

Learnings from 2018 on Off-target Movement of Auxin Herbicides

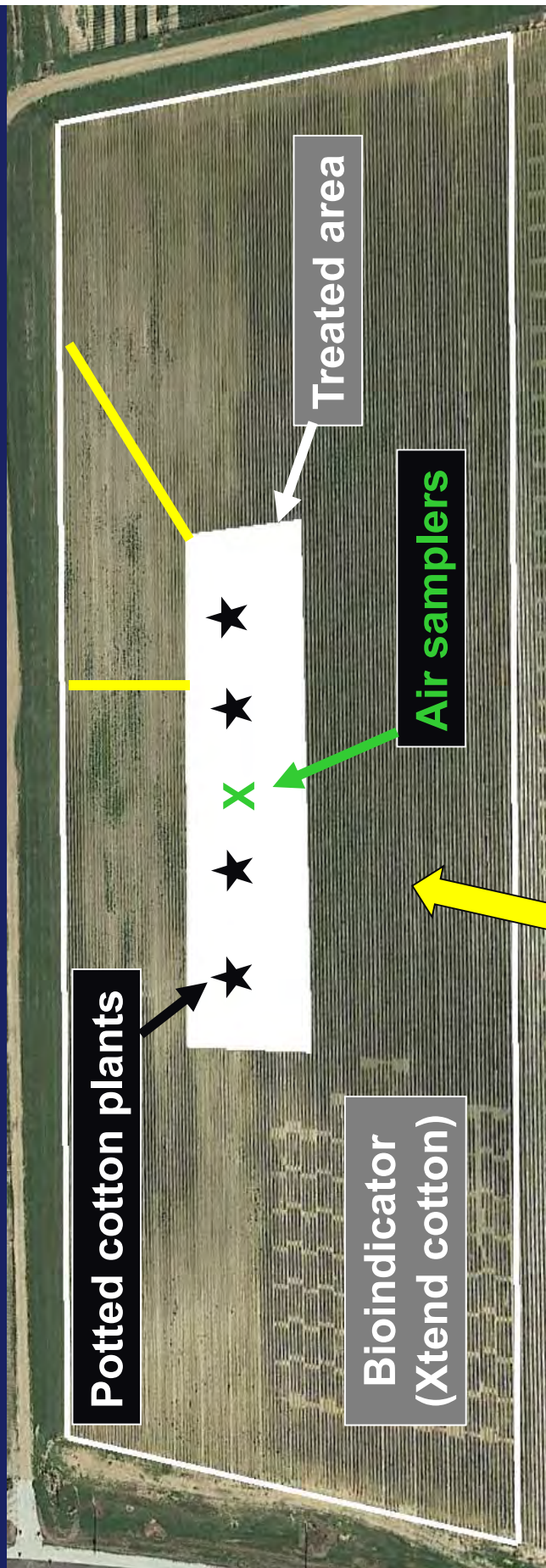
Jason K. Norsworthy
Professor and Elms Farming Chair of Weed Science

Tom Barber, Jeremy Ross, & Cammy Willett

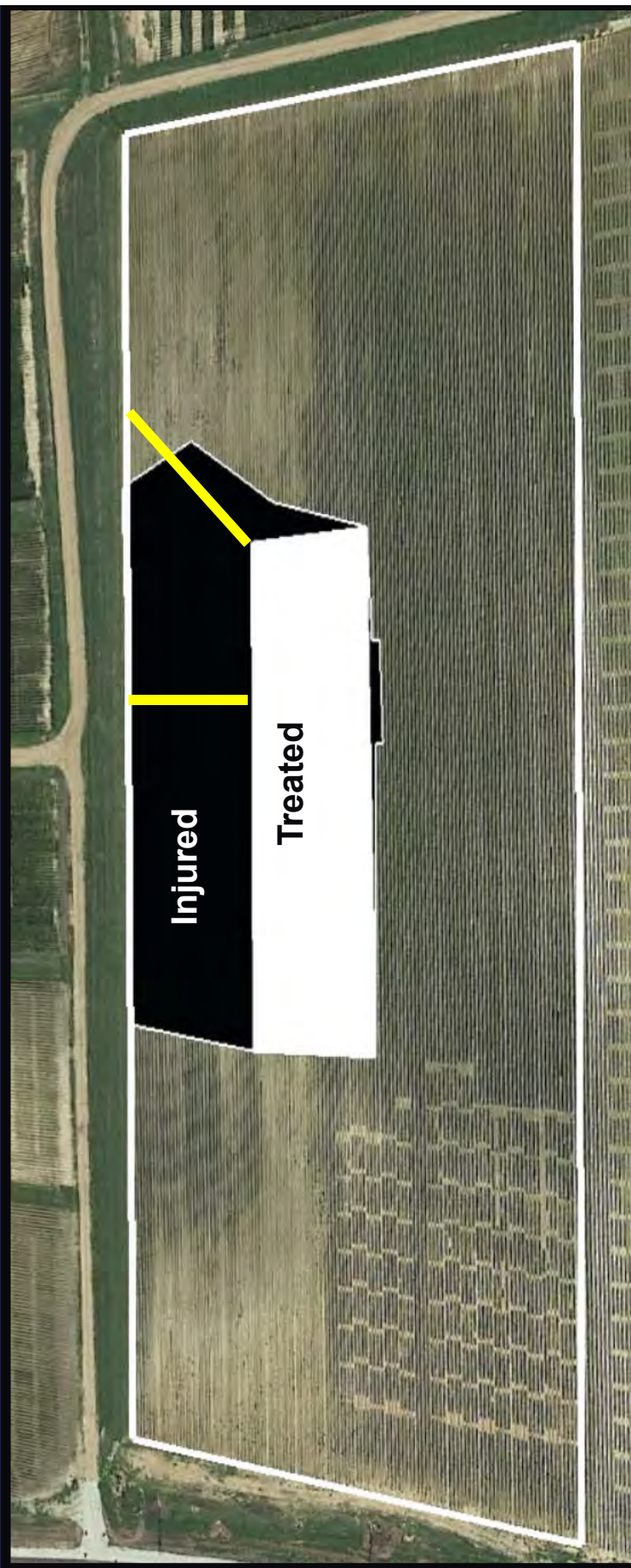


- **Objective:** Assess the likely causes for off-target movement of Enlist One with a commercial application
- **Cotton:** XtendFlex
- **Application:** 1 qt/A Enlist One + 1 qt/A Liberty
- **Date:** August 6, 2018 (1:55 to 2:05 PM)
- **Sprayer setup**
 - 25 ft boom; 8 mph; 10 GPA, 24 inch height
 - AIXR 11003 nozzles
- **Environmental conditions during application**
 - Avg. 8.0 mph; Range of 7.0 to 9.5 mph
 - 89 F and 54% RH

Enlist One Drift Trial (Field Setup)



Injury to Cotton



29 days after application

ER 0801



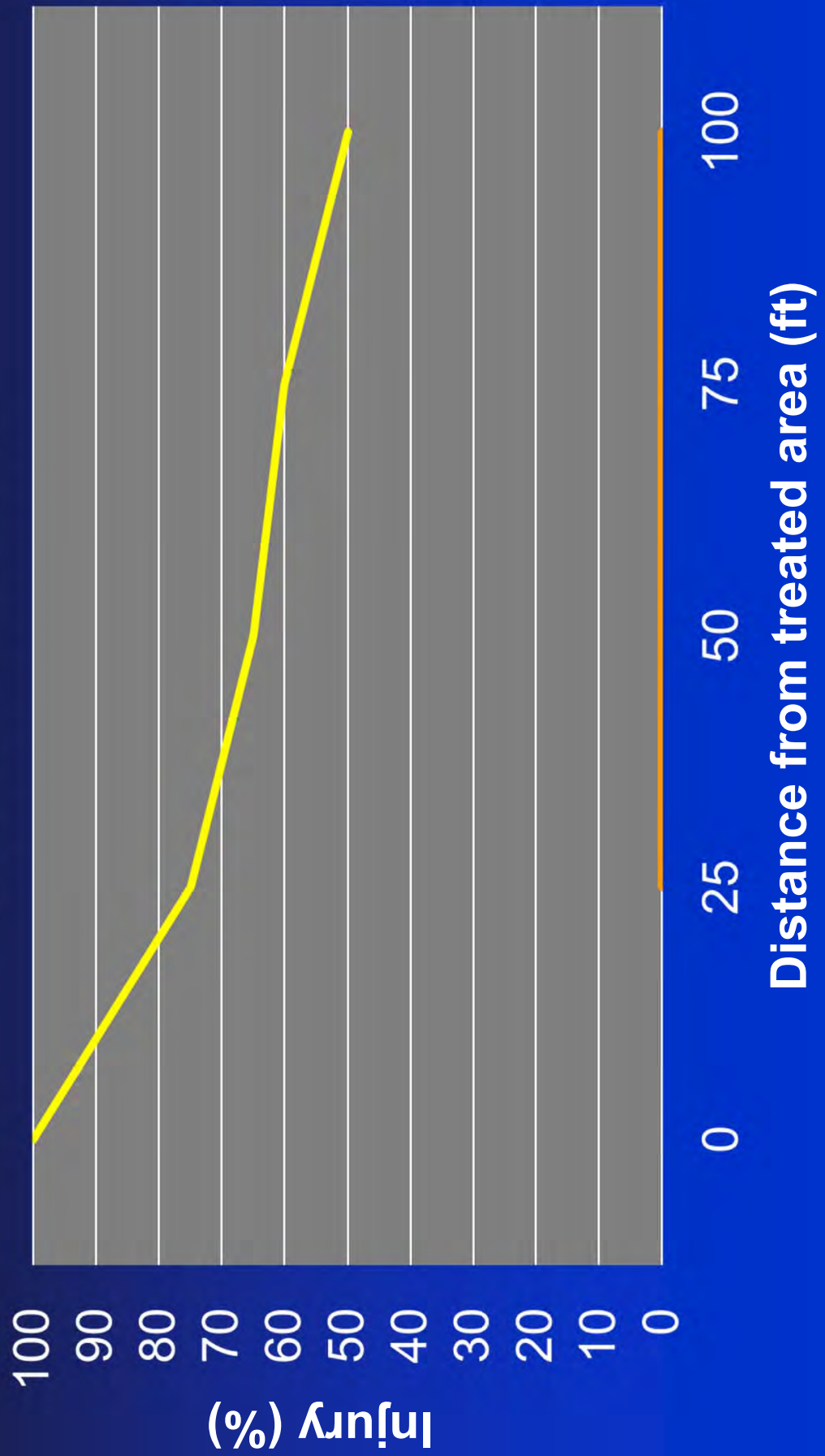
ER 0802



ER 0803

Injury from Enlist One

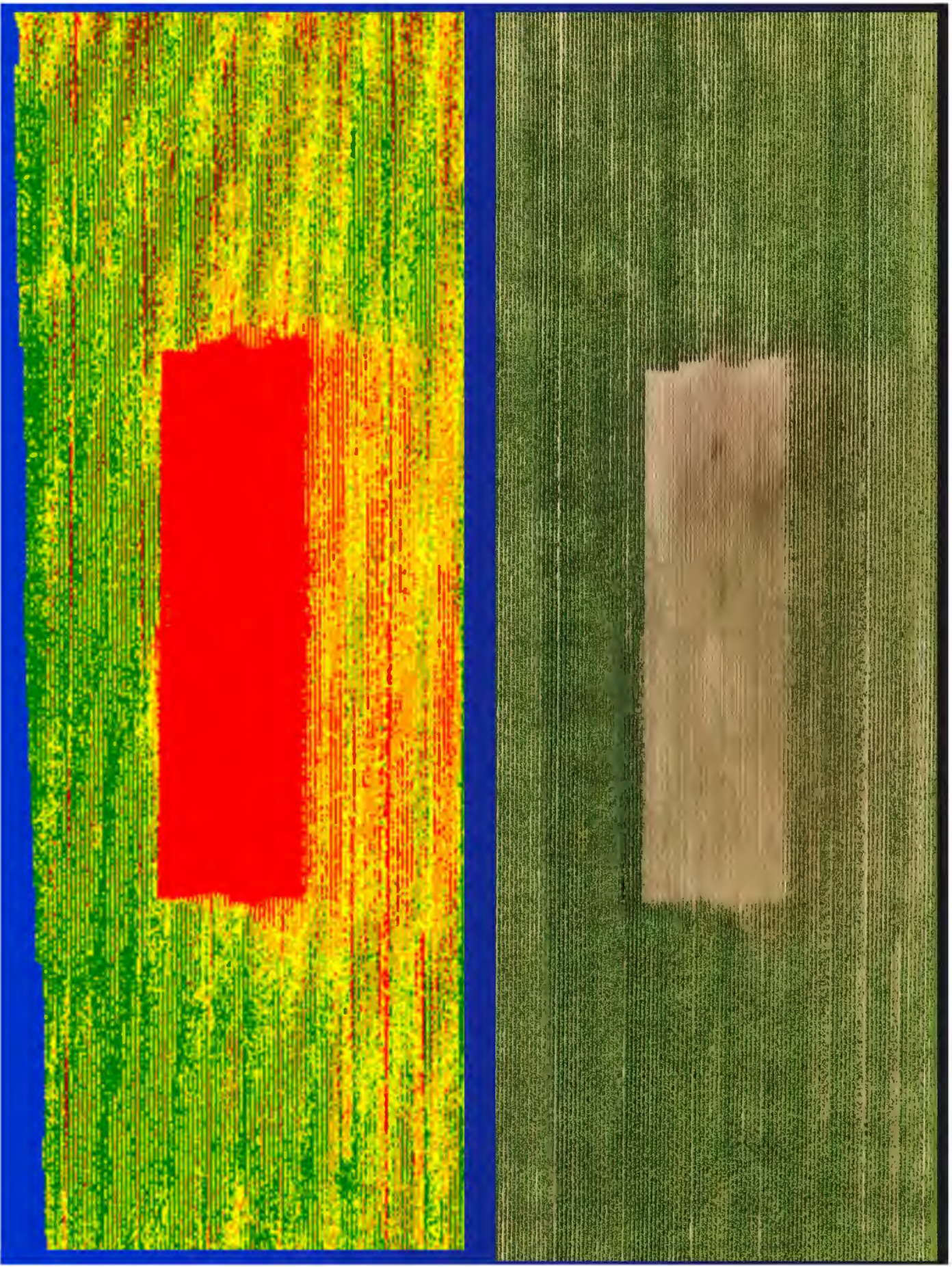
— Covered — Uncovered



ER 0804



ER 0805



ER 0806



ER 0807



48 to 72 hours
4 weeks after application

ER 0808



ER 0809



ER 0810

Objective: Assess the ability of the See-and-Spray system to control weeds and reduce off-target movement of dicamba



ER 0811



**June 11, 2018
Keiser, AR**

ER 0812

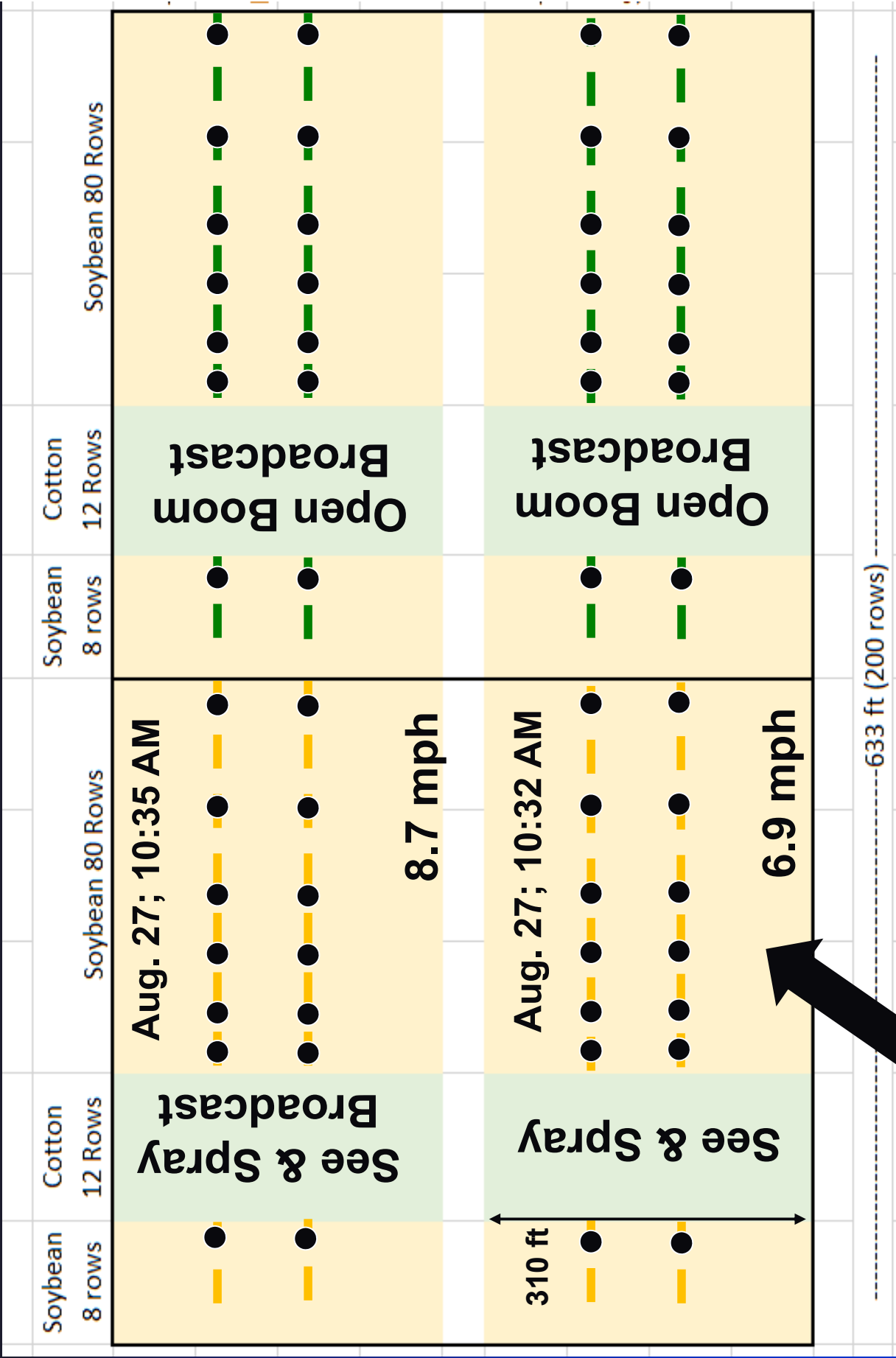
- **Objective:** Assess the ability of the See-and-Spray system to reduce off-target movement of dicamba
- **Location:** Keiser, AR
- **Treatments:**
 - Open boom broadcast vs. See-and-Spray
hooded boom broadcast
 - Open boom broadcast vs. See-and-Spray
- Engenia + Roundup PowerMax + Intact



ER 0814



ER 0815

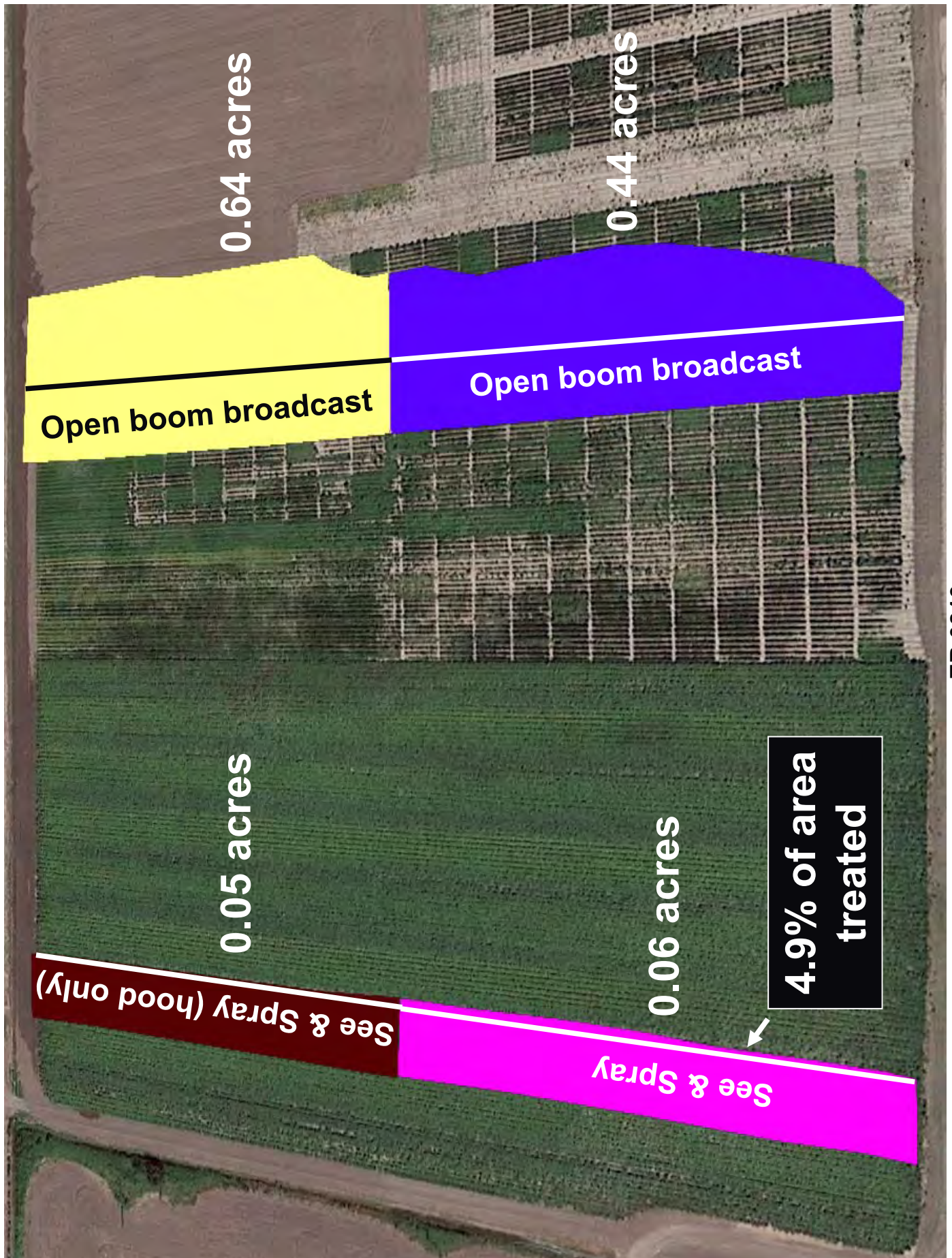




ER 0817



ER 0818



ER 0819



ER 0820

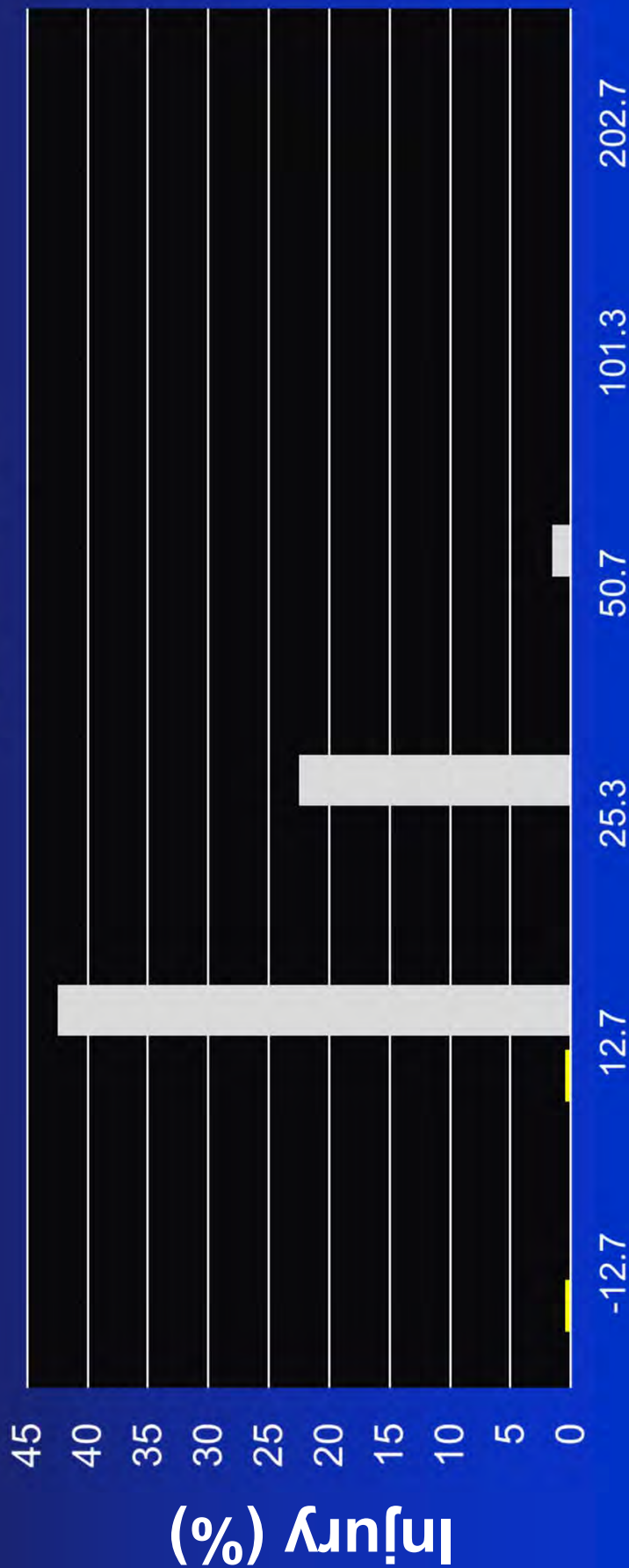
See & Spray System

See & Spray vs. Open Boom

(15 days after application)

Primary + Secondary Movement

■ See & Spray (broadcast) ■ Open boom broadcast

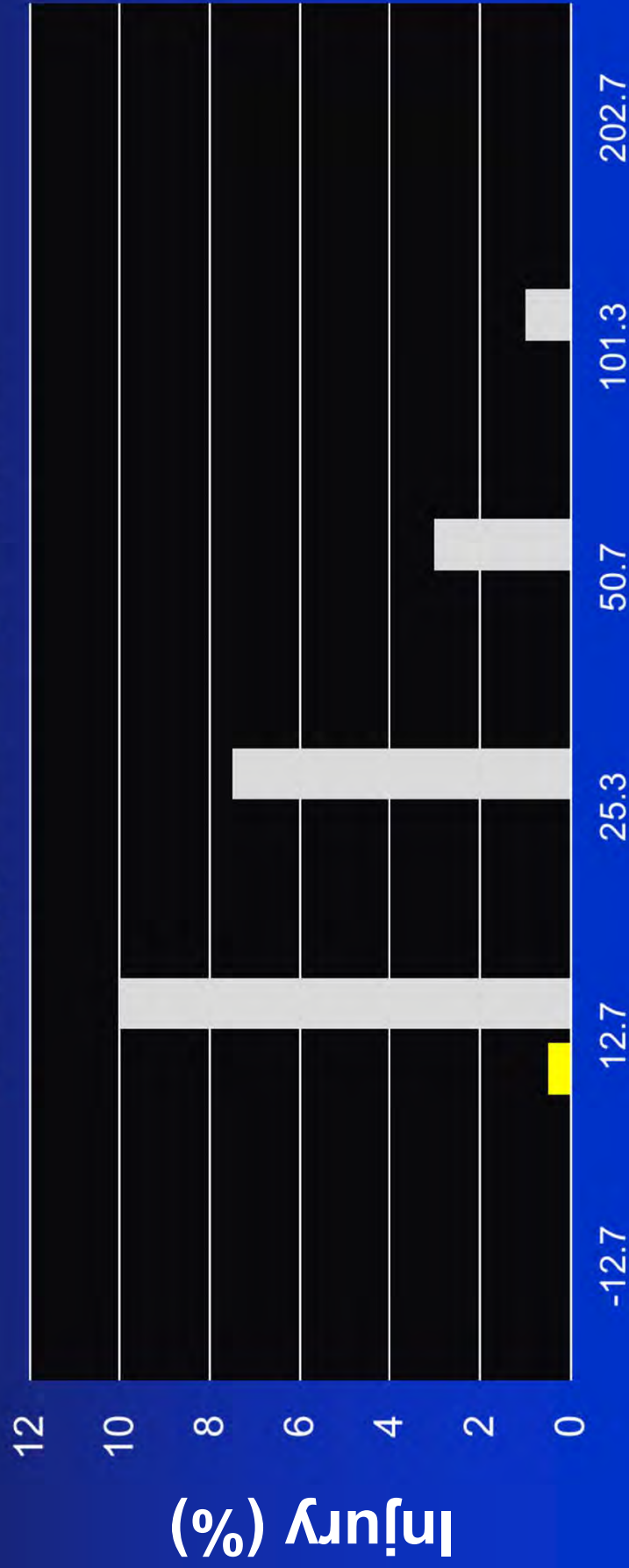


Distance from application (ft)

See & Spray (Broadcast) vs. Open Boom (Broadcast) (15 days after application)

Primary + Secondary Movement

■ See & Spray (broadcast) ■ Open boom broadcast



Distance from application (ft)

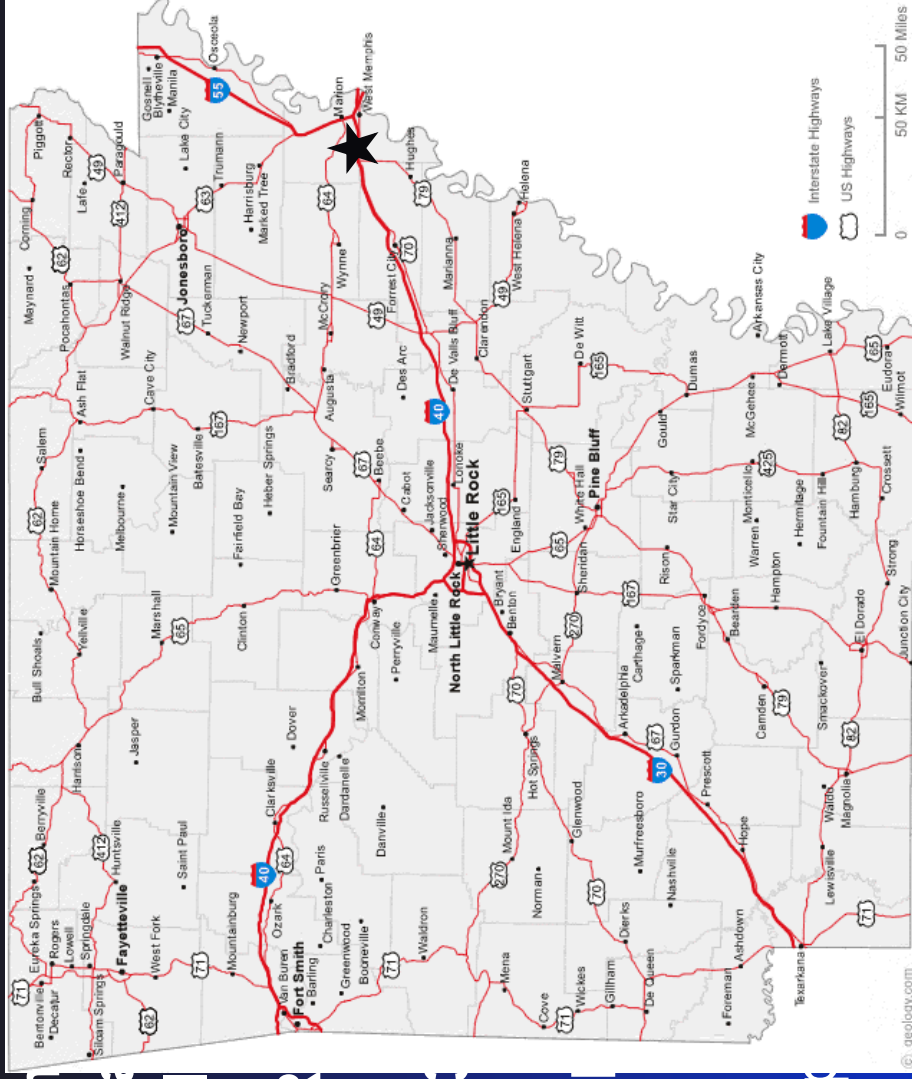
ER 0822

Goal: Determine the movement of dicamba commercial field application

Location: Proctor, AR

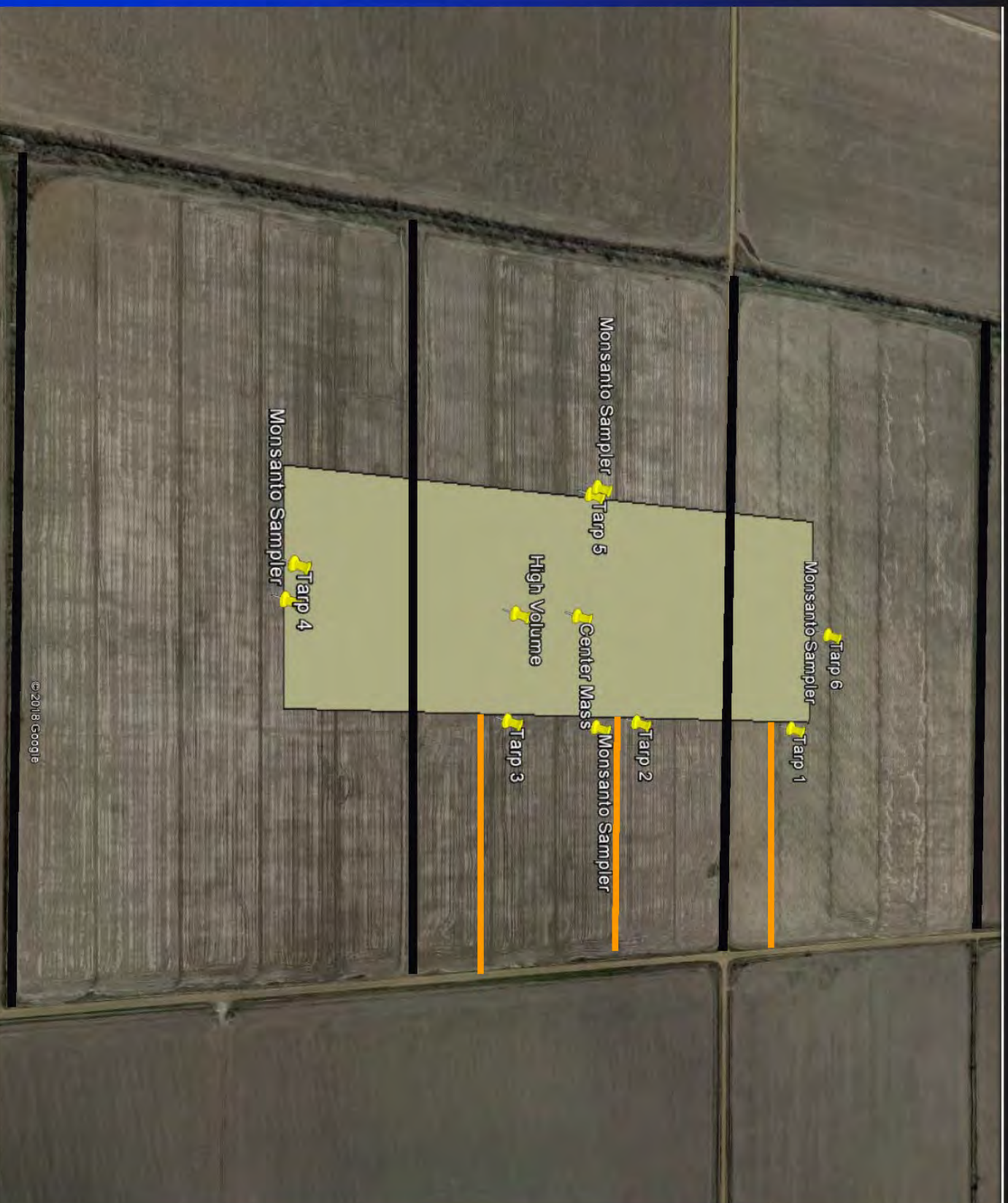
Trial size: 240 acres (3000 ft x 80 ft)

Cooperators: Mike & XendiMax + Roundup



From July 9 at 1:00 PM – July 16 at 2:58 PM there were no sustained wind speeds above 3 mph for a sufficient period to spray

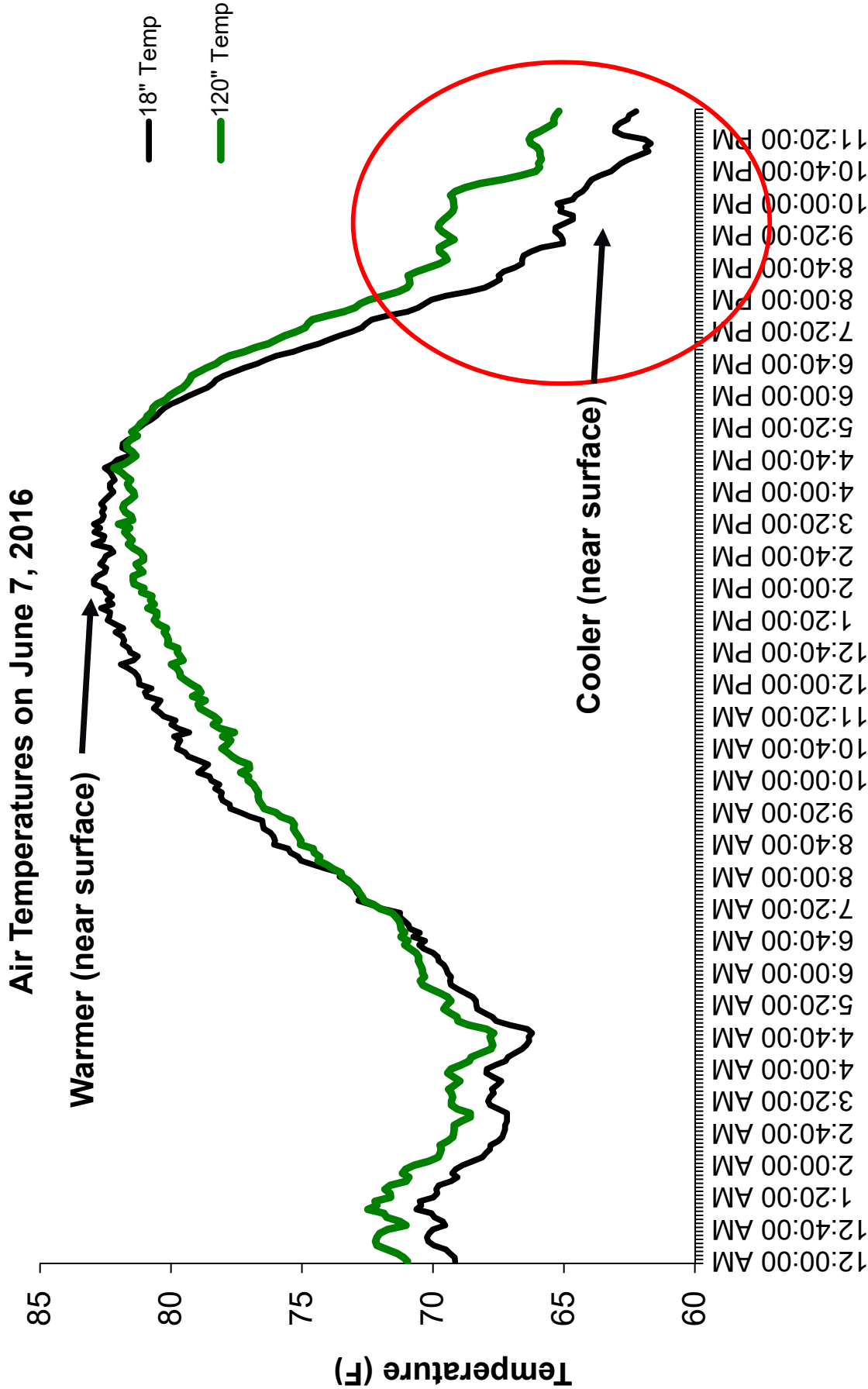
Application made July 16 at 2:58 PM



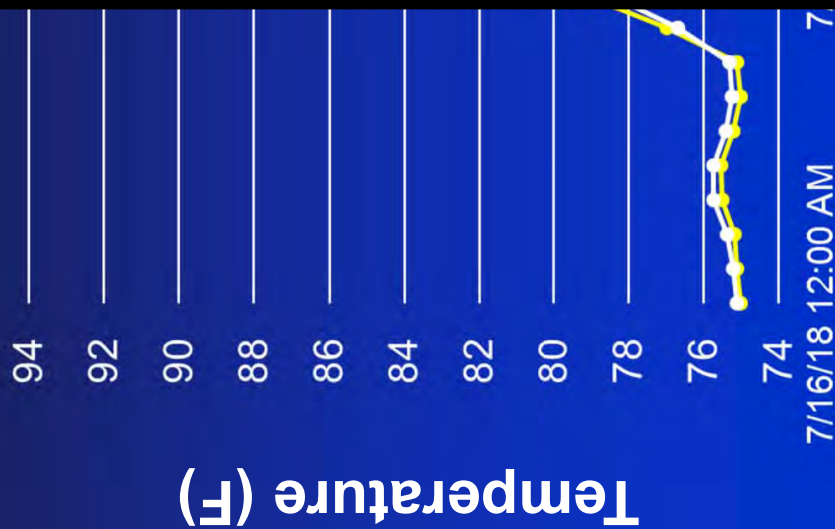
© 2018 Google

ER 0824

An Example Temperature Inversion in Southeast Missouri in 2016

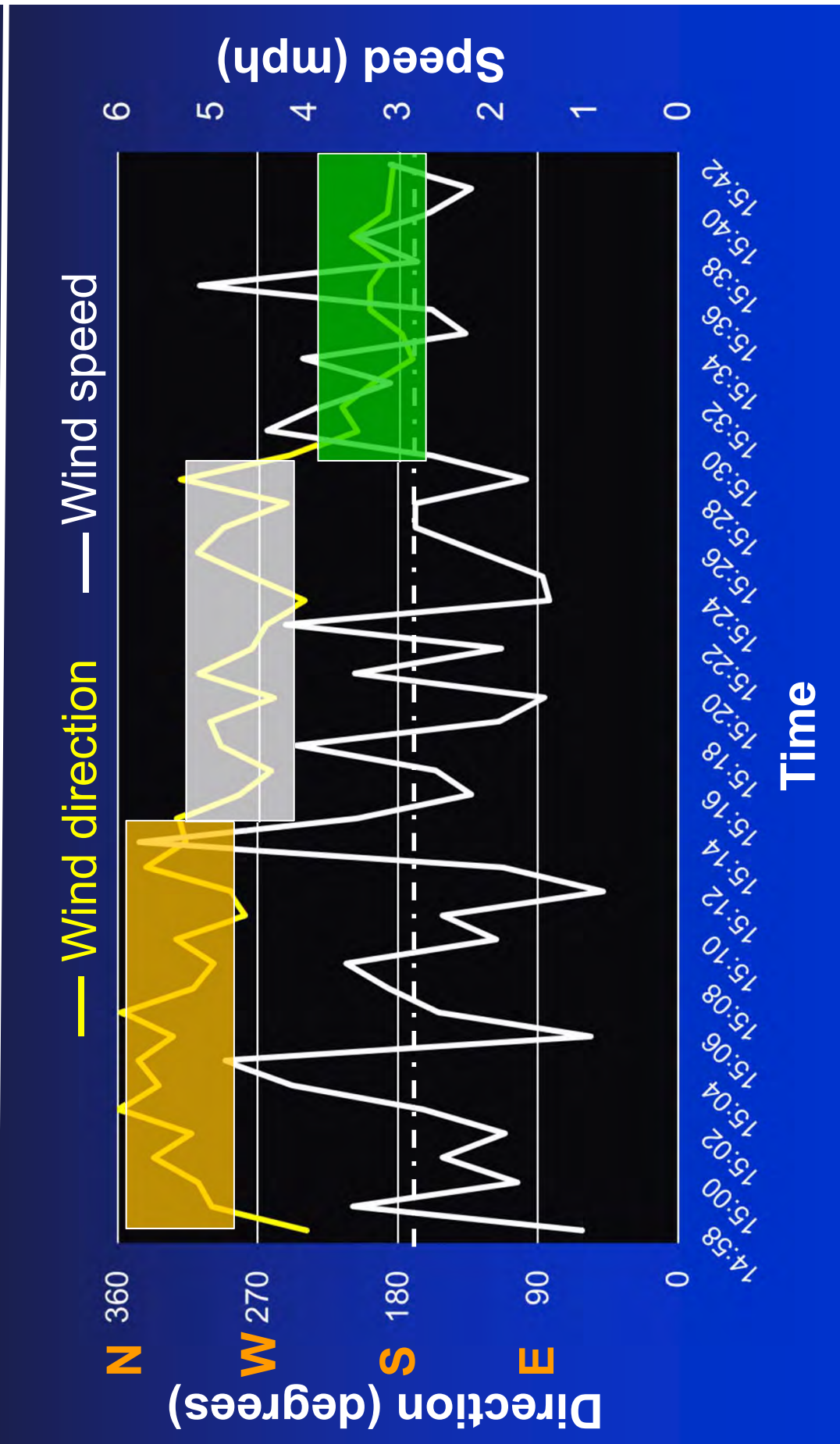


Temperature During and After Application



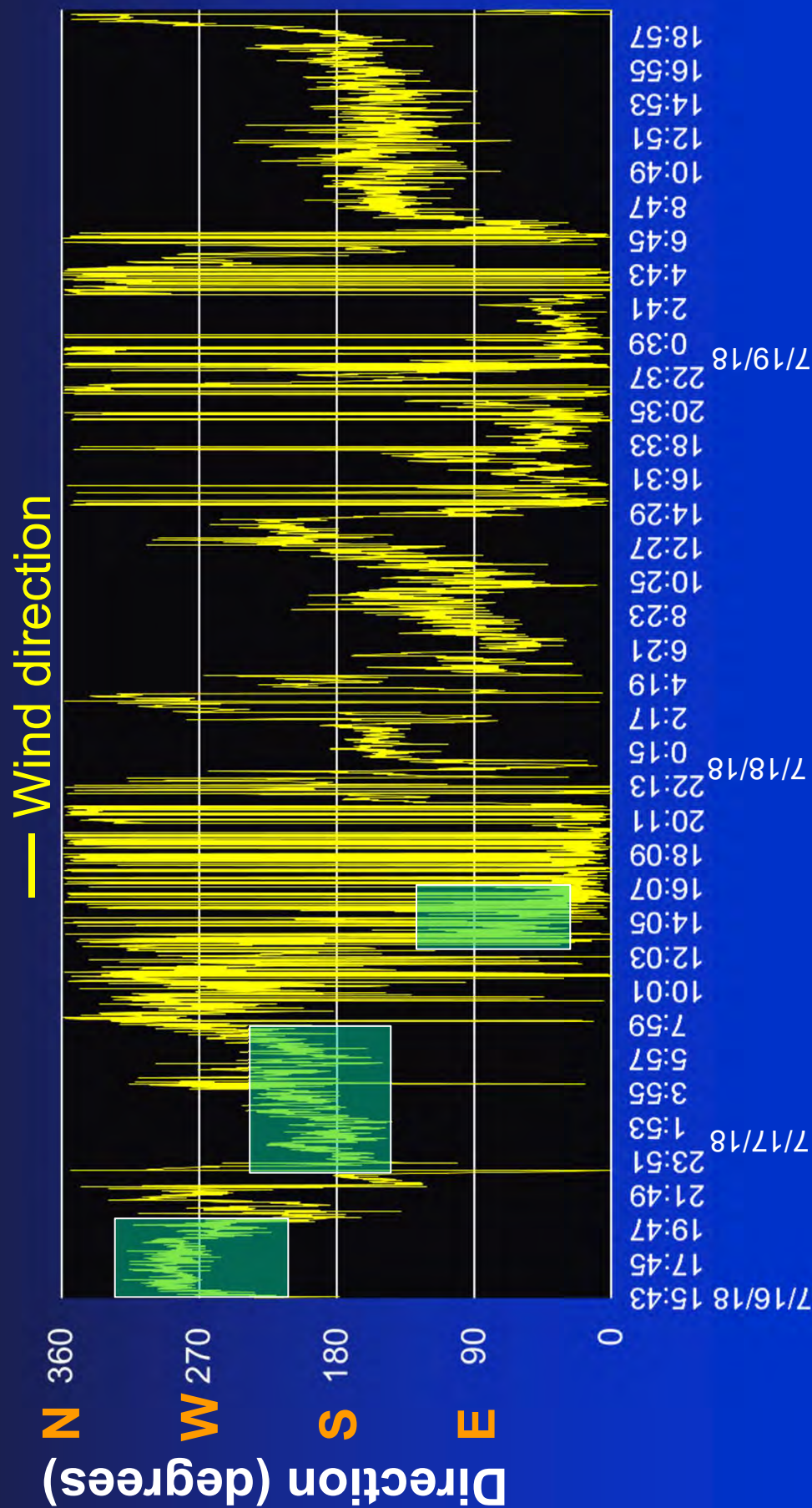
ER 0826

Wind Direction and Speed During Application at Boom Height



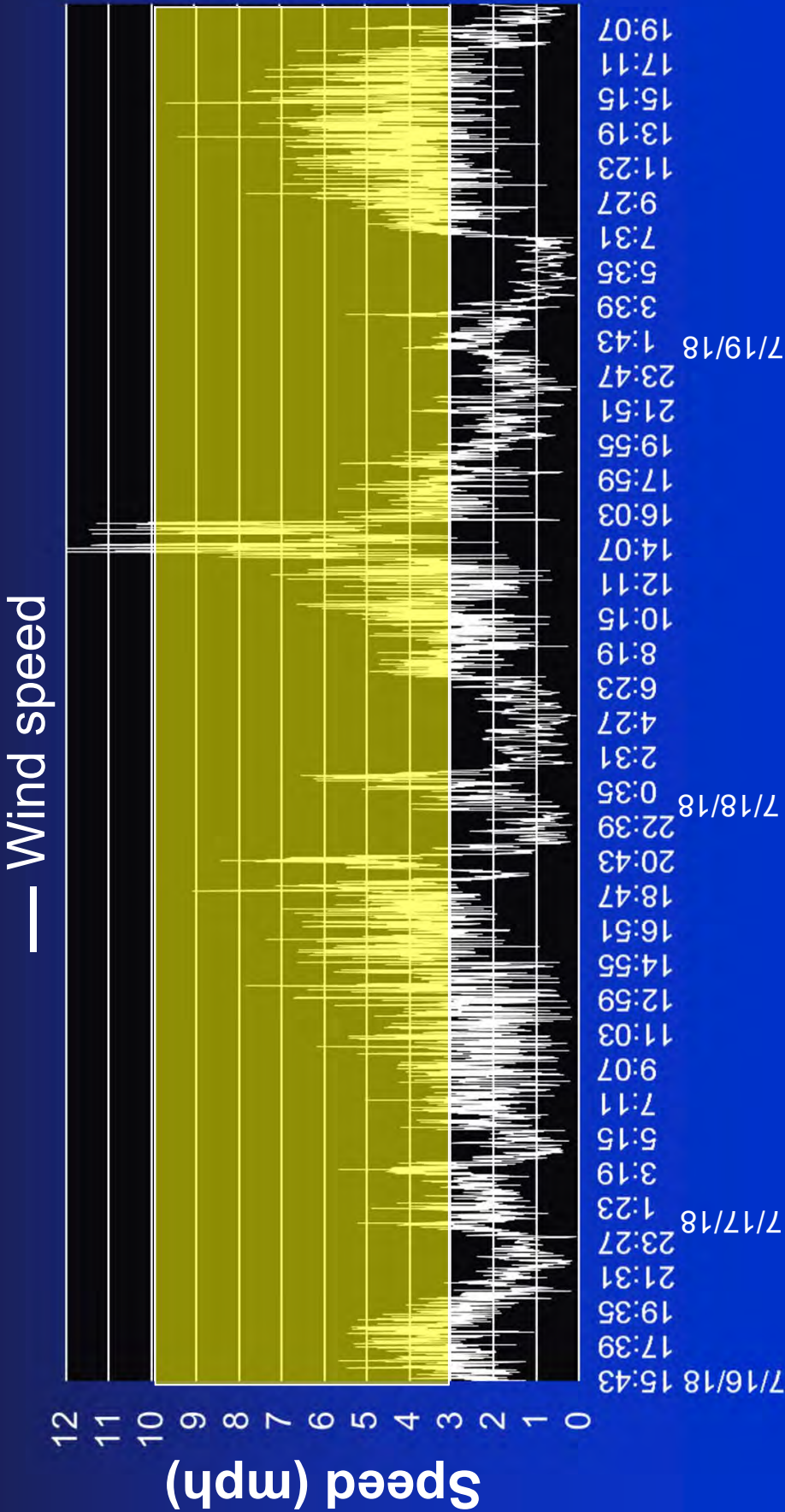


Wind Direction Following Application at Boom Height

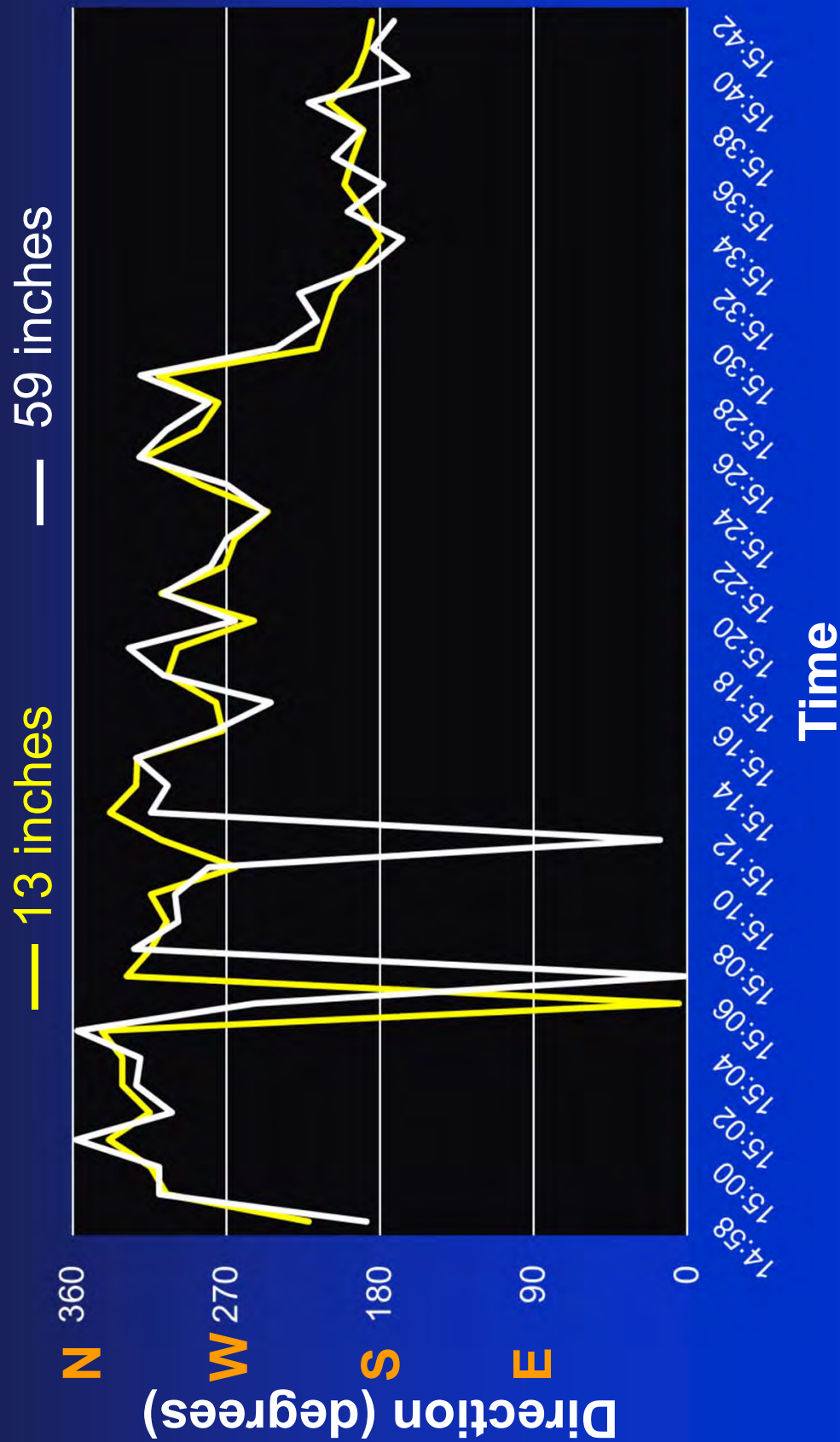


ER 0829

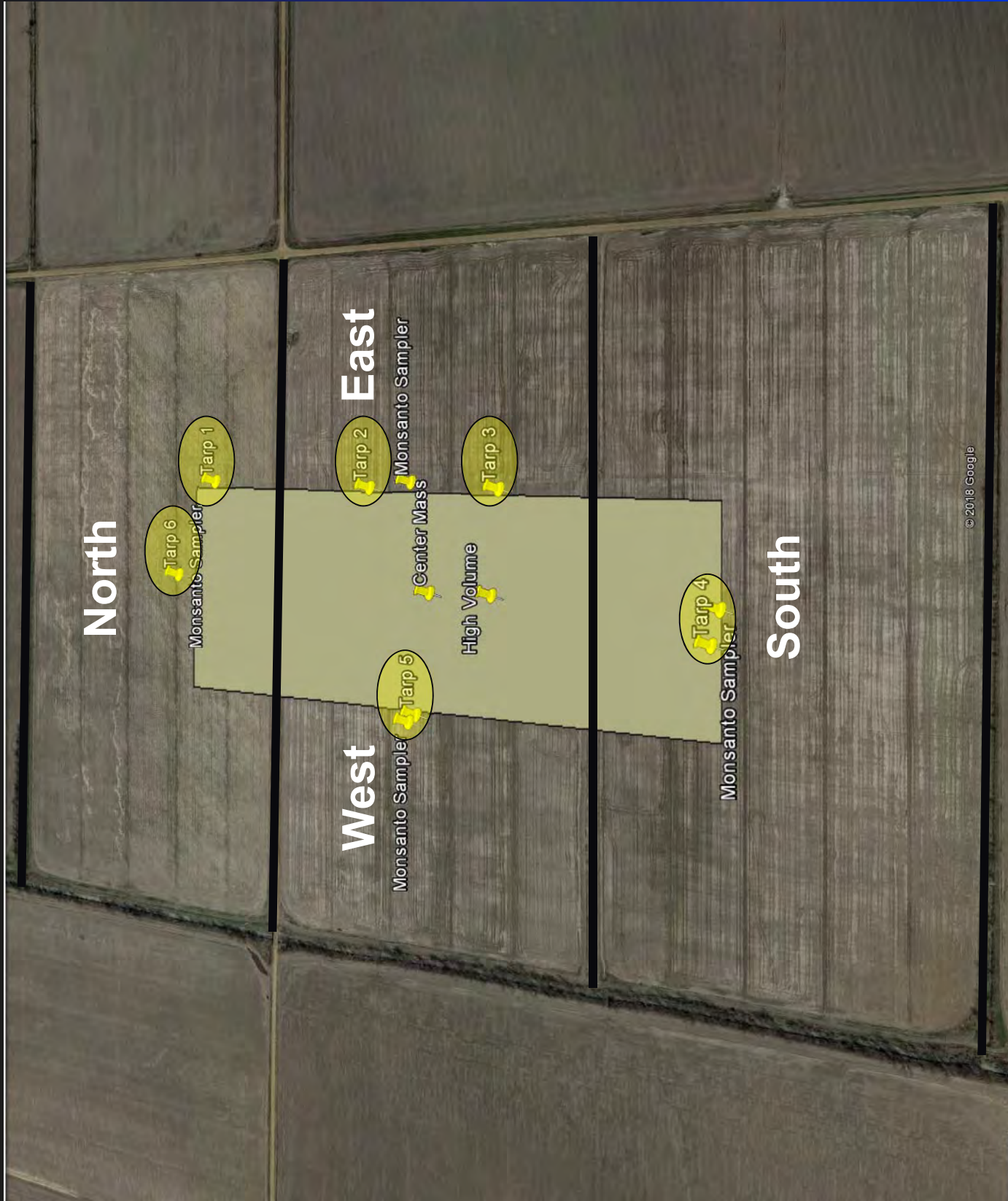
Wind Speed Following Application at Boom Height



Wind Direction at Two Heights During Application



ER 0831



ER 0832

Tarp Covered Soybean Outside Treated Area



Covered



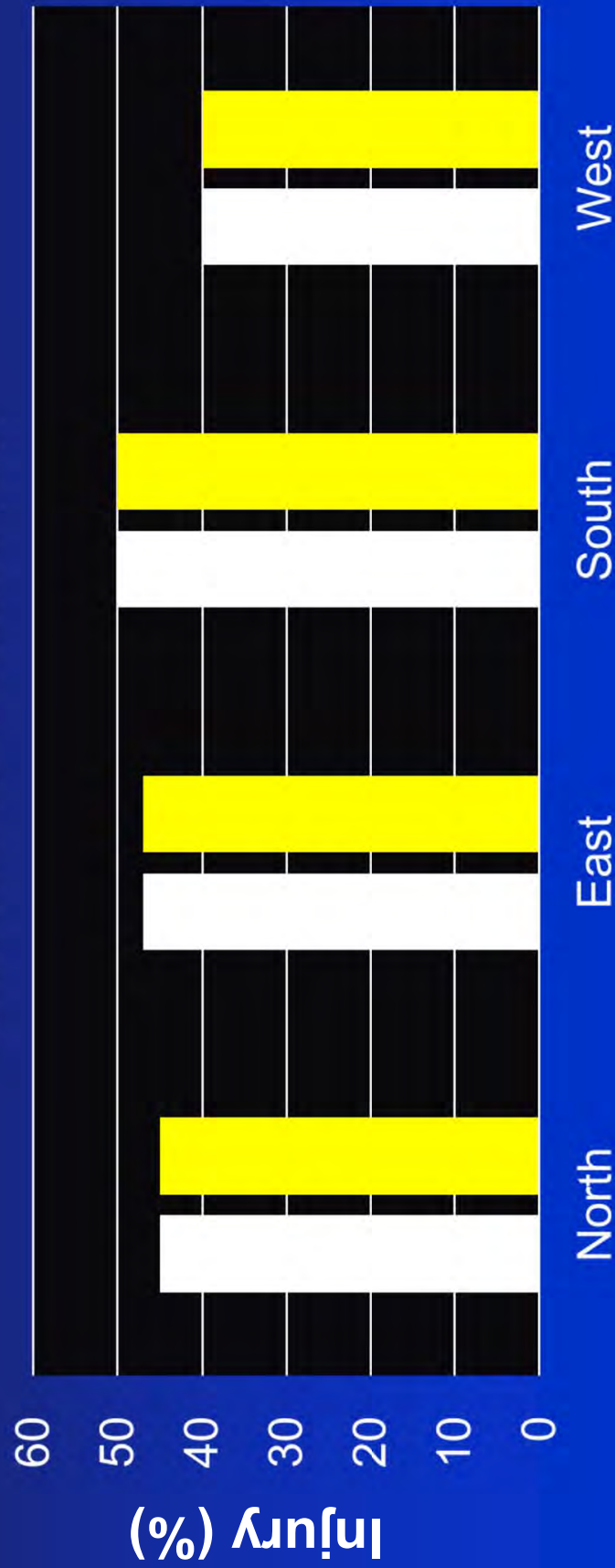
Not covered

ER 0833

Injury to Soybean Adjacent to and Beneath Tarps

22 days after application

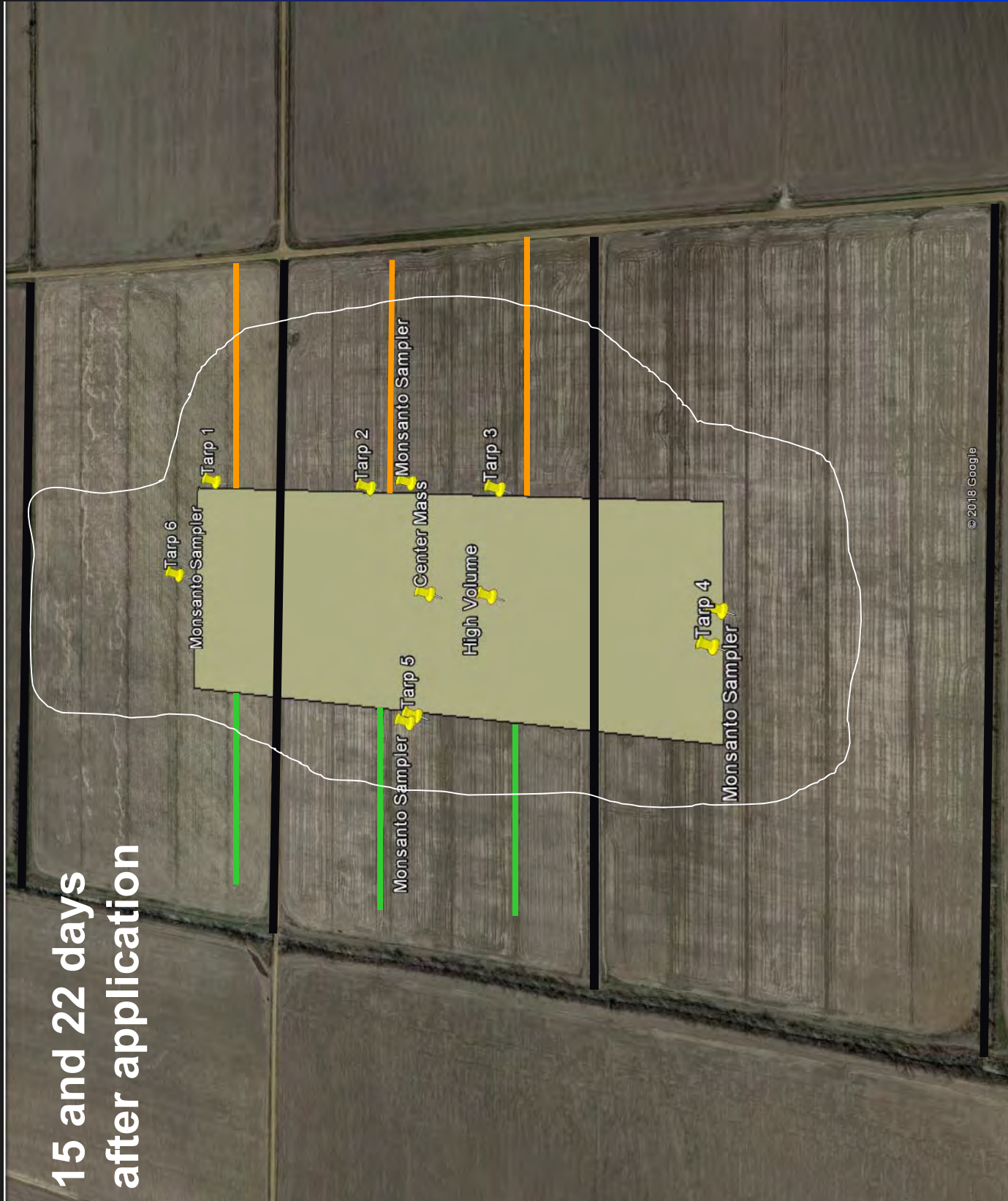
■ Not covered ■ Covered (tarp)





ER 0835

15 and 22 days
after application

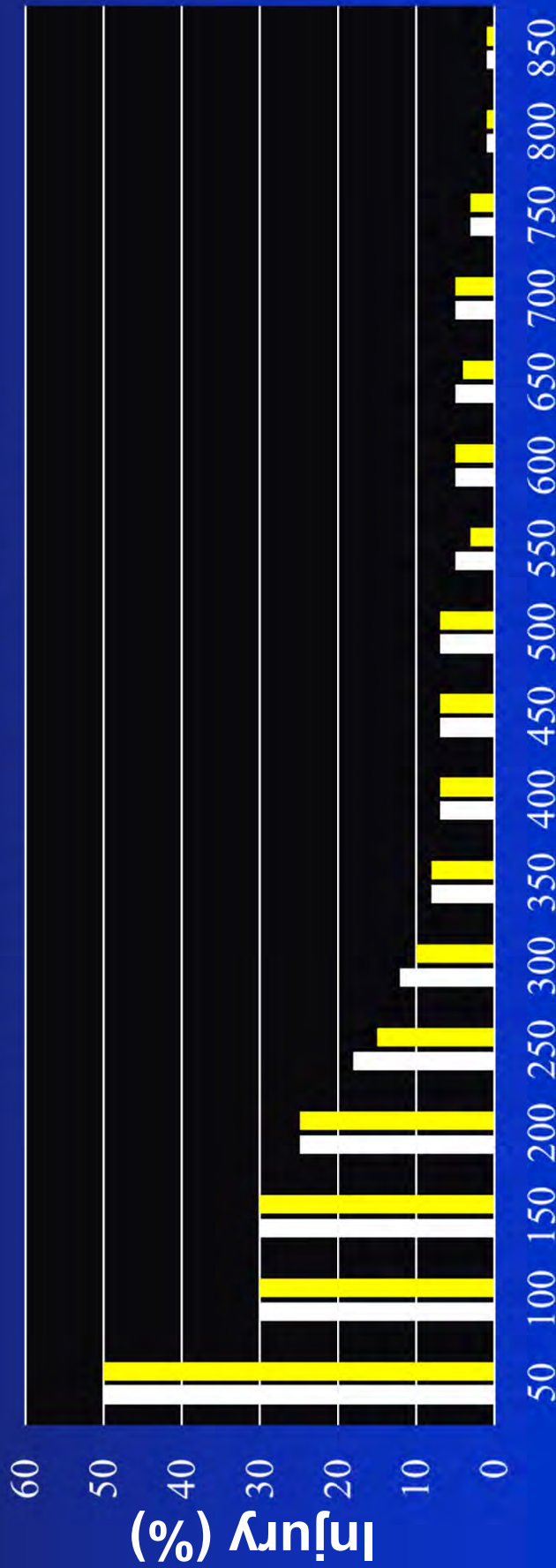


ER 0836

Contribution of Secondary Movement to Overall Soybean Injury

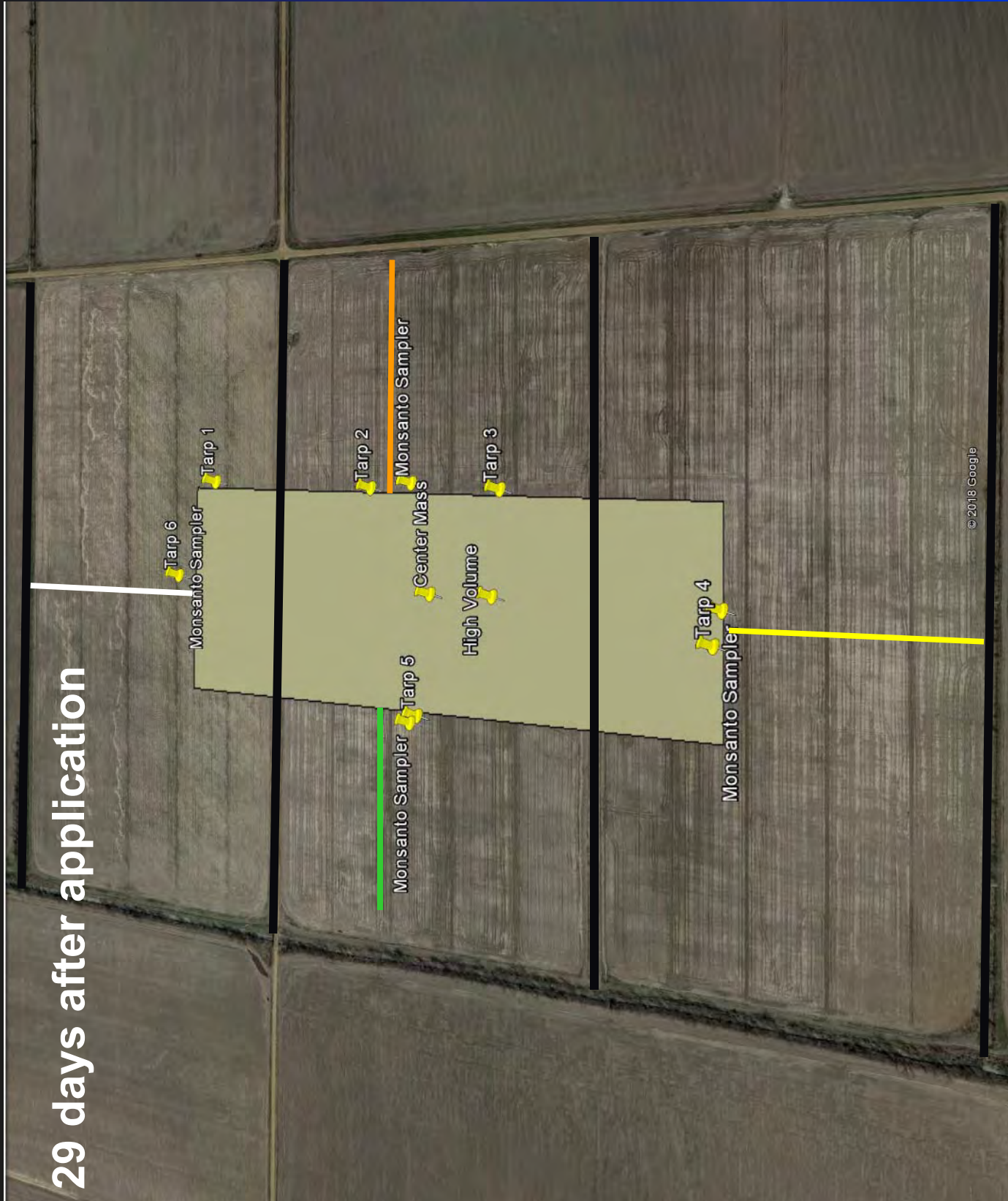
22 days after treatment (East Transect 2)

■ Not covered ■ Covered (bucket)



Distance from treated field (ft)

29 days after application



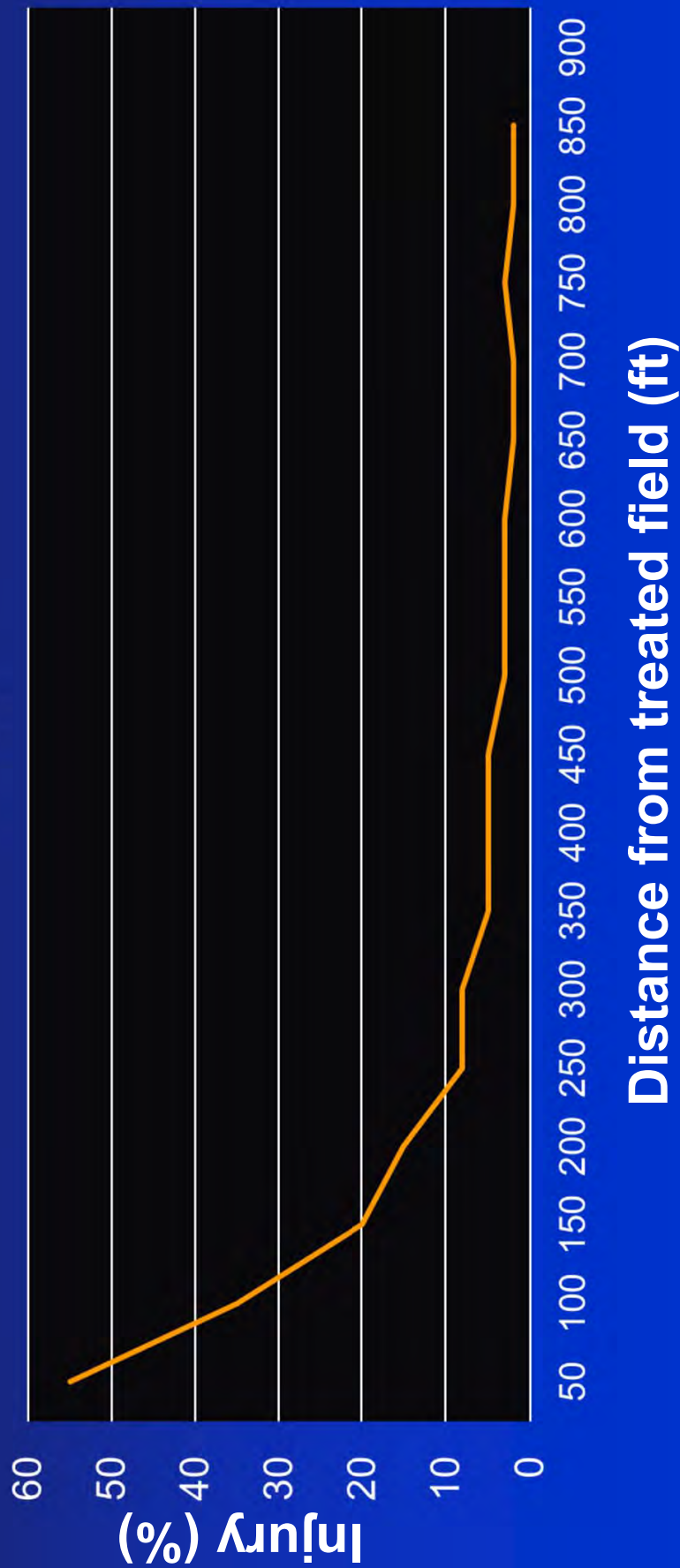
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ER 0838

Injury to Soybean on East of Treated Field

29 days after treatment

—East



ER 0839

Injury to Soybean on South Side of Treated Field

29 days after treatment

—South



Distance from treated field (ft)

ER 0840

Injury to Soybean on West Side of Treated Field

29 days after treatment

— West



Distance from treated field (ft)

Injury to Soybean on North Side of Treated Field

29 days after treatment

—North



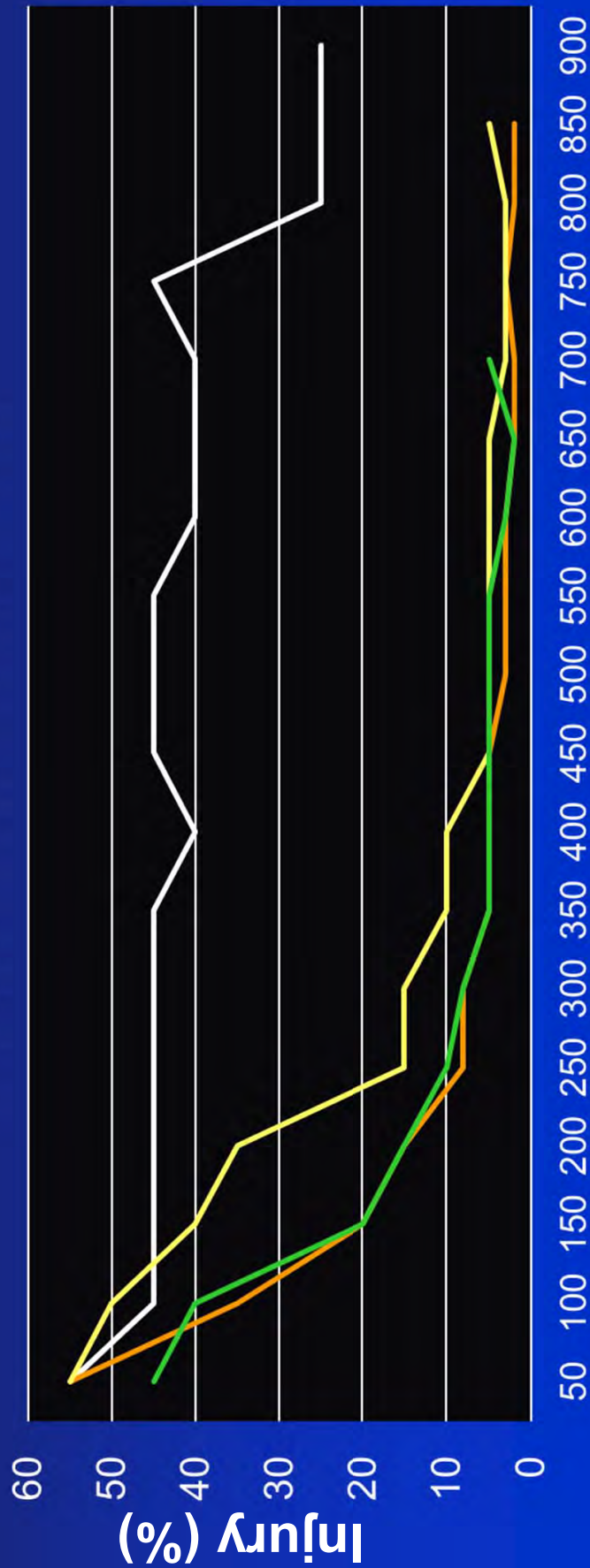
Distance from treated field (ft)

ER 0842

Injury to Soybean on Each Side of Treated Field

29 days after treatment

—North —East —South —West

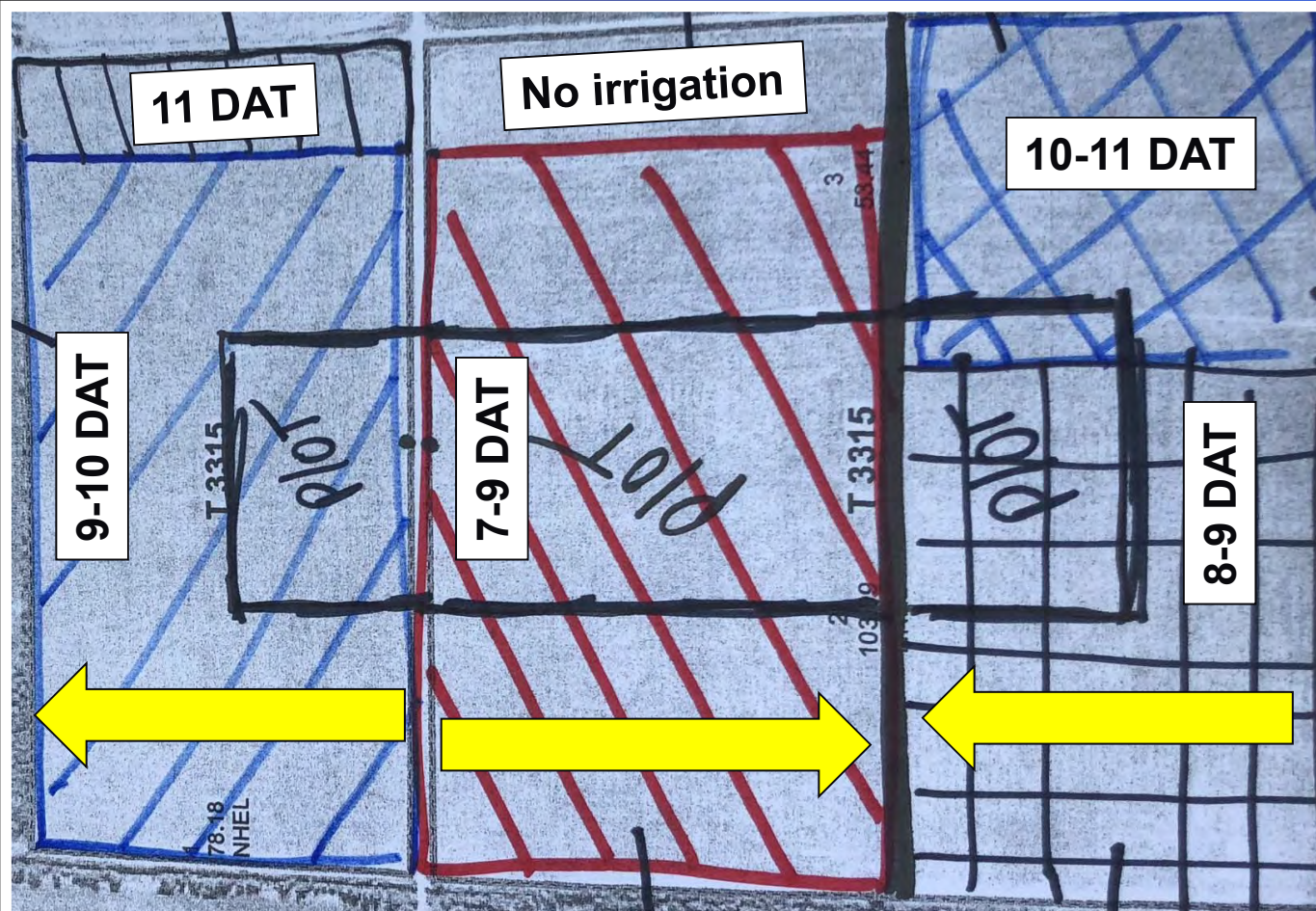


Distance from treated field (ft)

ER 0843

Irrigation Schedule

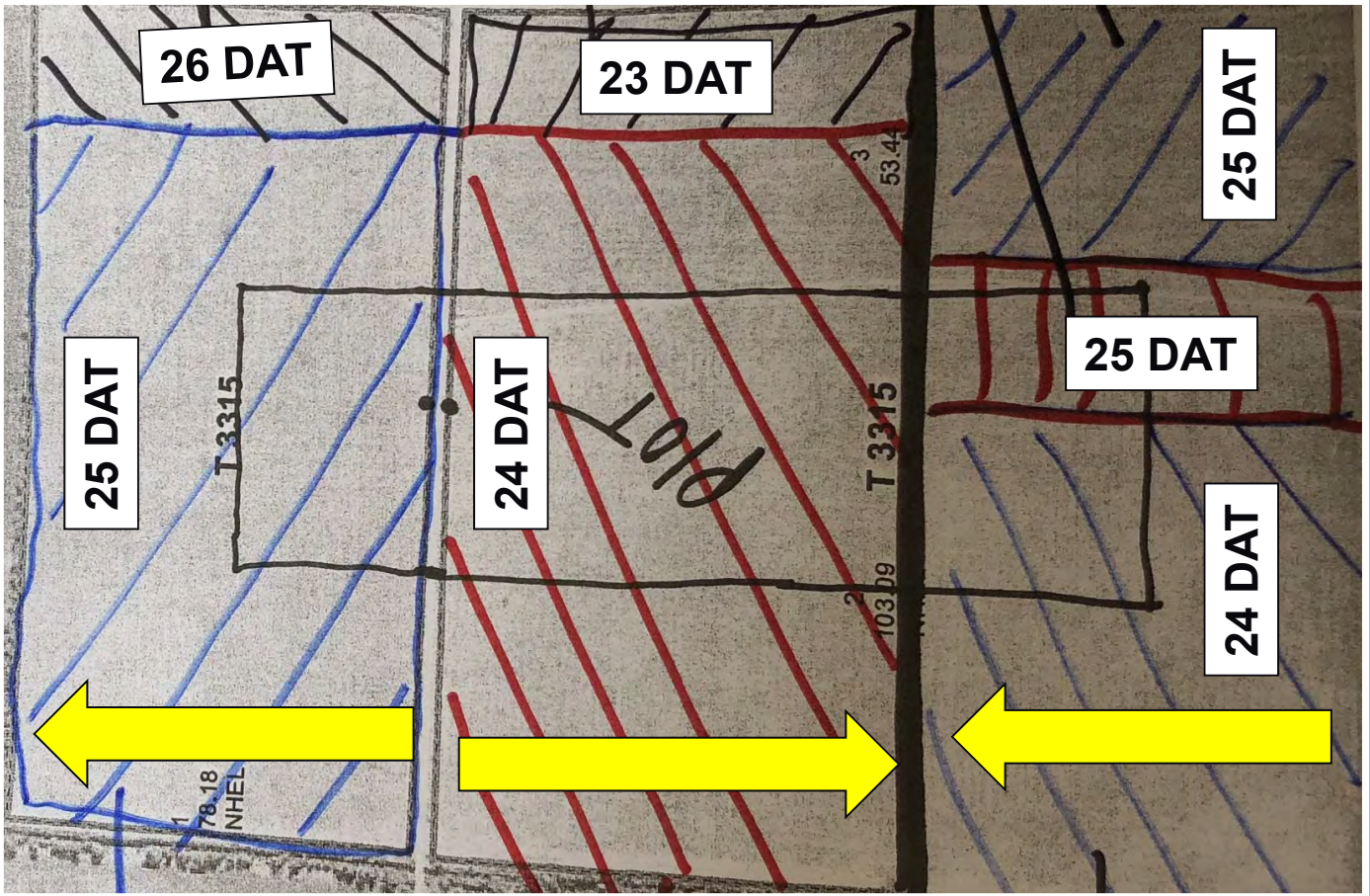
Plot sprayed July 16



ER 0844

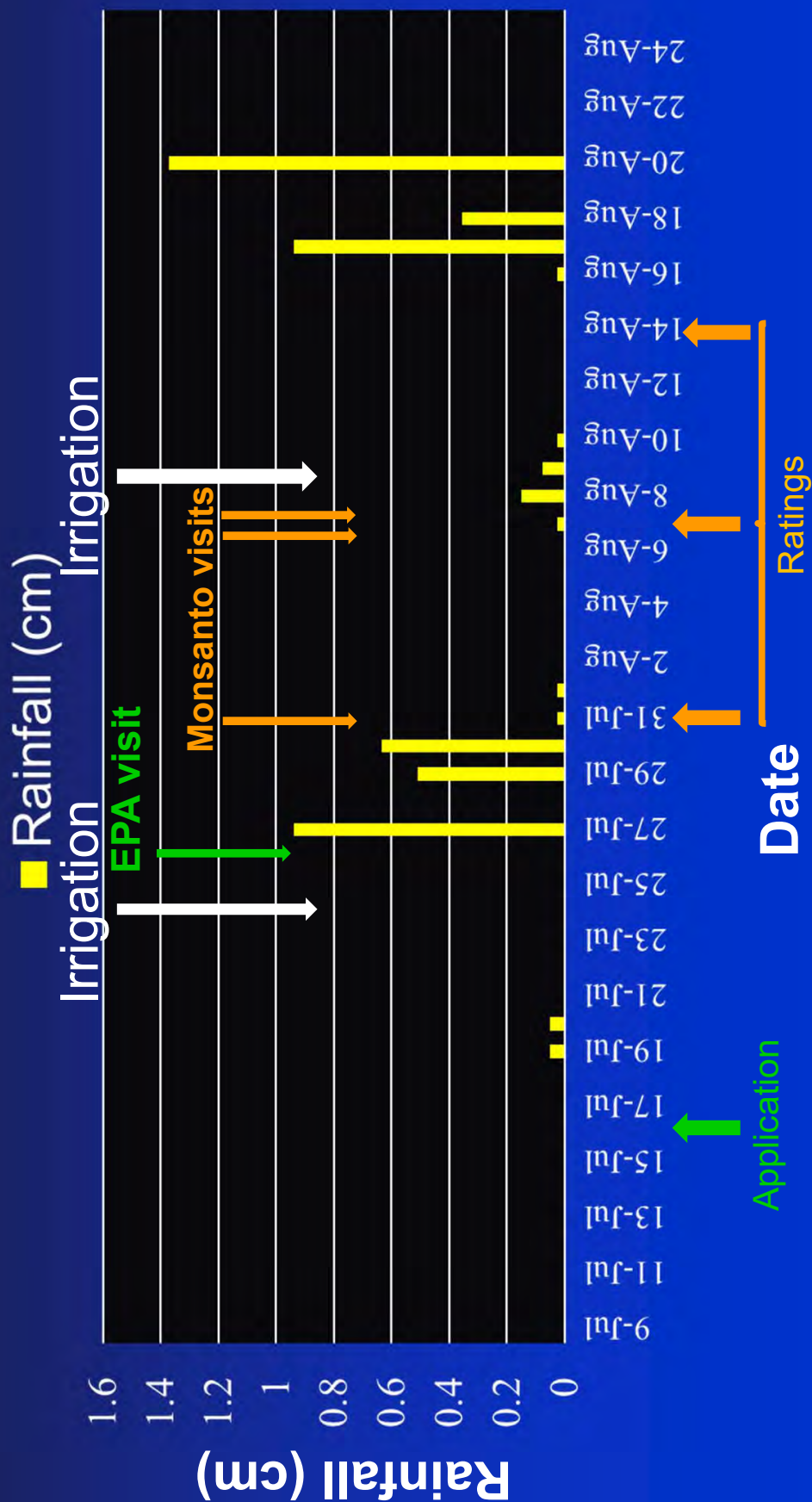
Irrigation Schedule

Plot sprayed July 16



ER 0845

Rainfall, Irrigation, & Field Visits



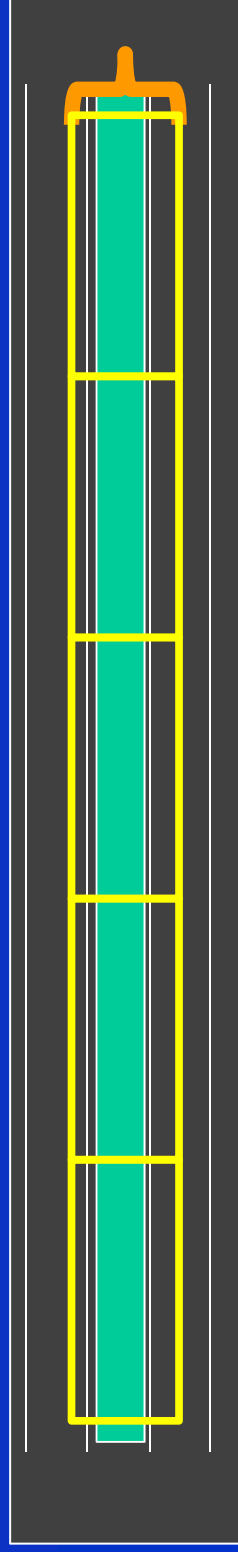
ER 0846

Takeaways from Trial

- Symptomology observed on all four sides of field
- Secondary movement contributed greatly to observed damage
 - Volatility
 - Irrigation and possibly rainfall
- Damaged area from dicamba exceeded size of treated area

Irrigation with Contaminated Tailwater

- Dicamba dissolved in irrigation water at five known concentrations
- Applied as 1 acre inch of water via furrow irrigation
 - Held water on field with in-furrow soil dams to facilitate timely application of all treatments
- Ratings collected from zones within a furrow
 - Mid-furrow ratings represent “average” impact
 - Bottom of furrow ratings represent max impact



Damage from dicamba in irrigation water applied at V3 stage



None



0.1 ppm



0.5 ppm



5 ppm



ER 0850

Dicamba in irrigation water applied at V3 and R1 growth stages



V3

0.1 ppm



R1

ER 0851



Symptoms following irrigation with dicamba contaminated water

ER 0852

September 18, 2018



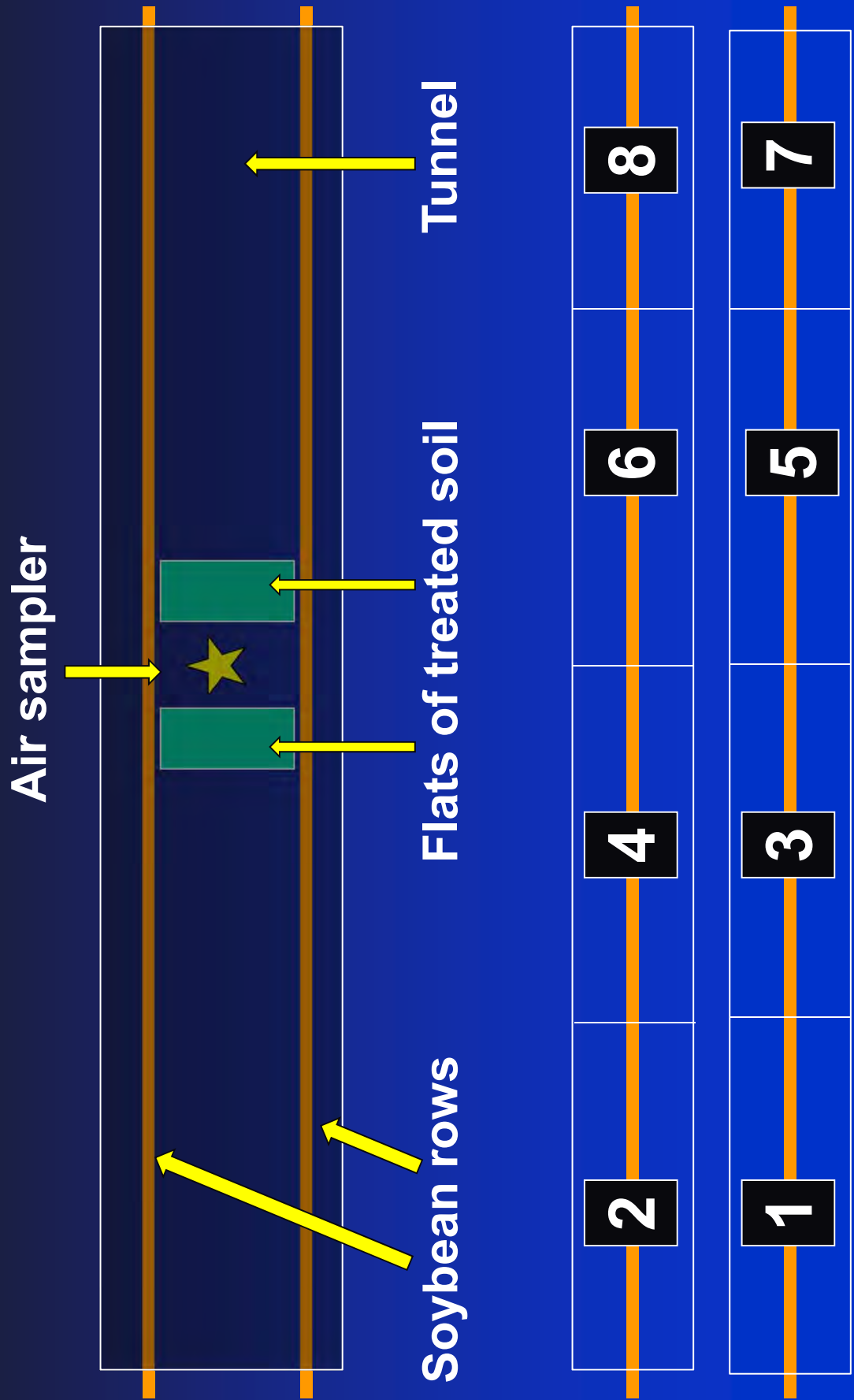
ER 0853

- **Objective:** Assess relative differences in volatility of auxin products in the field inside of low tunnels
- **Location:** Fayetteville, Lonoke, & Tillar
- **Growth stage:** V2 to V6
- Tunnels and treated soil removed 48 hours after application



ER 0855

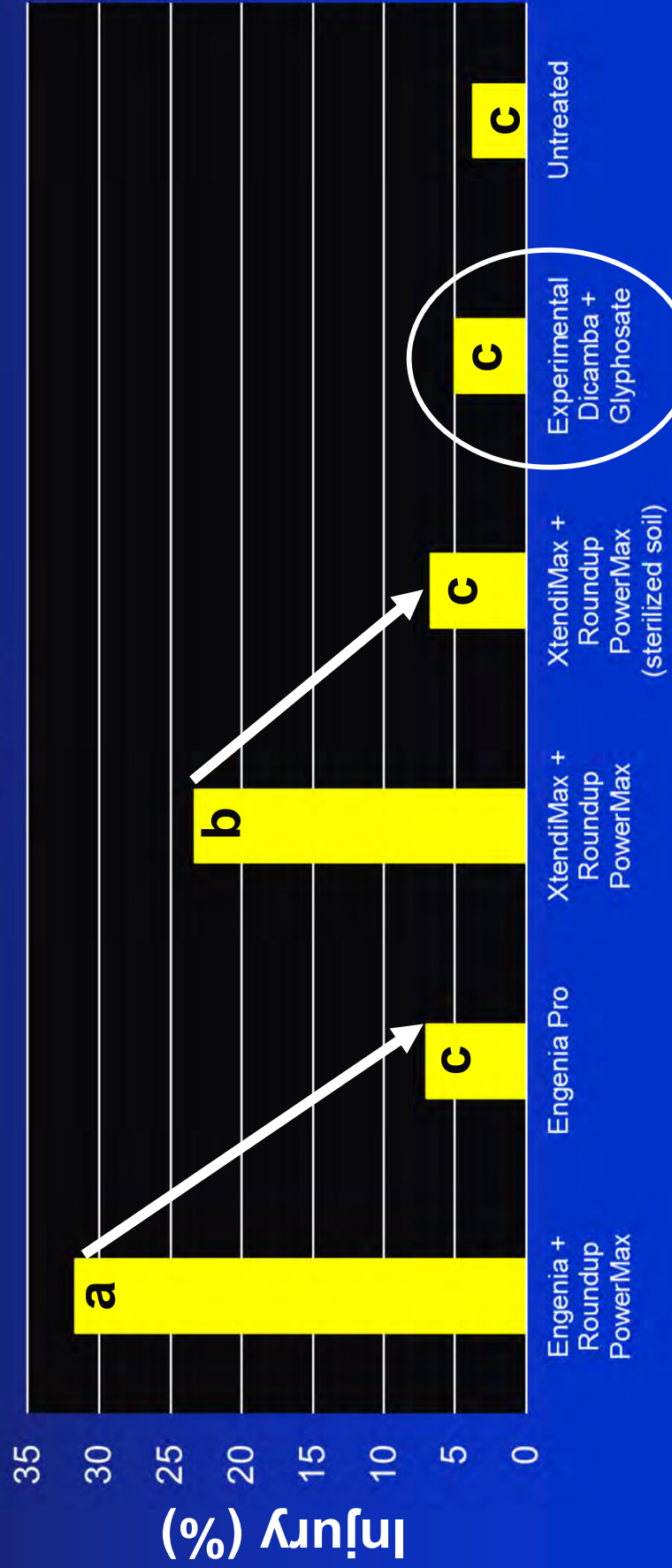
Low Tunnel Volatility Setup



Low Tunnel Volatility Evaluation of Dicamba Formulations

26 days after application

■ Maximum



Experimental Dicamba + Glyphosate



Engenia + Roundup PowerMax



ER 0858

Xtend Cotton

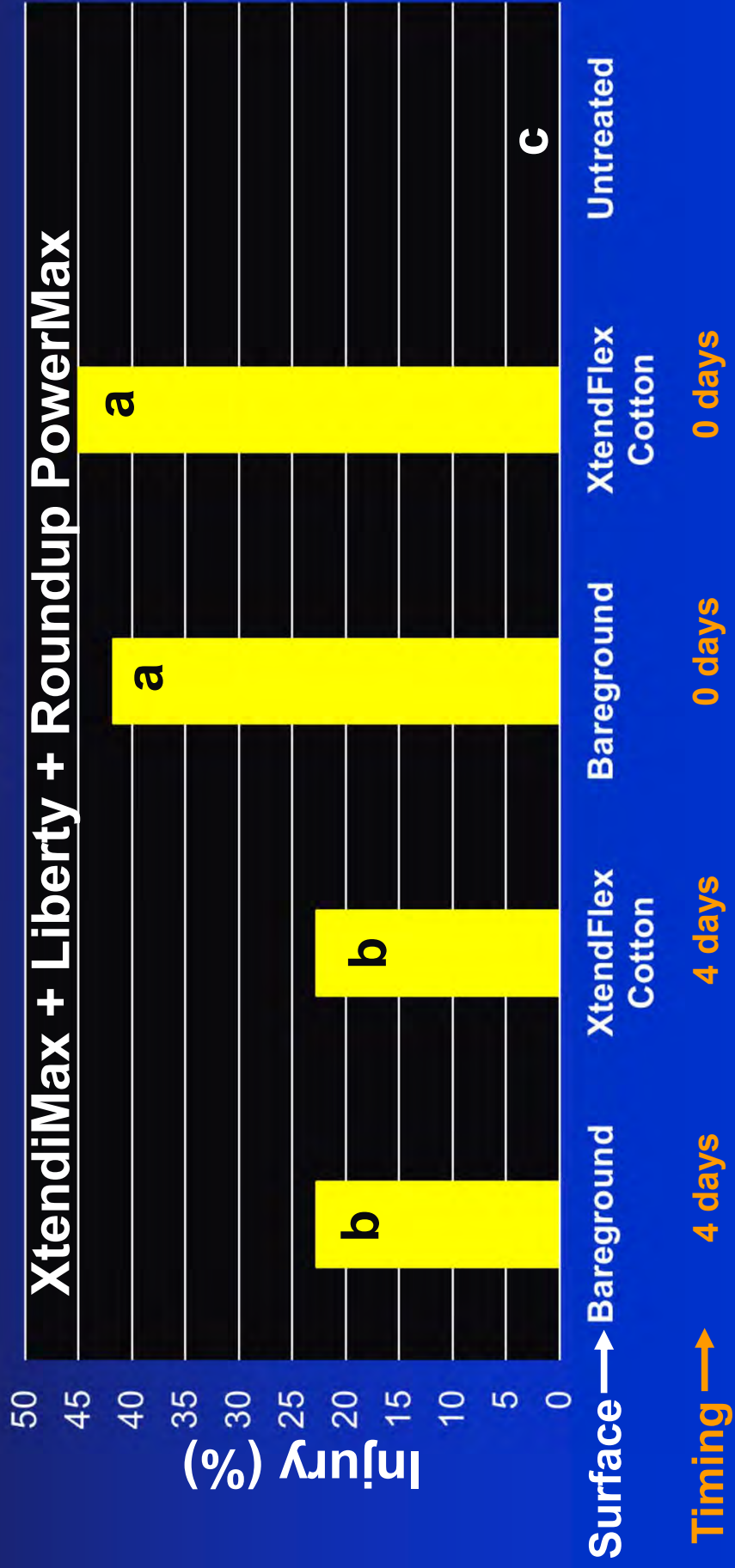


ER 0859

Low Tunnel Volatility Evaluation (Surface and Timing)

18 days after application

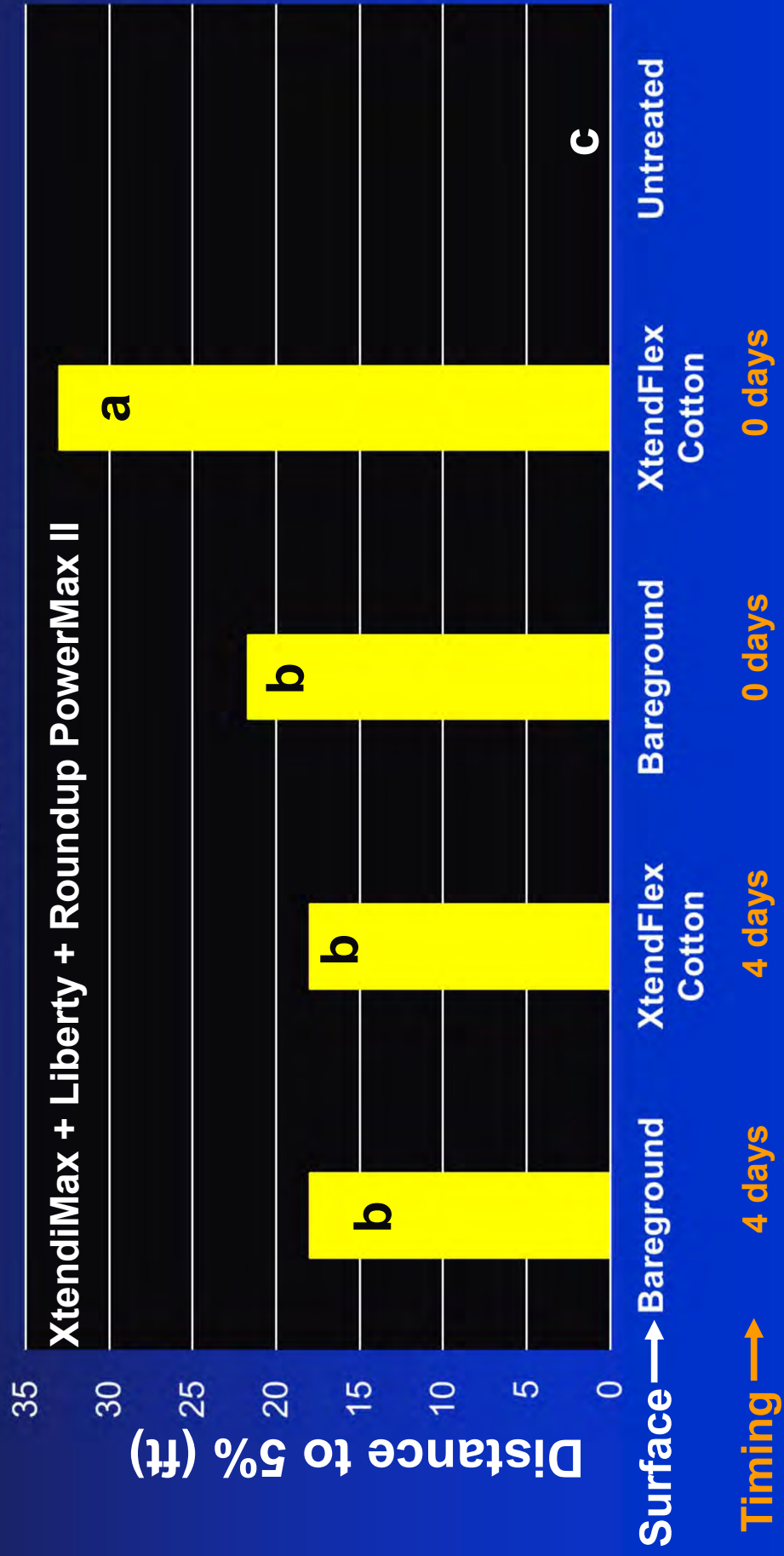
■ Maximum



ER 0860

Low Tunnel Volatility Evaluation (Surface and Timing)

22 days after application

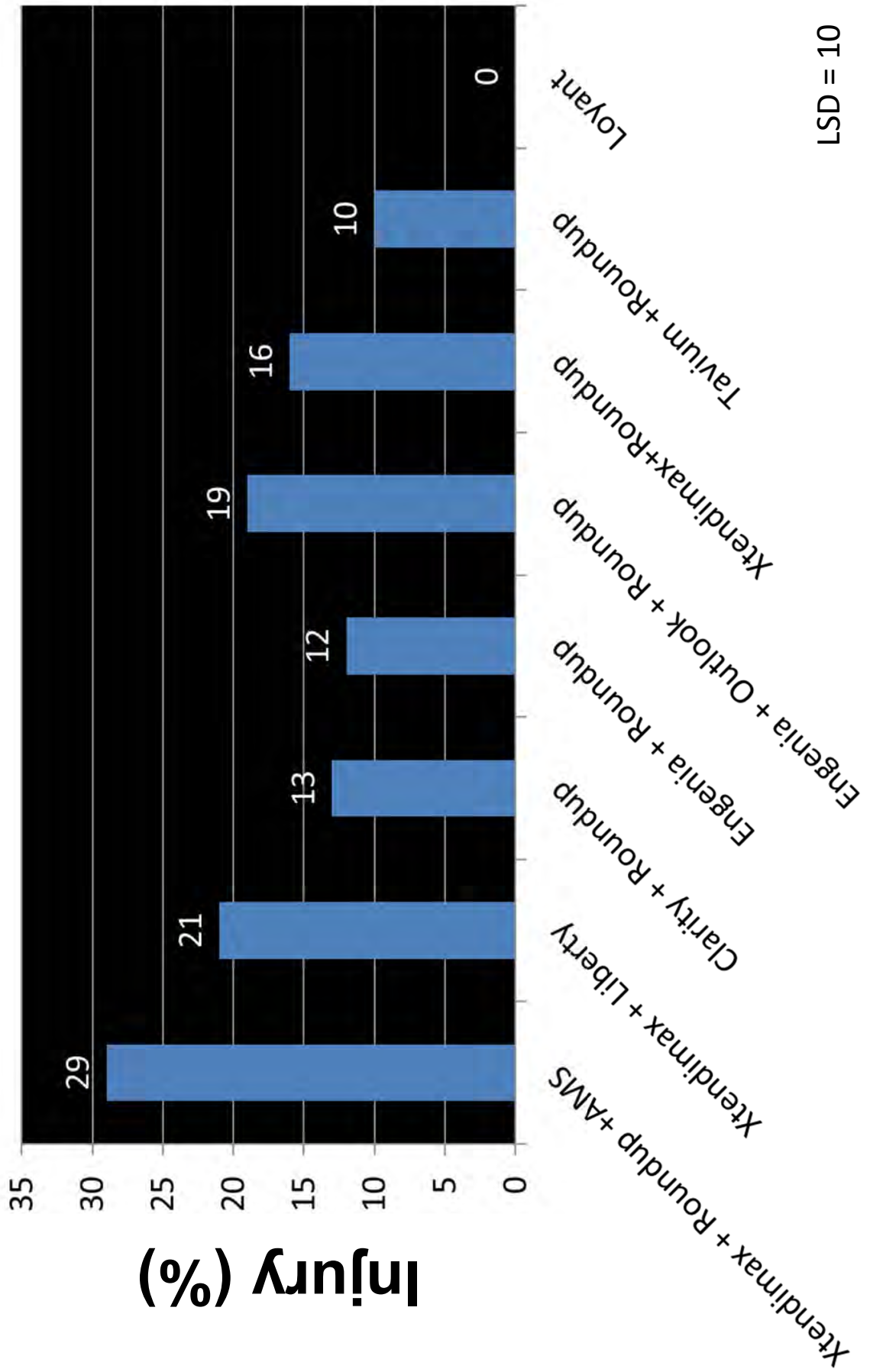




ER 0862

2018 Lonoke Low Tunnel Study

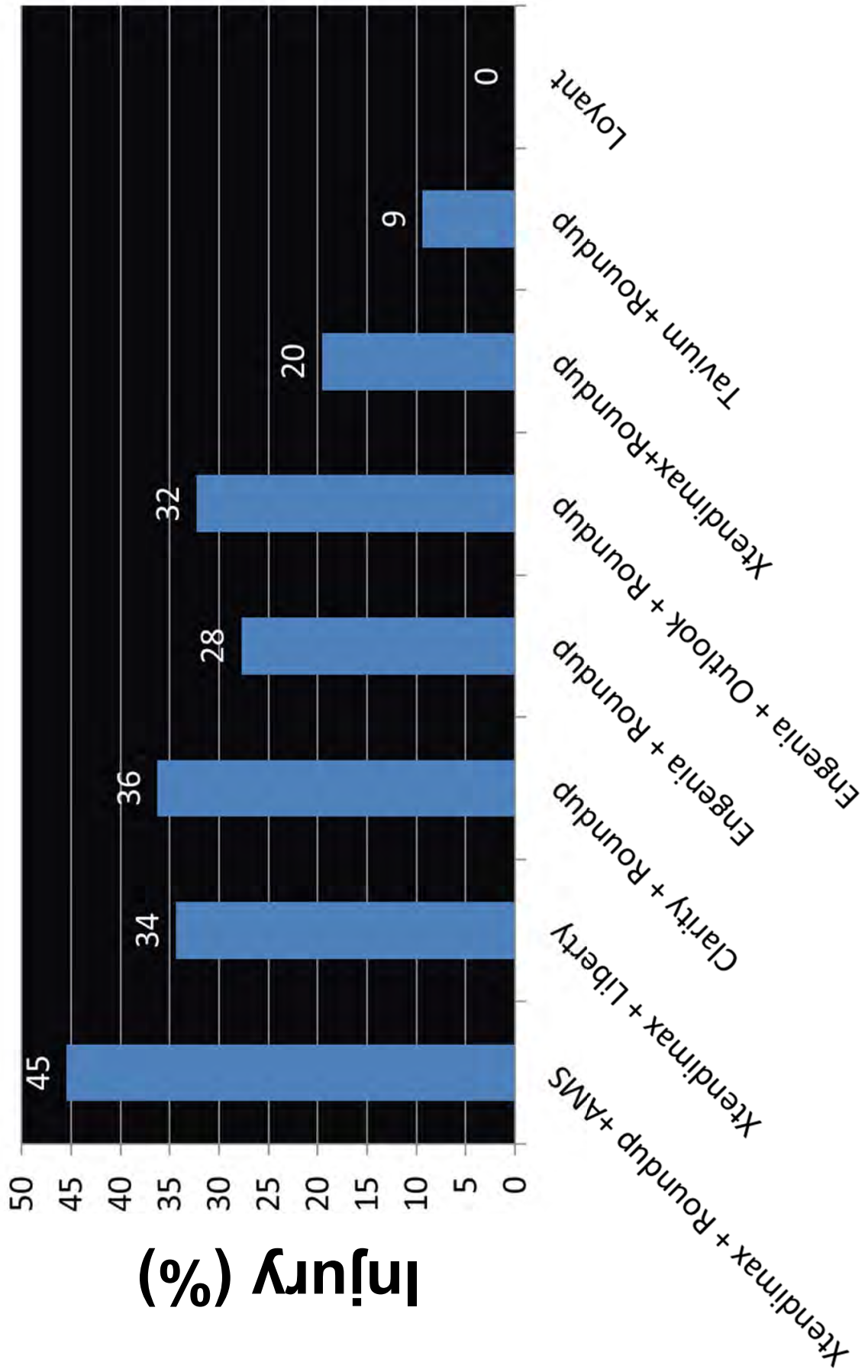
14 Days After Treatment



ER 0863

2018 Tillar Low Tunnel Study

14 Days After Treatment



ER 0864



XtendiMax

**XtendiMax +
SelectMax**

**XtendiMax +
Rdp PMax**

**XtendiMax +
Rdp Pmax +
Warrant**

ER 0865

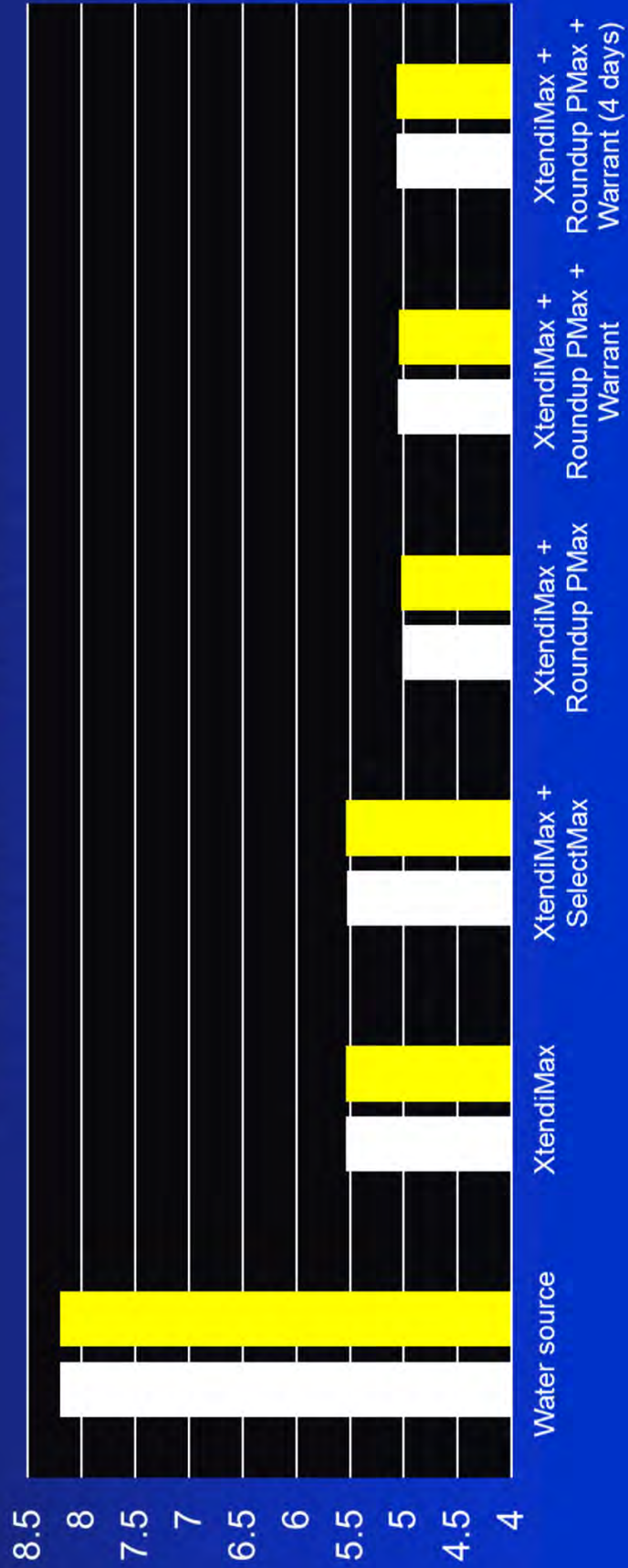
**XtendiMax +
Rdp Pmax +
Warrant (4 days)**

**XtendiMax +
Rdp PMax**

pH of XtendiMax Spray Solutions

Solution pH

■ Before application ■ After application



Treatment

ER 0866

- **Objectives:** Determine if Roundup PowerMax increases off-target movement of XtendiMax
- **Soybean:** LibertyLink
- **Applications:**
 1. XtendiMax + Roundup PowerMax + **Quadris** + Intact
 2. XtendiMax + **Quadris** + Intact
- **Date:** August 13, 2018
- **Sprayer setup:**
 - 25 ft boom; 6 mph; 15 GPA, 24 inch height
 - TTI 11003 nozzles
- **Environmental conditions:**
 - Avg. 3.2 mph; range 0 to 5.7 mph
 - Daily max. 93 F



ER 0868



ER 0869

**Xtendimax, Quadris,
Intact, Rdp PowerMax**

**Xtendimax, Quadris,
Intact**



14 days after treatment

ER 0870

**Xtendimax, Quadris,
Intact, Rdp PowerMax**

**Xtendimax, Quadris,
Intact**



28 days after treatment

ER 0871

- **Objective:** Determine if non-Xtend soybean varieties differ in tolerance to drift rates of dicamba
- **Location:** Fayetteville, AR
- **Rate:** 1/250X
(0.002 lb/A or 0.088 fl oz/A XtendiMax)
- **Growth stage:** V3 & R1



ER 0873

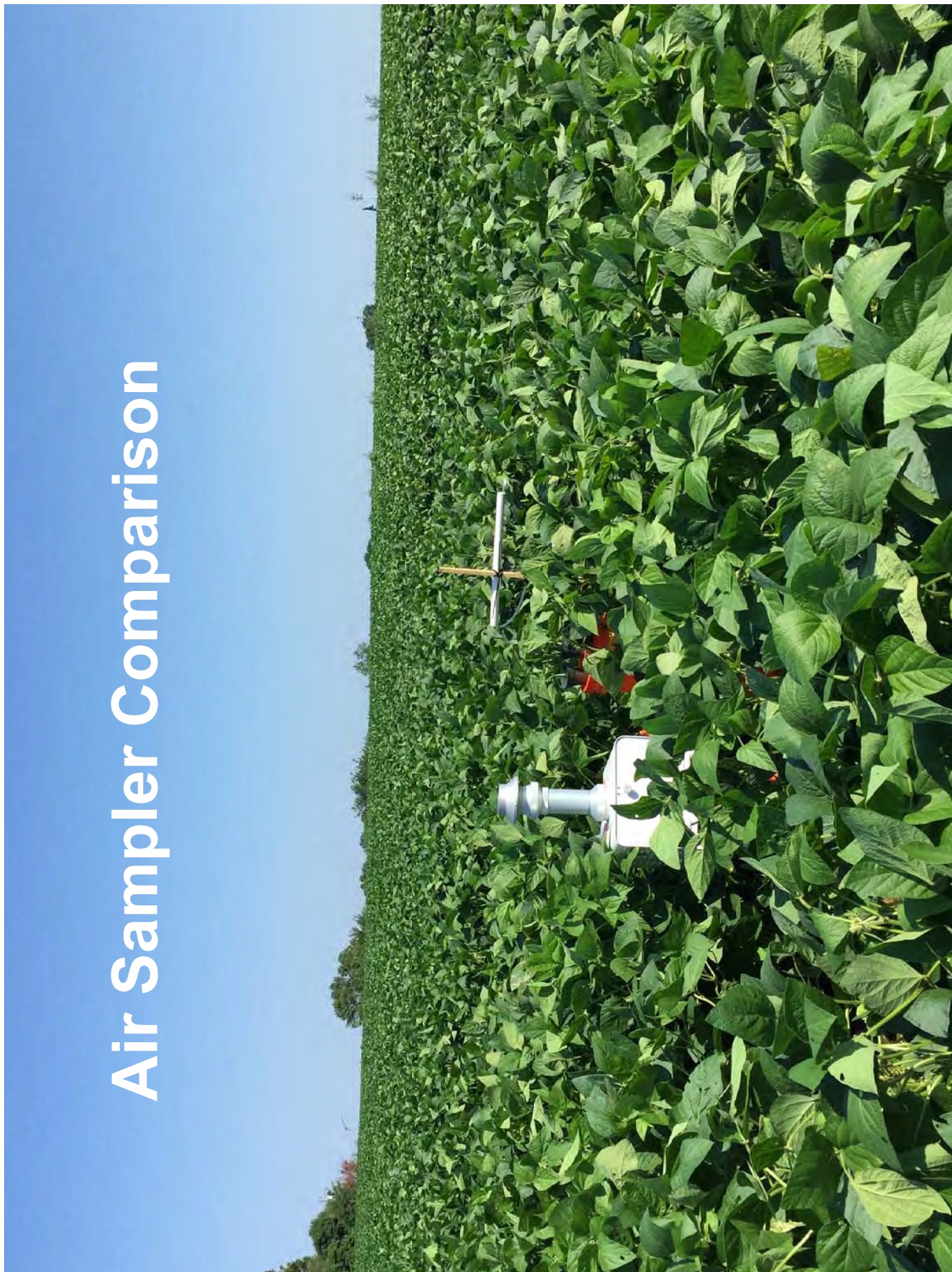


ER 0874



ER 0875

Air Sampler Comparison



ER 0876

Relationship between environmental conditions and XtendiMax volatility



ER 0877

Inversion Frequency

Mississippi County

Crittenden County

Lee County

Washington County



ER 0878

Conclusions thus far from 2018

- Damaged to soybean caused by Loyant was not a result of volatility
- Off-target damage caused by Enlist One is a result of physical drift or tank contamination
- Addition of Roundup PowerMax to dicamba products increases volatility and off-target movement
- Irrigation from tailwater recovery systems in areas where dicamba is used should be a concern
- Volatility continues to be a significant contributor to off-target movement of dicamba during the summer months

Additional On-going Projects

- Can SelectMax substitute for Roundup PowerMax as a dicamba tank-mix partner without increasing volatility?
- Does length of time in spray tank influence volatility?
- Does soil pH influence volatility of dicamba?
- Relationship between dicamba air concentration and symptomology on soybean?
- Influence of rainfall or irrigation on XtendiMax volatility

Encouragement through research

- Experimental dicamba is superior to XtendiMax & Engenia (Is this good enough?)
- The relationship between XtendiMax volatility and temperature in the field soon be better understood
 - Complicated by interaction with other factors
- Removing Roundup PowerMax from the spray and replacing with SelectMax
- Use of See-and-Spray will reduce off-target movement from physical drift and volatility

2018 Support

- Direct or indirect support
 - Mike & Dusty Carlson
 - U of A Systems Division of Agriculture
 - Arkansas State Plant Board
 - Northeast Research and Extension Center
 - Lon Mann Cotton Branch Station
 - Arkansas Agricultural Research Center
 - BASF, Corteva, & Bayer CropScience
 - United Soybean Board
- \$350,000 spent on volatility research

Questions?

ER 0883