timing

Drift

- Drift problems may increase in the near future
  - Increase in weed resistance forces producers to modify their weed control strategy and use products with different modes of action
  - Co-application of insecticides/herbicides (need to increase product distribution – use of lower droplet size, GPA?)
  - Multiple GE crops side by side with conventional crops will create "*perfect storm scenario*"
    - Dicamba-resistant soybean
    - 2,4-D resistant cotton

Grower

Consultant

Applicator

CROP

ZERO DRIFT SHOULD BE THE GOAL OF THE INDUSTRY

Concerns

- Drift this year's toughest issue (Delta Farm Press, 06-02-2011, by F. Baldwin)
  - "bulk of drift complaints in rice continue to be glyphosate and newpath"
  - "I am aware of a 350-acre rice replant due to gramoxone plus cotoran drift"
  - "in almost every situation I look drift could have been prevented…"
  - "a lot of drift appears to be blatant disregard"
  - "if what we're seeing with drift right now is the real world, then we have not seen anything yet"

Concerns

- A viable aerial application industry is in the interest of both growers and consultants
- Pressure put on aerial applicators to “put the product out now” negatively affects his decision making process and may contribute for less than optimal conditions for product application
- Phrases like “drift is not my problem” or “that’s what insurance is for” do not help

Illinois Pesticide Sensitive Crops and Habitats Registry

register here

Driftwatch™ is a tool to help protect pesticide-sensitive crops and habitats in Illinois. Managers of ecologically sensitive areas and owners of commercial fields and apiaries may register - this site is not intended for homeowners.

Pesticide applicators can easily locate registered sites before they spray using a Google Maps™ interface.

Learn how to register your site.

Register for applicator emails.

Learn about our resources for applicators.

View maps.

Photo by Ben Alkire

General information
regarding
Pesticide Use and Regulation
in Illinois
http://www.agr.state.il.us/Environment/Pesticide/pestuses

General information regarding the
Aerial Application of Pesticides
in Illinois
http://www.agr.state.il.us/Environment/Pesticide/aerialap.html

Locate Field by address, town, or zipcode

62794

Search

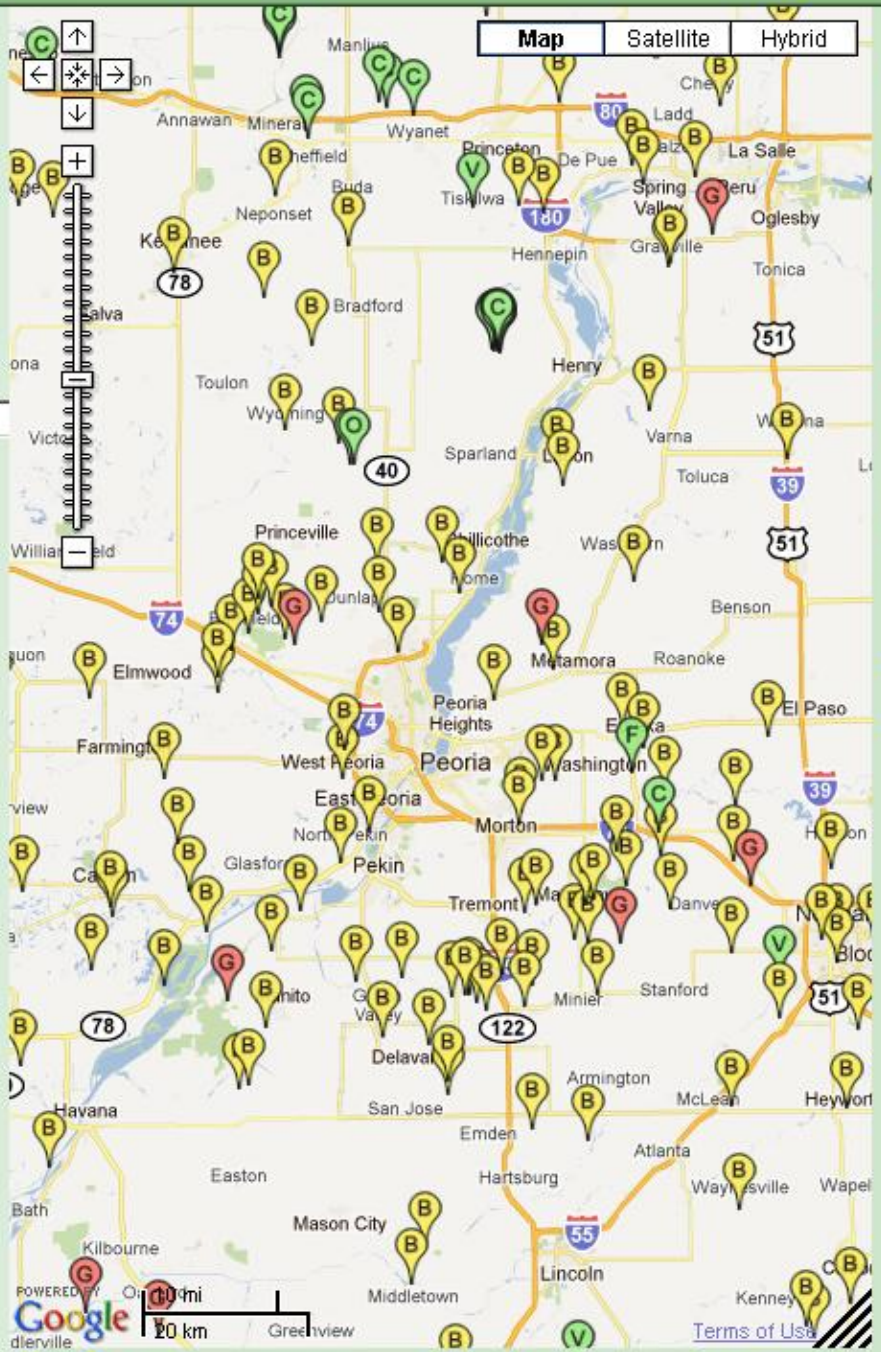
These data are meant to facilitate communication between applicators and growers.

Note: bounding lines indicate approximate positions of sensitive lands submitted to the site, not property lines.
Disclaimer

Legend

Sensitive Areas!

☐ View county lines.
☐ View Commercial Wind Turbines.



Sensitive Areas Legend
Click to expand

-Vegetables and Fruits:

- ☑ Beehives
- ☑ Fruits
- ☑ Grapes
- ☑ Pumpkins or Melons
- ☑ Tomatoes
- ☑ Vegetables
- ☑ Nursery Crop

+Organics:

+Others:

- ☑ All

Flag *The* Technology

A quick and inexpensive method to prevent misapplication of pesticices and warn of technology that is sensitive to potential off-target drift.

UofA
UNIVERSITY OF ARKANSAS
DIVISION OF AGRICULTURE

The Flag the Technology idea is simple. Colored Bicycle-type flags that represent a particular herbicide technology are placed at the field entrance or in conspicuous location in the field visible from ground and air. The color of the flag represents the technology. Multiple flags may be used if needed to insure visibility. In fields where stacked technology (such as Roundup Ready and Liberty Link) is utilized, flags representing both technologies are displayed.

Preferred flag size is 8' x 1/4" fiberglass pole with minimum 11" x 17" flag for maximum visibility

Color Codes:

RED signifies conventional varieties with no herbicide technology traits. Extreme caution.

PMS 1797
R-201, G-40, B-45
C-15, M-98, Y-93, K-4

WHITE represents the Roundup Ready® Technology that is tolerant to glyphosate herbicide.

BRIGHT GREEN indicates the Liberty Link® Technology. This technology is tolerant to glufosinate (Ignite) herbicide.

PMS 354
R-0, G-174, B-66
C-95, M-0, Y-100, K-0

BRIGHT YELLOW is the color chosen for Clearfield® technology. This technology is tolerant to imazethapyr (Newpath) and imazamox (Beyond) herbicides.

PMS 102
R-251, G-231, B-0
C-5, M-3, Y-100, K-0

How to measure drift?

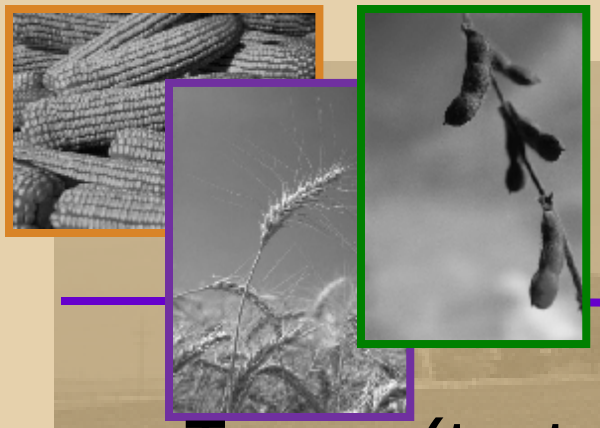
- Field measurement of drift is not simple
  - Difficult to reproduce good drift “scenarios”
  - Need to test different nozzle/pressure configurations to establish knowledge base
- Use 3 different samplers:
  - Ping-pong balls
  - Monofilament (fishing) line (100 ft total, 2 heights: 24” and 48”)
  - Water-sensitive cards

Protocol

Ping-pong balls: 3D object, used for medium to large droplet capture

Monofilament (fishing) line: 3D object, favors impaction & sedimentation of small droplets.

Water sensitive cards (WSC): 2D object, favors droplet impaction over sedimentation



Protocol

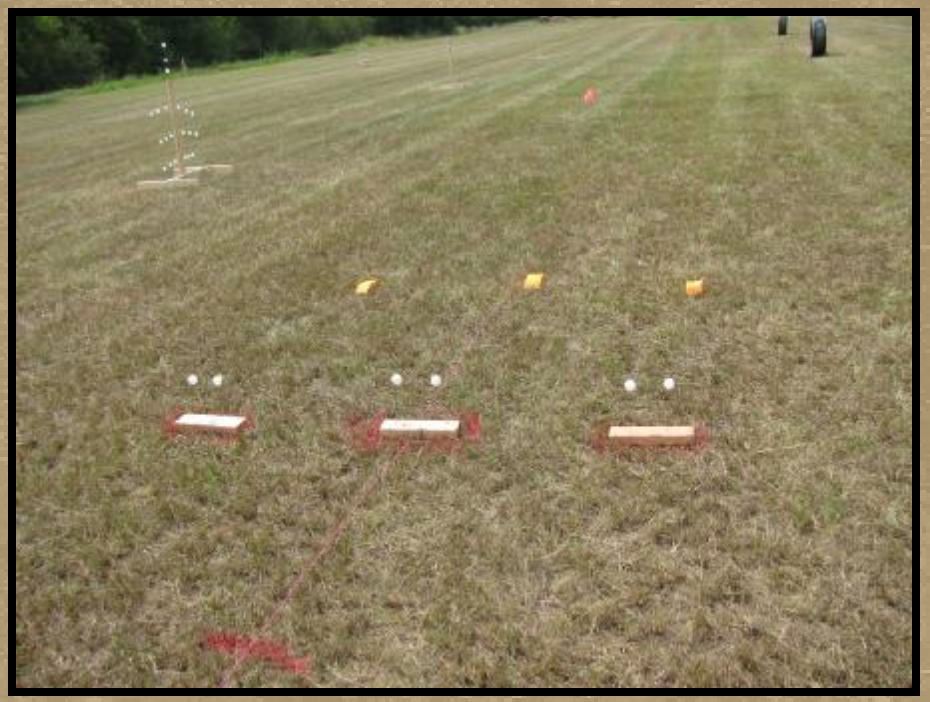
- Tracer (tartrazine) dissolved in water. Concentration (g/ac) remains constant, so GPA does not play a role
- Sprayer travels perpendicularly to the wind direction
- Samplers placed in 3 stations at varying distances downwind from the spray line

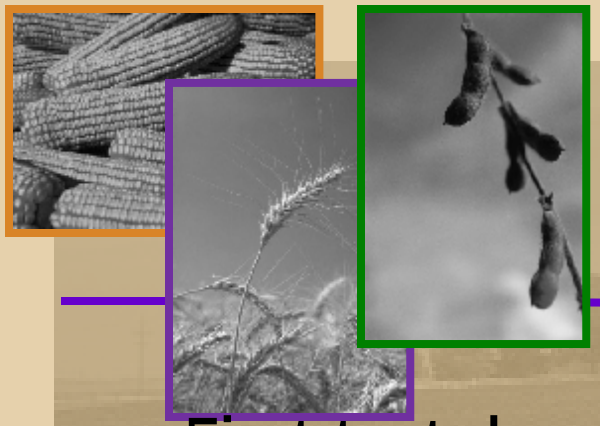
Protocol

- Ping-pong balls are collected in a plastic bag and washed. Sample is measured by colorimetry.
- Monofilament line is “stripped” in the field, and sample measured by colorimetry
- WSC are analyzed with scanner (n# droplets, average droplet size)

Field Trial

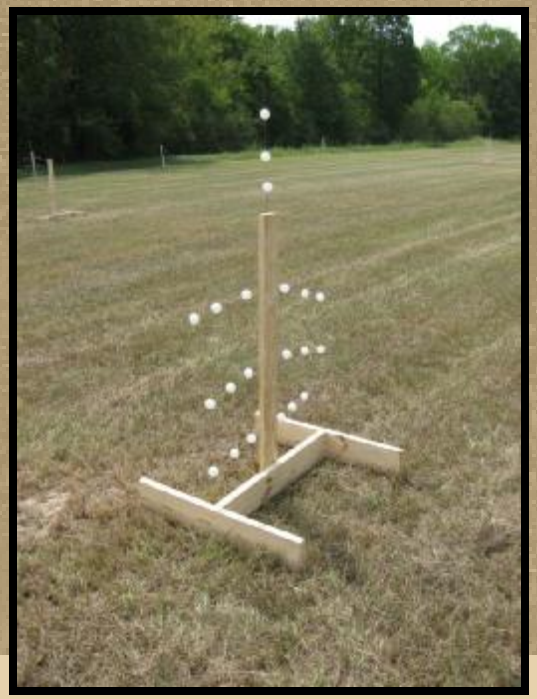
- Protocol was tested twice at Macon Ridge Research Station





Field Trial

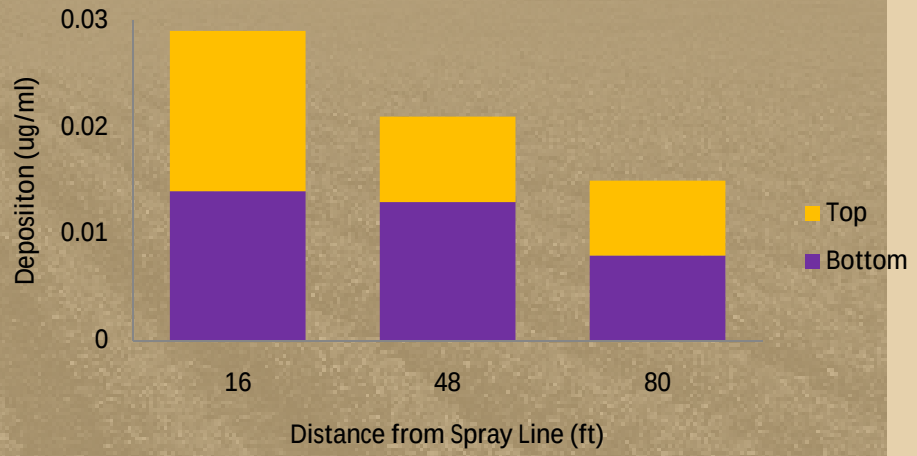
- First test done with Conejet nozzles (small droplets)



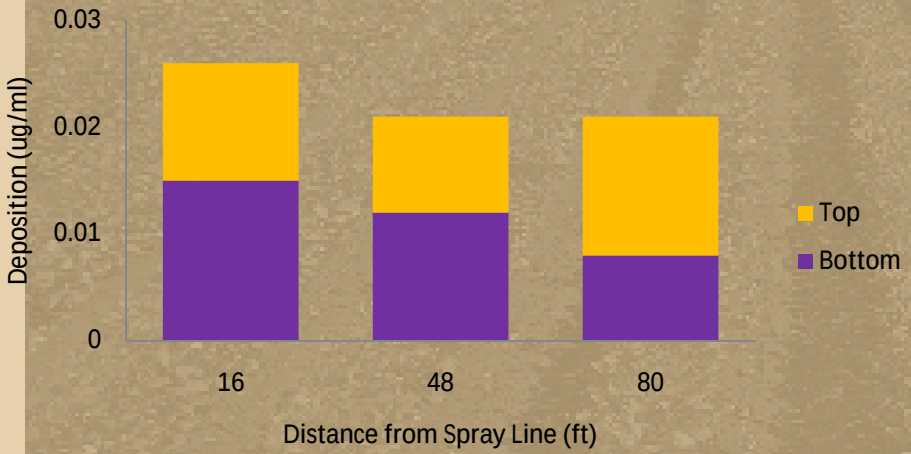
- Second test used Conejet, AI, and flat fan (XR) nozzles

Monofilament Deposition

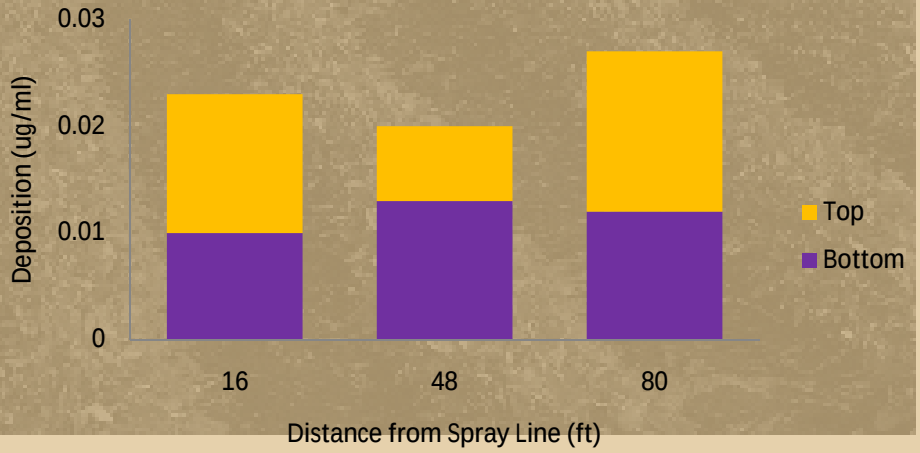
RI



RII

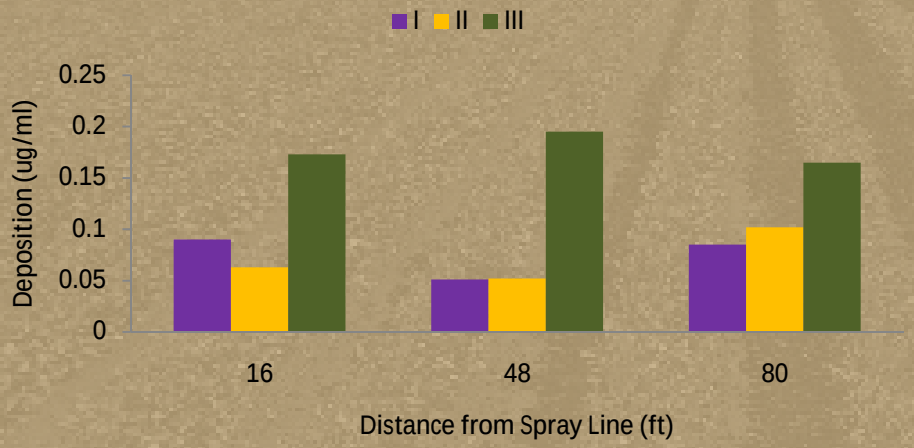


RIII

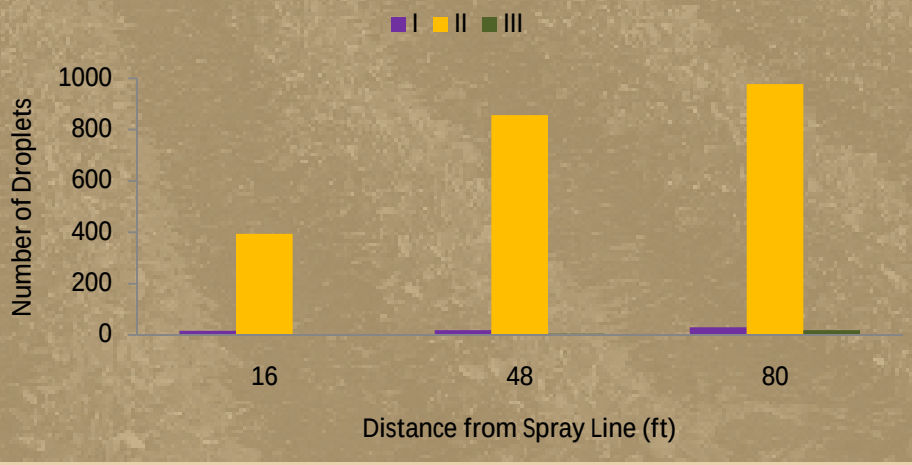


Results

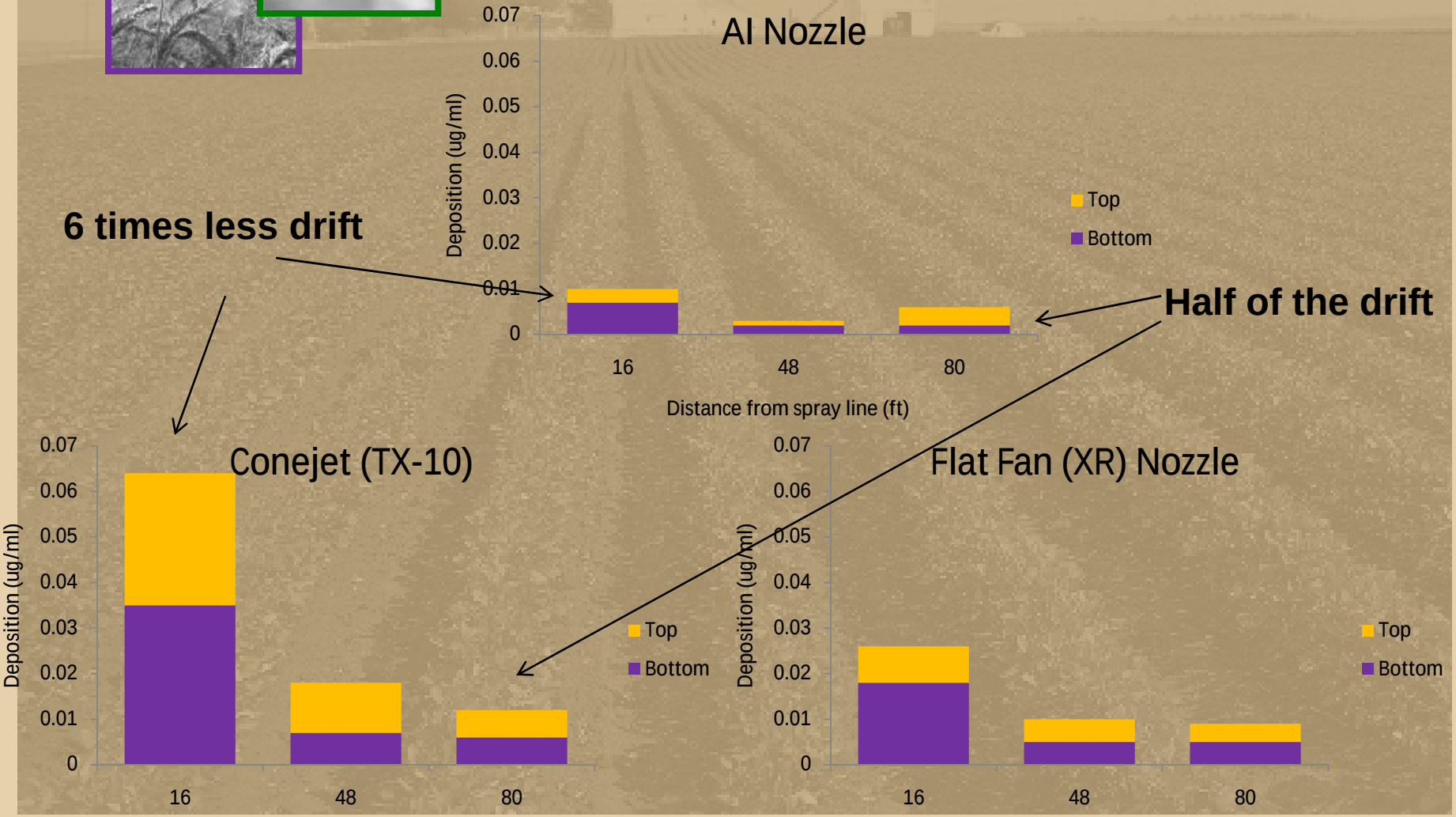
Ping Pong Balls



Water Sensitive Cards

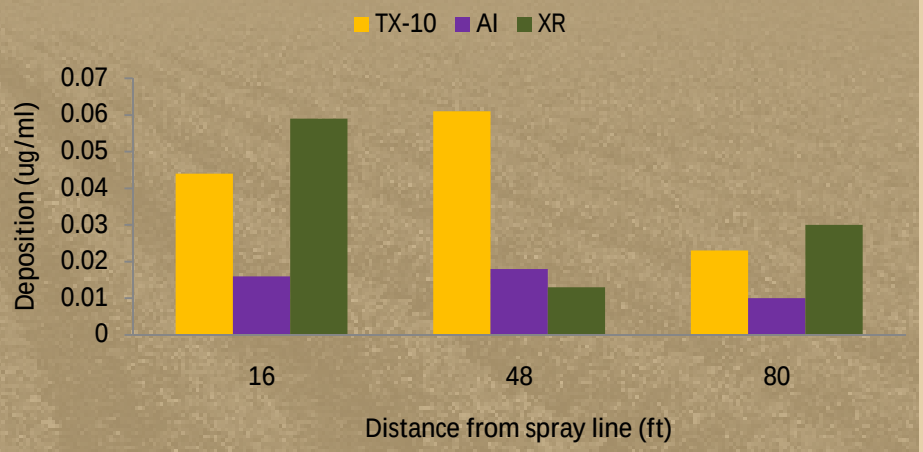


Results 2nd Test

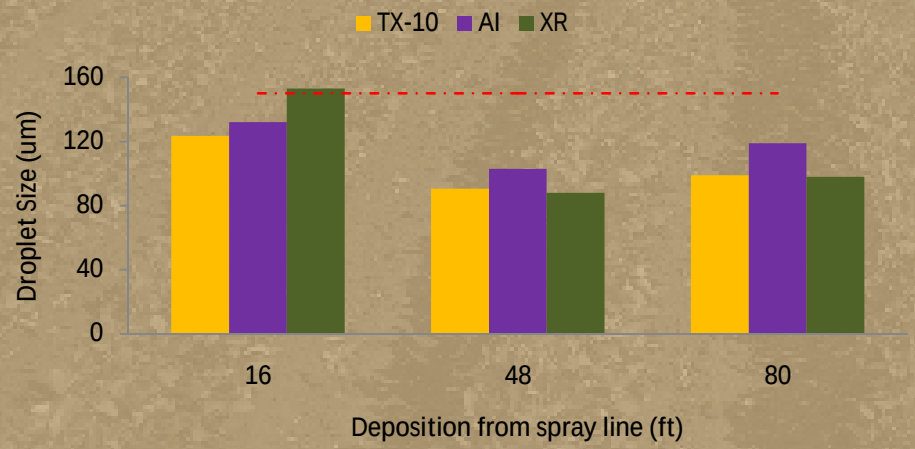


Results 2nd Test

Ping Pong Balls

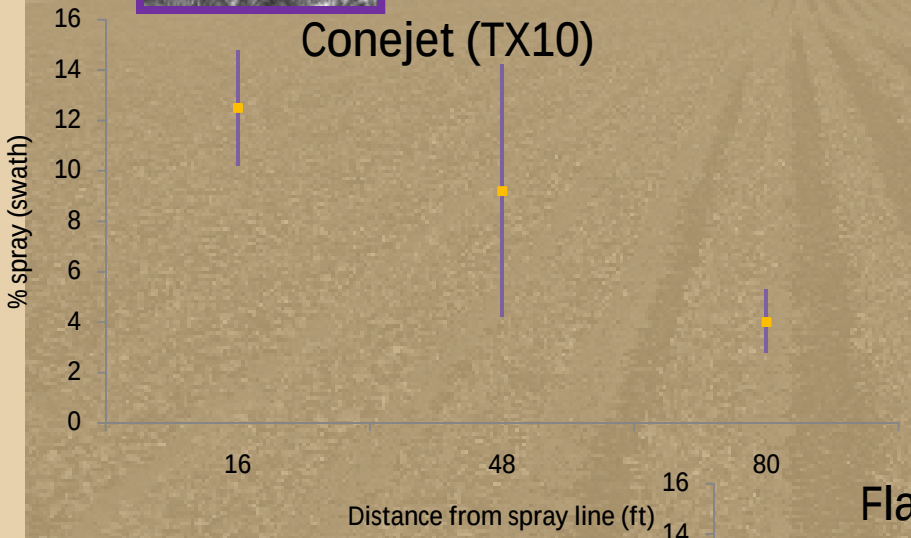


Droplet Size - WSC

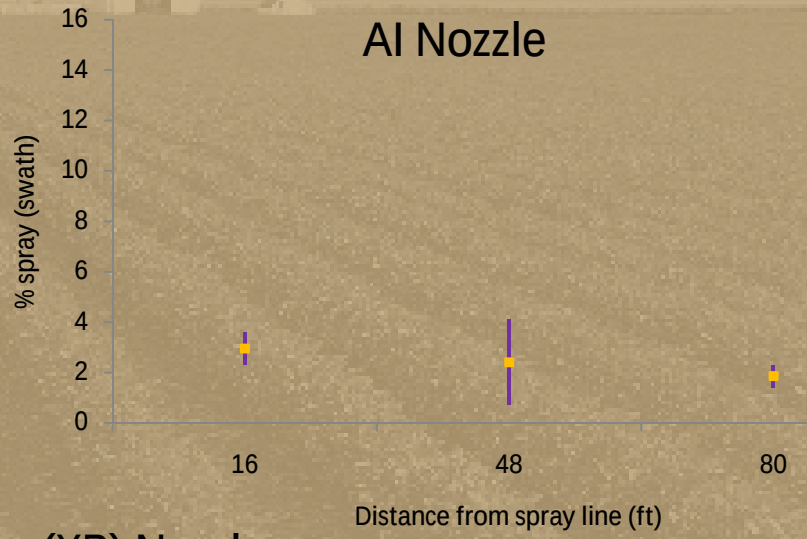


Results 2nd Test

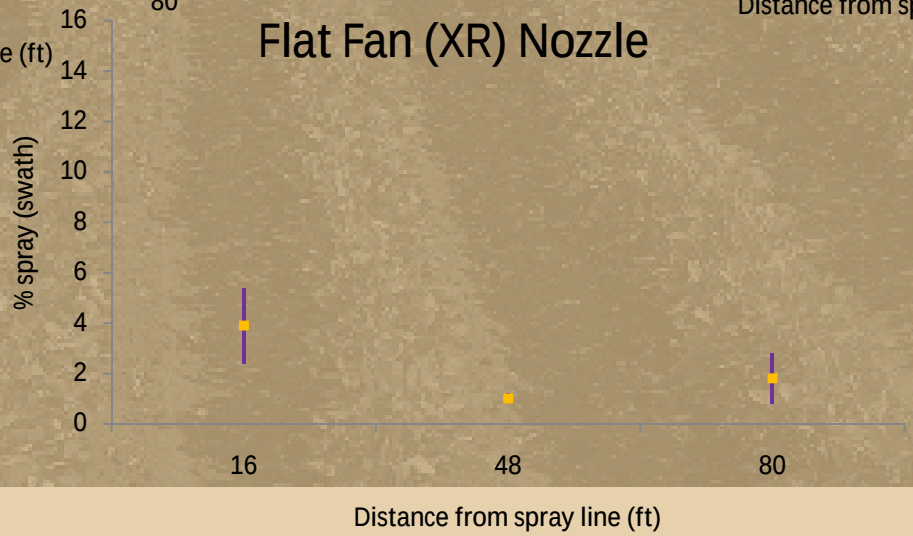
Conejet (TX10)



AI Nozzle



Flat Fan (XR) Nozzle



Questions?