

# Further Insights into the Epidemiology and Monitoring Practices of Tomato Viruses

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Joseph Russo, H. Charles Mellinger, Galen  
Frantz, Leon Lucas, Eugene McAvoy, and  
Scott Adkins





# Outline

- ▶ Brief review of what we've learned about insect–vectored viruses
  - Thrips–vectored tospoviruses
    - Adkins, Webster, Reitz, and Funderburk
  - TYLCV
    - Distribution and factors influencing development
- ▶ **AgScouter**
  - A mobile–device/computer–based system for managing disease and insect pests



# Introduction

- ▶ Insect–vectored viruses have been a constant threat to the tomato and vegetable industry
- ▶ The particular virus threats change as a result of:
  - Introductions, cultivar selection, management practices, climate, and sometimes for reasons unknown
- ▶ For the last several years, *Tomato yellow leaf curl virus* has been a consistent industry threat, being worse in some years/locations than others
- ▶ The thrips–transmitted tospoviruses are an emerging group of viruses threatening Florida tomato production



# *Groundnut ringspot virus* (GRSV) hosts in Florida





# GRSV hosts in Florida



**Pepper**



**American black  
nightshade**



**Eggplant**



***Tomato chlorotic spot virus***  
**(TCSV) hosts in Florida**



**Tomato**



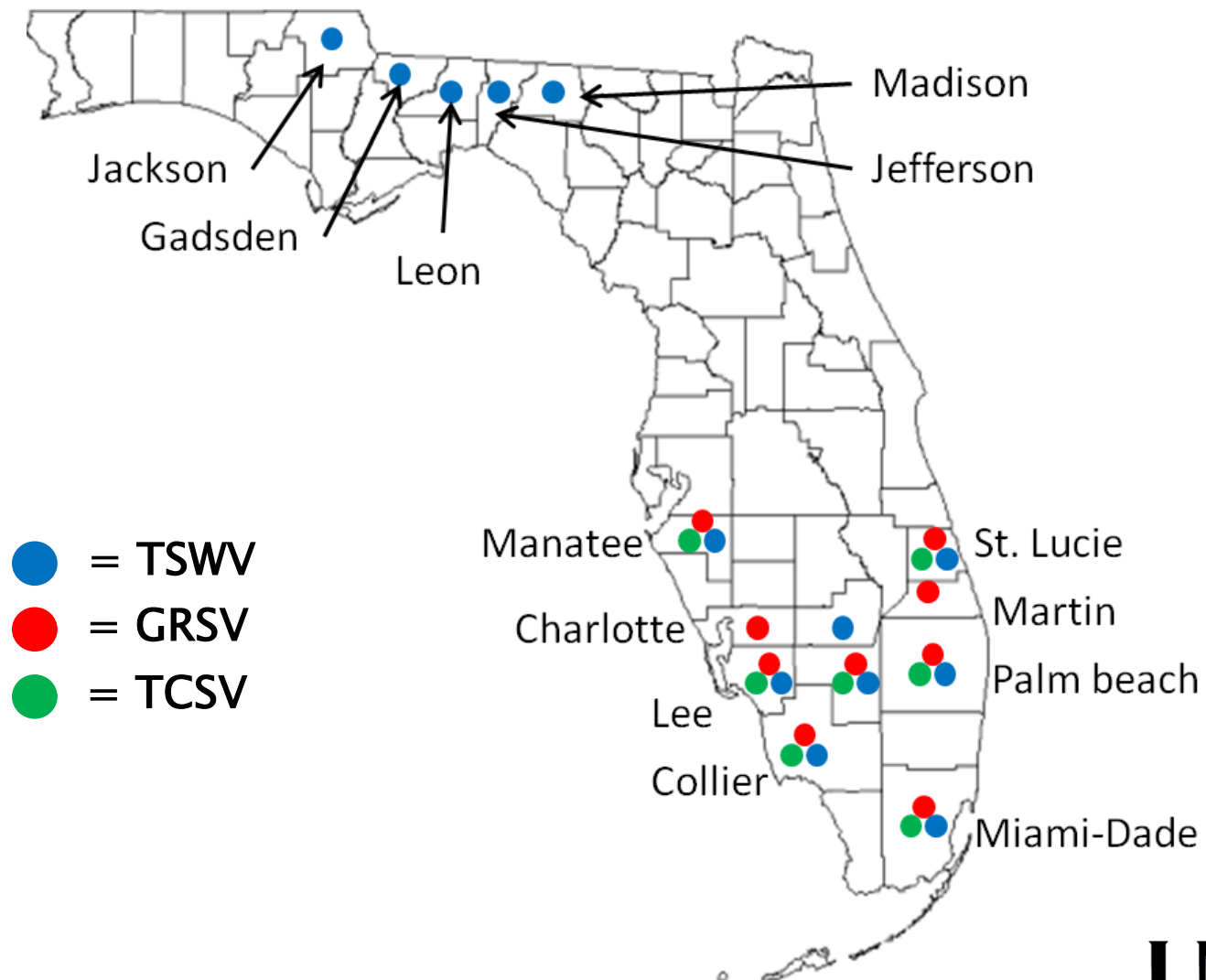
**Pepper**



**Lettuce**

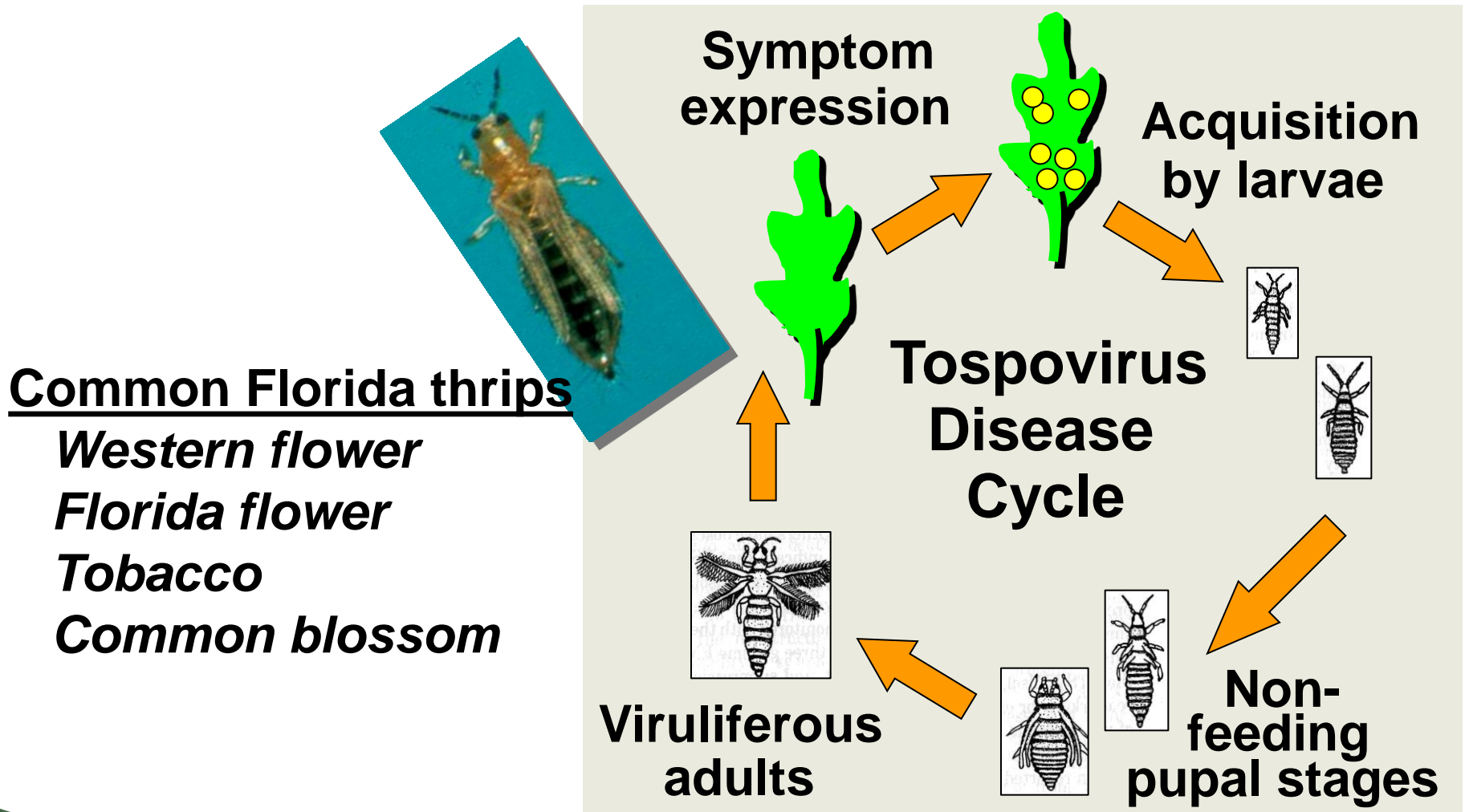


# Field surveys





# Thrips transmission of tospoviruses





# Florida thrips species as vectors of GRSV and TCSV

- ▶ Western flower thrips acquired and transmitted both GRSV and TCSV
- ▶ Common blossom thrips was the most efficient vector of GRSV (TCSV not tested)
- ▶ Florida flower thrips acquired GRSV but did not transmit the virus (TCSV not tested)
- ▶ Tobacco thrips does not acquire or transmit GRSV (TCSV not tested)

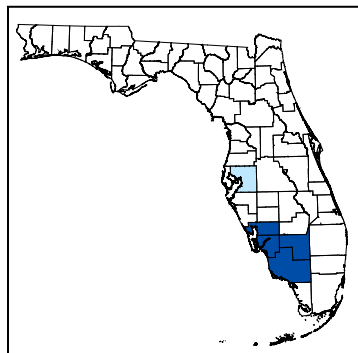


# TYL CV Epidemics

Lee

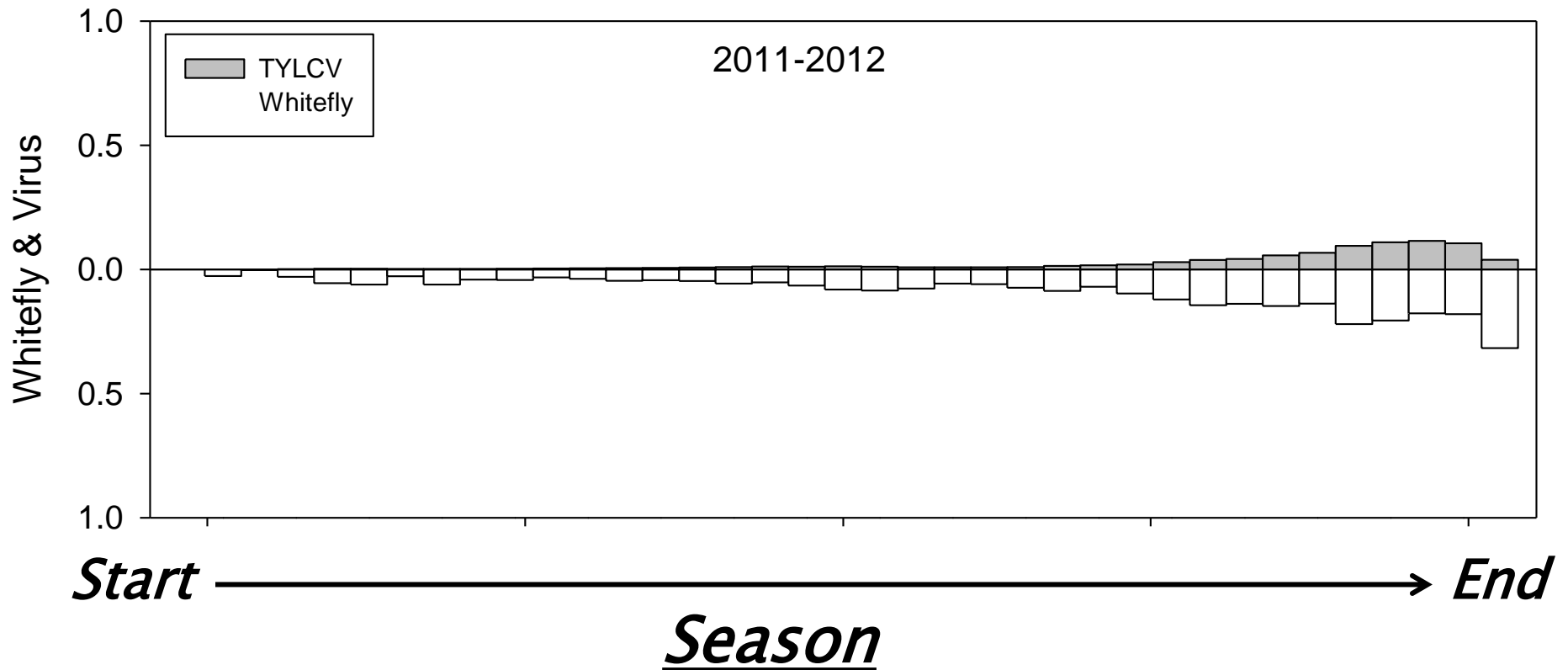
Hendry

Collier





# TYLCV-Whitefly Epidemics





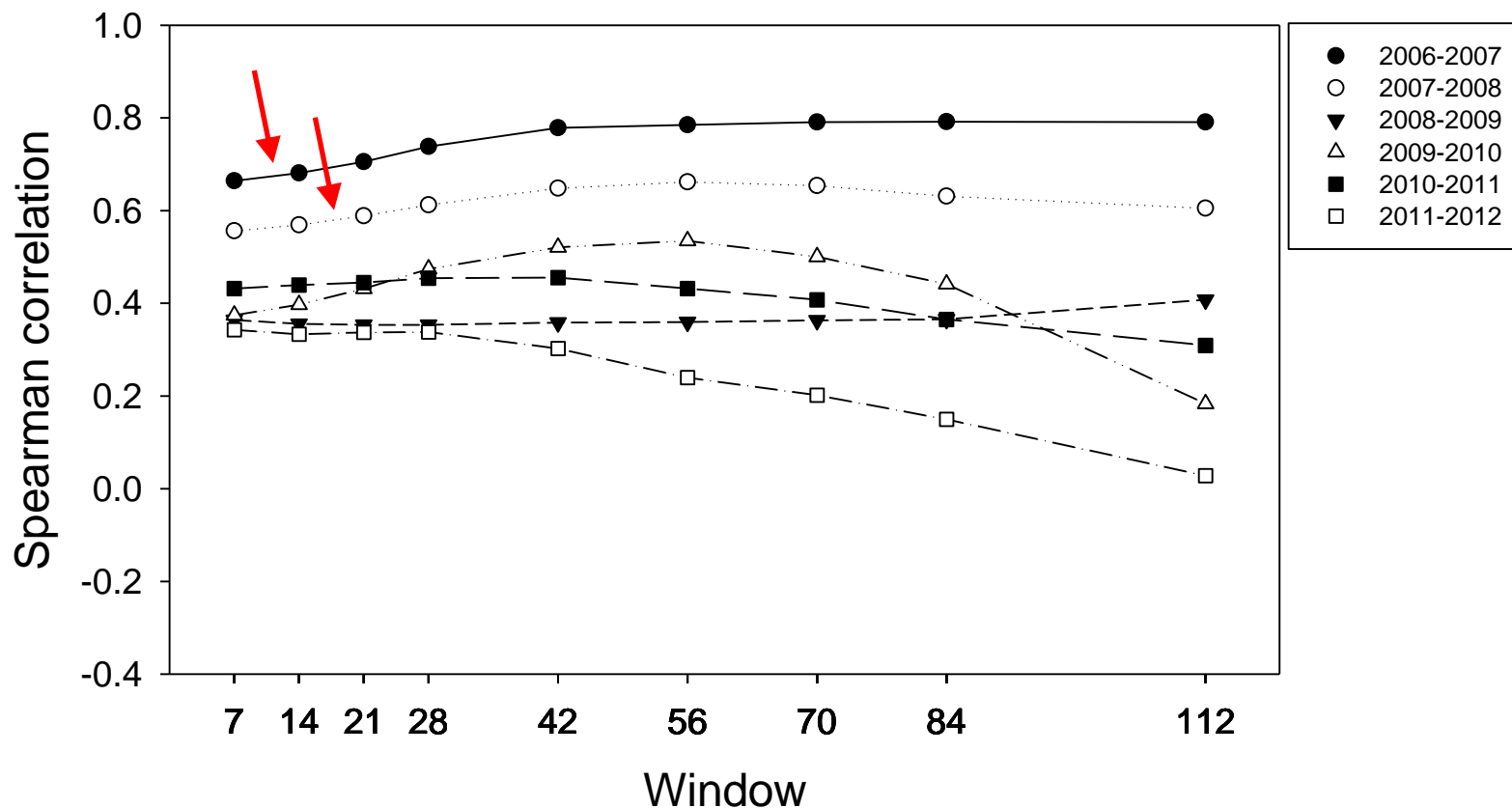
# Some Natural Questions

1. What is the relationship between whitefly densities and TYLCV severity?
2. Can we rely on weather conditions to predict whitefly and/or virus outbreaks?
3. Can we rely on geographical attributes or simply location to predict whitefly and/or TYCLV outbreaks?



# Window-pane analysis

TYLCV Mean vs. Whitefly Mean





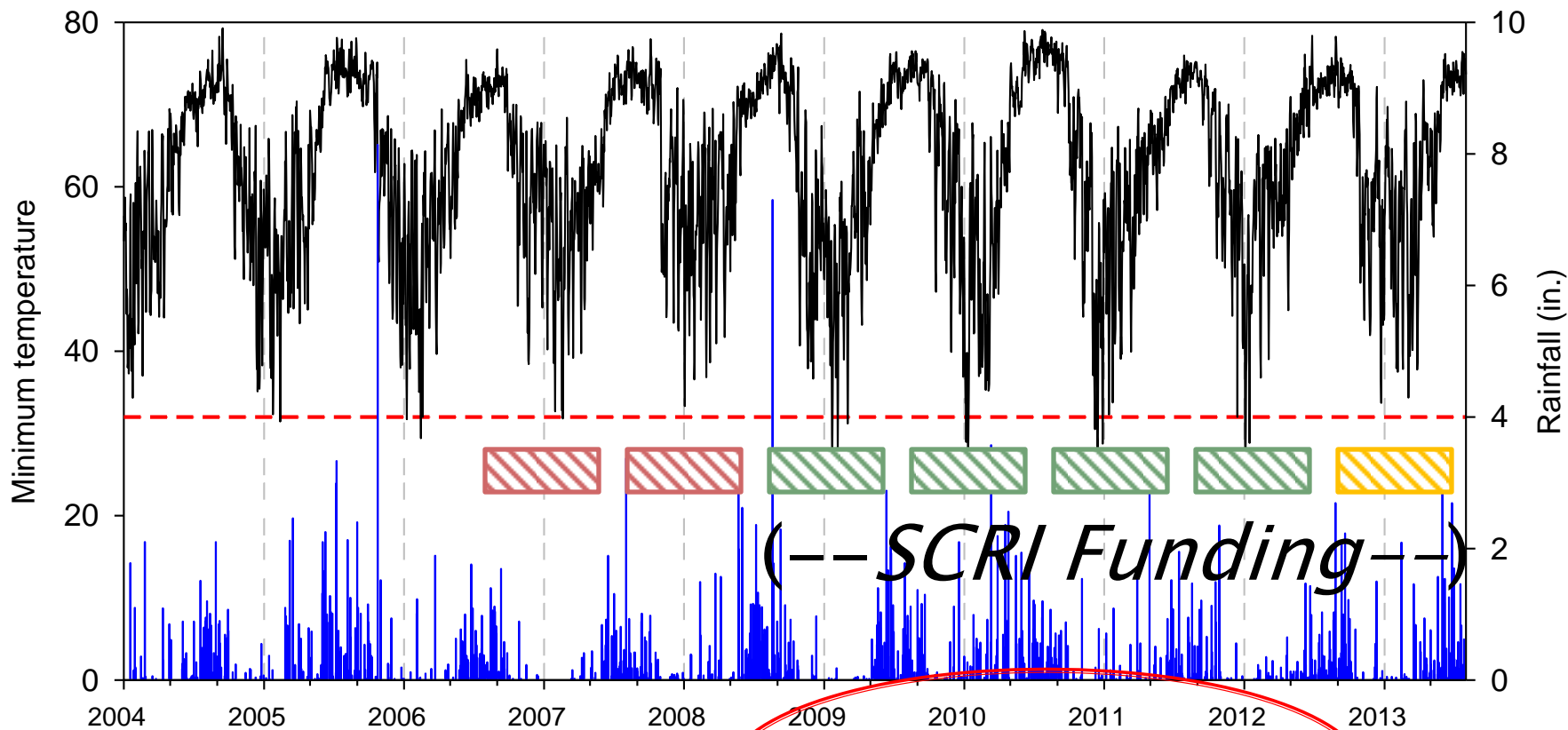
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# Mother Nature's Role

Minimum temperature and total daily rainfall recorded in Immokalee



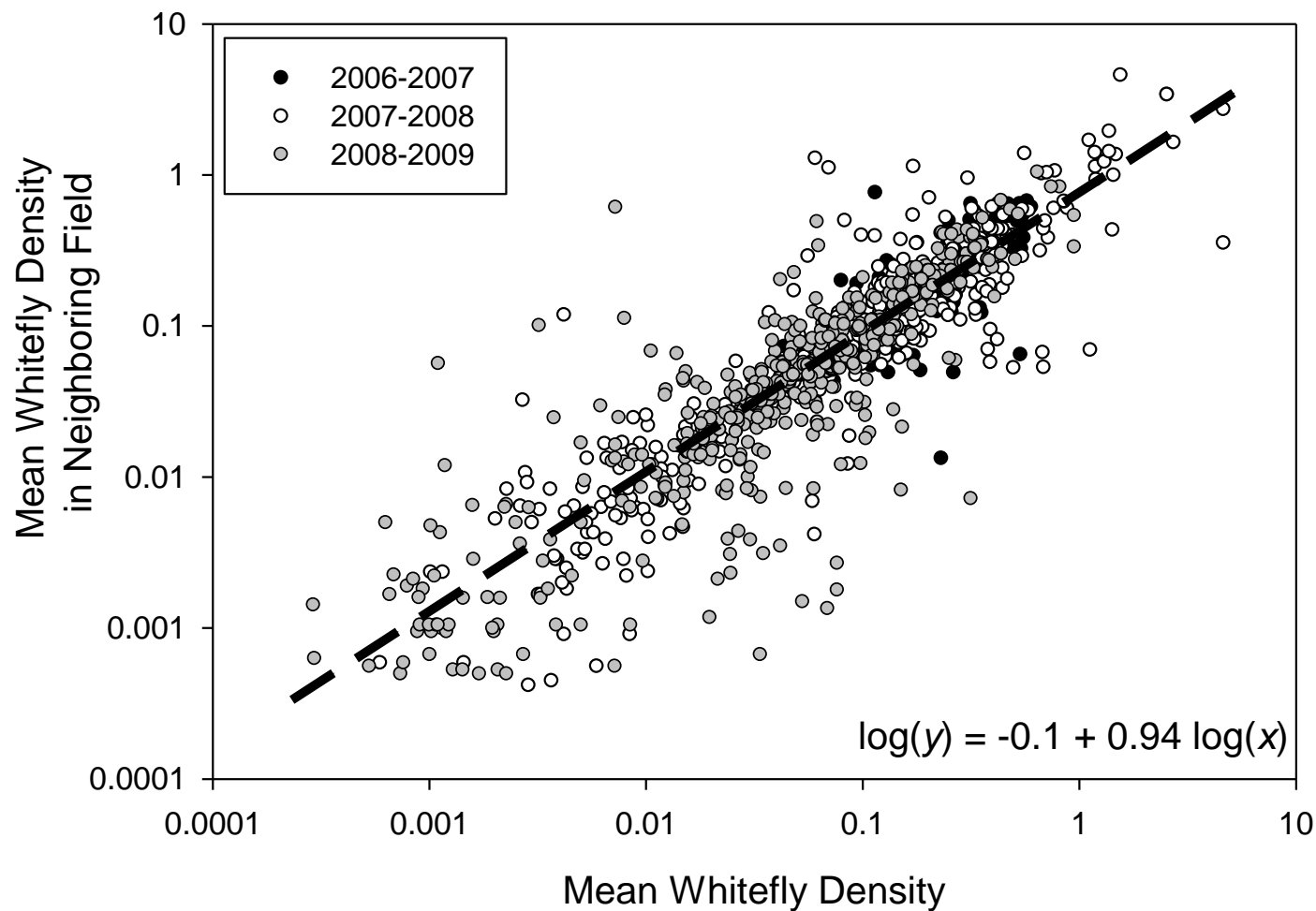


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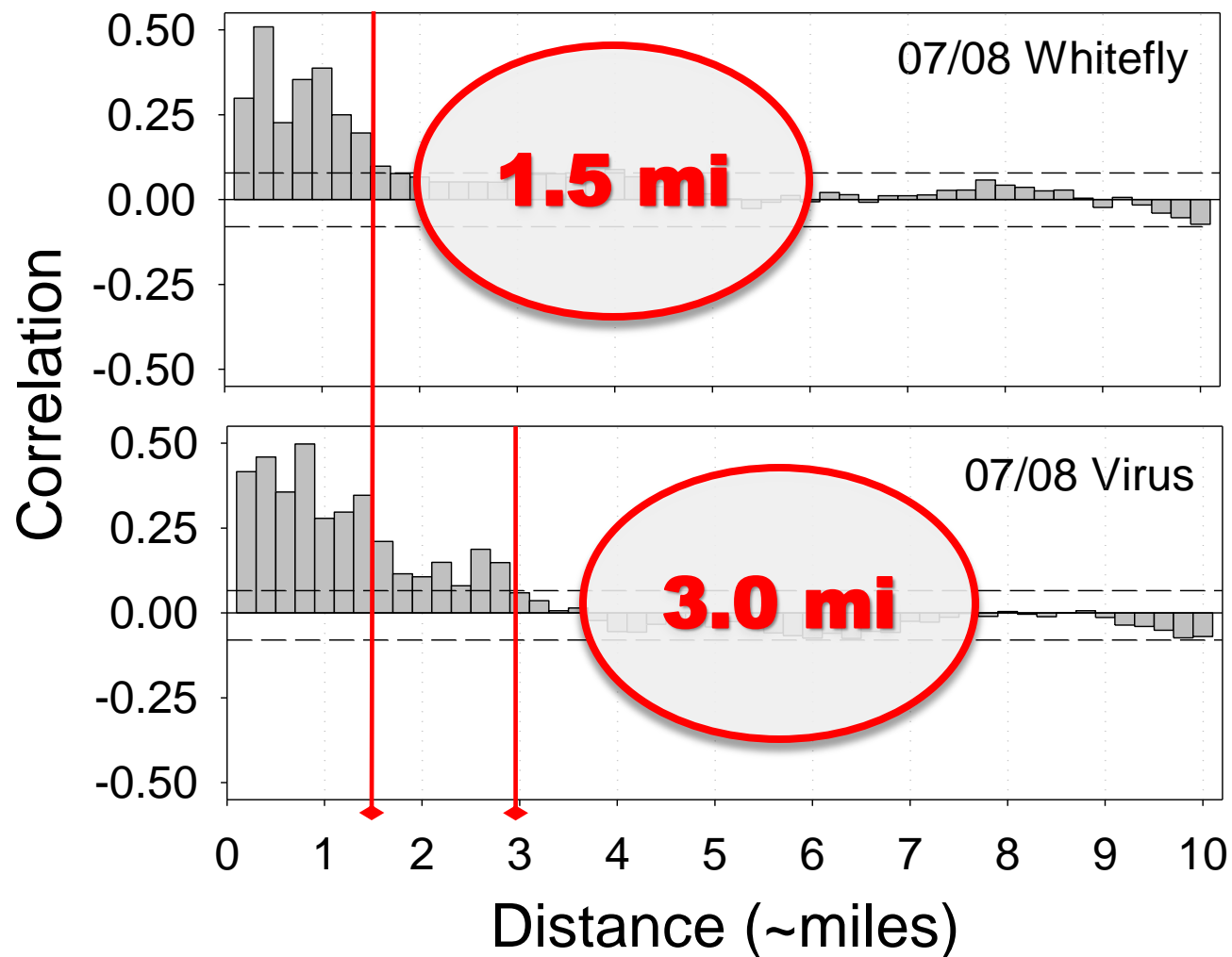


# 1<sup>st</sup> Order Nearest Neighbors (whiteflies)



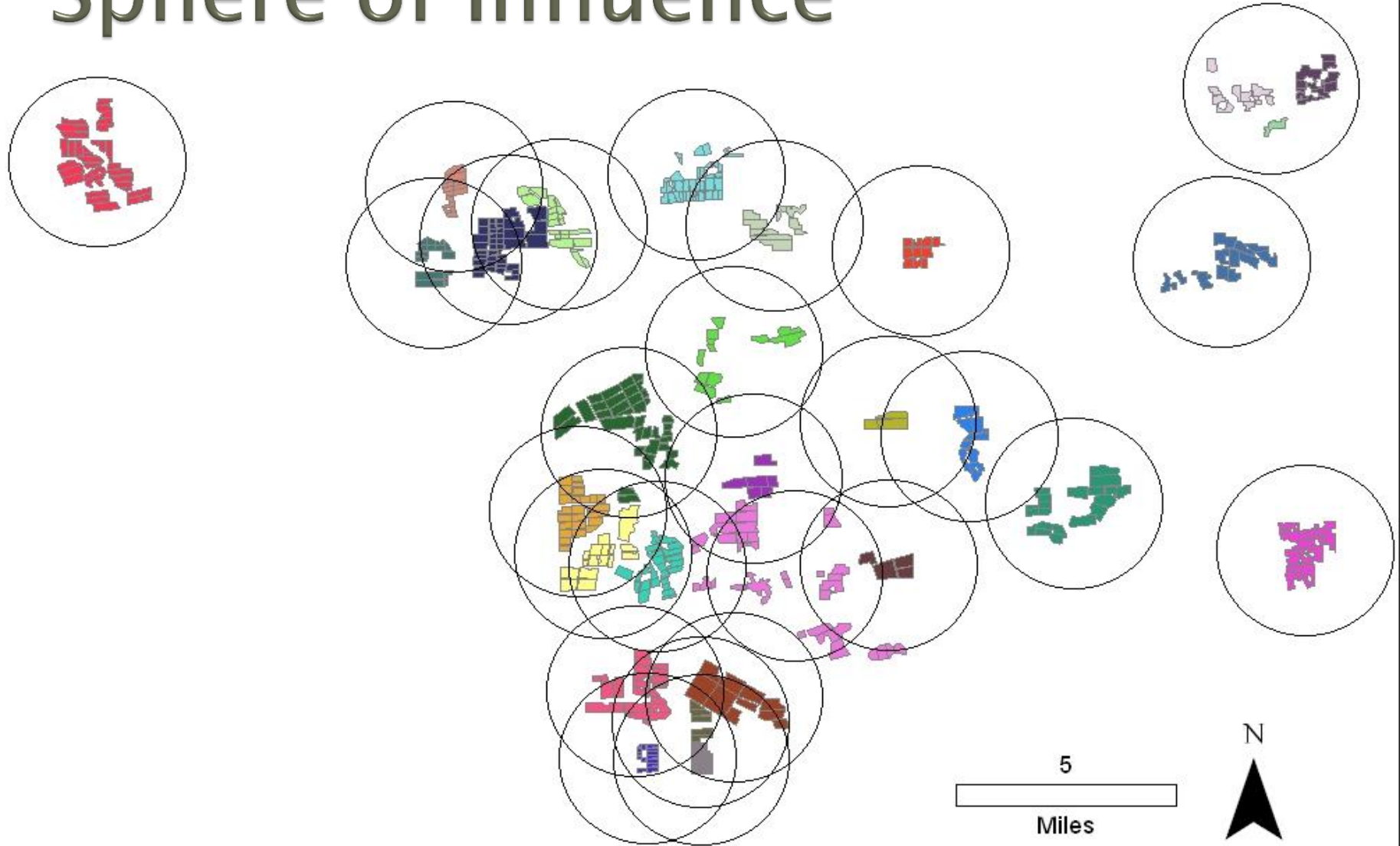


# Correlation Analysis





# Sphere of Influence





# So...

- ▶ Aside from cold weather events, geographical features – like proximity to affected fields – are perhaps the best predictors of these pests
  - Natural scale of these pests is regional
- ▶ Developing/coordinating an area-wide pest management protocol could lead to improved control
- ▶ The tools to enable the implementation of an area-wide pest management program need to be developed
  - *AgScouter* could facilitate such an effort



# What is *AgScouter*?

- A system that uses the GPS-capability of

**ZedX Inc. (zedxinc.com) was hired to develop the *AgScouter* interface**

A tool for delivering and storing management recommendations

- A comprehensive system for pest management
  - To make it widely adaptable, we enabled the system to record both production and pest information for a wide variety of crops



# Accessing AgScouter

## ► Mobile-device Access

- Download the AgScouter “App”
- Available on iPhone and Google Store

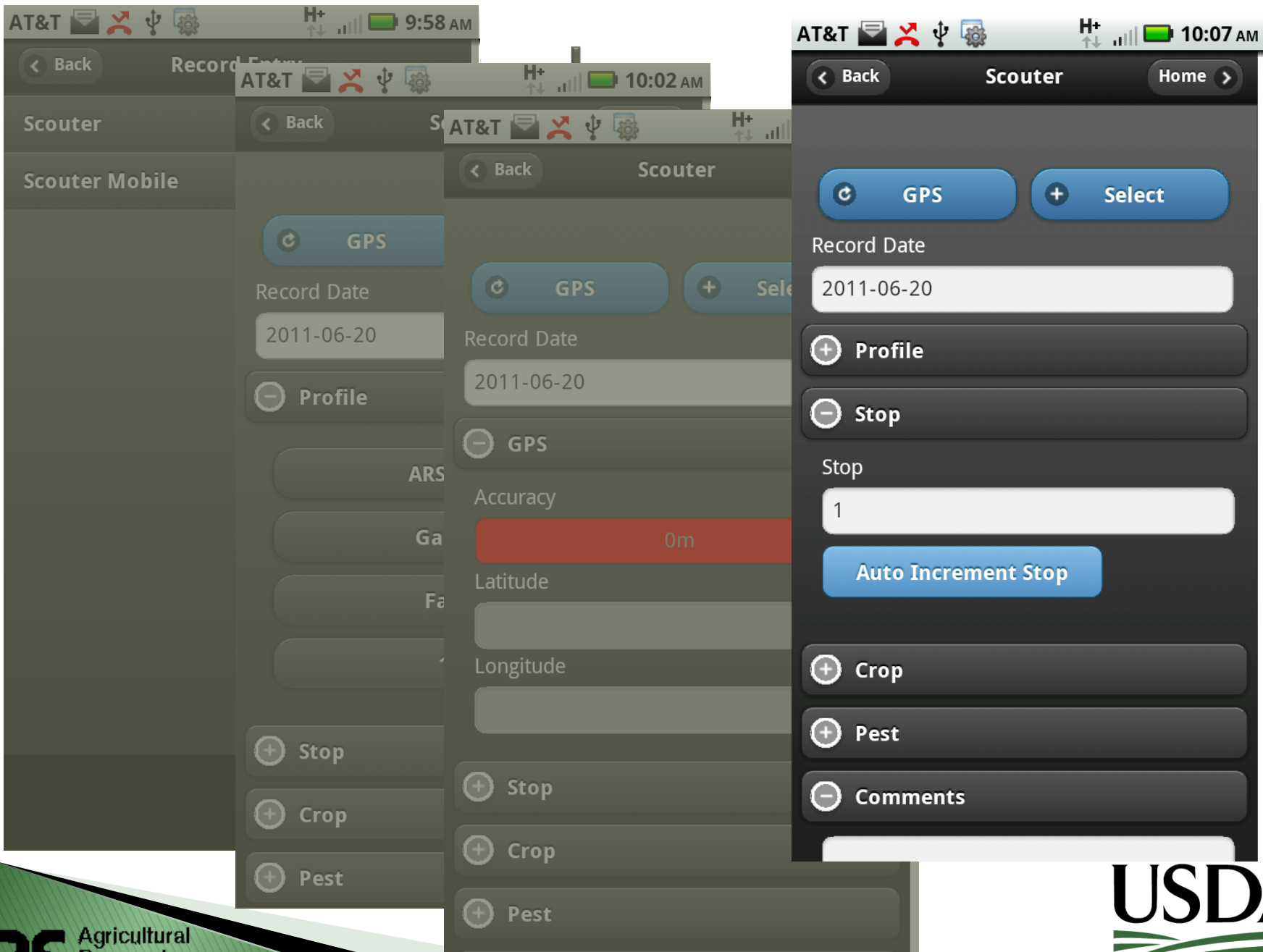
## ► Web-based Access ([AgScouter.com](http://AgScouter.com))

- Create field boundaries/name fields
- View data
- Modify data entries
- View video tutorials

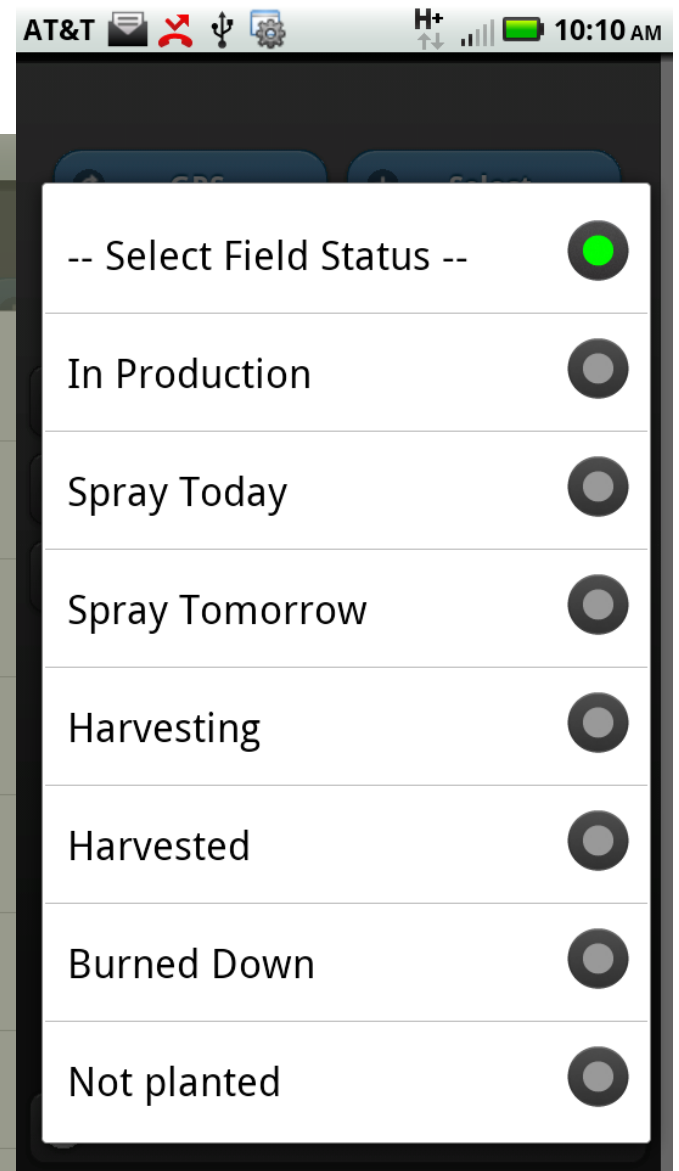
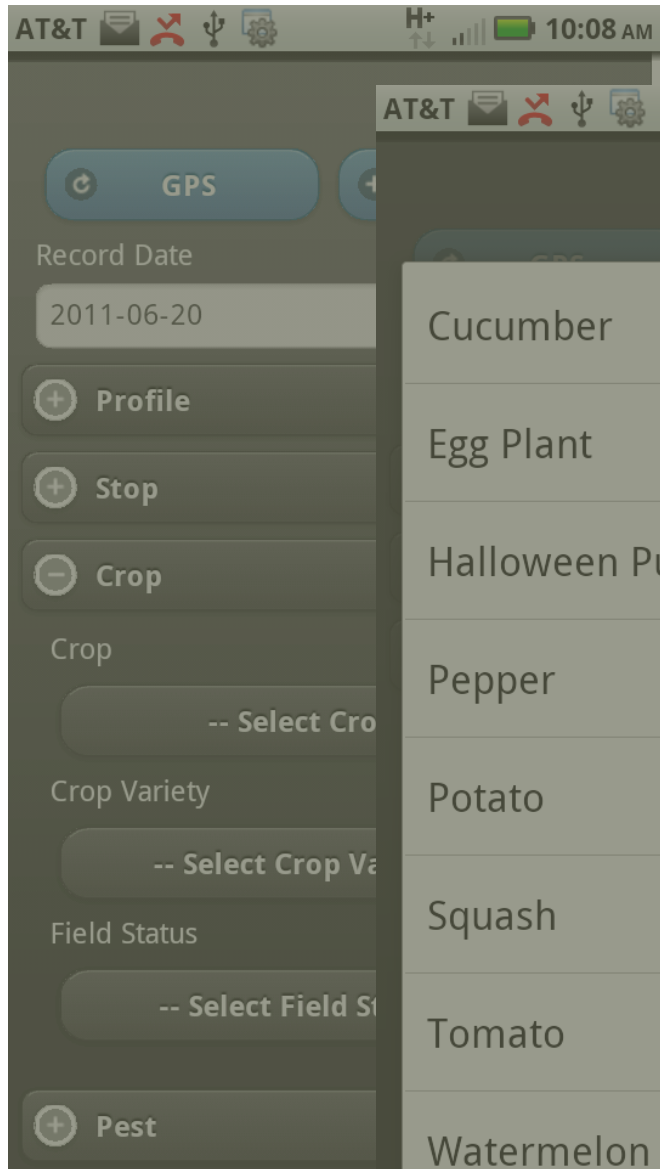
## ► System is secure (password protected)

- But flexible enough to share disease and pest information among collaborating growers











AT&T 10:10 AM

Scouter

GPS

Record Date

2011-06-20

+ Profile

+ Stop

+ Crop

- Pest

Pest

-- Select Pest Category

Pest Name

-- Select Pest

Pest Amount (%)

0

AT&T 10:11 AM

Scouter

GPS

-- Select Pest Category

Bacterial Disease

Fungal Disease

Insect

Viral Diseases

Weed

Pest Amount (%)

0

Squash Vein Yellow Virus (SqVYV)

Tobacco Etch Virus

Tomato Chlorosis (ToCV)

Tomato Infectious Chlorosis Virus (TICV)

Tomato Spotted Virus (TSWV)

Tomato Yellow Leaf Virus (TYLCV)

Watermelon Mosaic (WMV)

Zucchini Yellow Mosaic Virus (ZYMV)

AT&T 10:12 AM

Tomato Yellow Leaf Cu...

Pest Amount (%)

14

- Comments

Submit

1	2 ABC	3 DEF	-
4 GHI	5 JKL	6 MNO	.
7 PQRS	8 TUV	9 WXYZ	DEL X
* # (	0 +	_	Next



Save

AT&T H+ 10:15 AM

10N

+ Stop

+ Crop

- Pest

Connected

Record Saved to Server.

OK

Pest Amount (%)

7

+ Comments

Submit

AT&T H+ 10:14 AM

GPS Select

Record Date

2011-06-20

Profile

ARS Demo

Gargiulo

Farm 4

10N

Stop

Stop

2

Auto Increment Stop

Crop





### Contact Information

#### AgScouter Support

Monday-Friday 8AM to 9PM Eastern  
Saturday 9AM to 5PM Eastern

[+1 \(814\) 357-8498](tel:+18143578498)

[+1 \(814\) 357-8499 \(fax\)](tel:+18143578499)

[support@zedxinc.com](mailto:support@zedxinc.com)

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### Manage pest, crop, insect and weather scouting observations

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User Name

Password

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# AgScouter

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[FARM MANAGER](#) [SCOUTER](#)

Welcome, Bill Turechek Send Questions or Report Bugs to [support@zedxinc.com](mailto:support@zedxinc.com) or call support at [+1-814-357-8498](tel:+1-814-357-8498)

## Farm Manager

### Select a Field

Location	-- Location --	
Grower	-- Grower --	<a href="#">+</a> <a href="#">✎</a> <a href="#">-</a>
Management Units	-- Optional --	<a href="#">+</a> <a href="#">✎</a> <a href="#">-</a>
Farm	-- Farm --	<a href="#">+</a> <a href="#">✎</a> <a href="#">-</a>
Field	-- Field --	<a href="#">+</a> <a href="#">✎</a> <a href="#">-</a>

[Upload Boundary](#)

### Draw a Field Boundary

Please select a field.



Click and drag to move. Double Click to zoom in.

[+Date: 2013-08-26](#)



125%

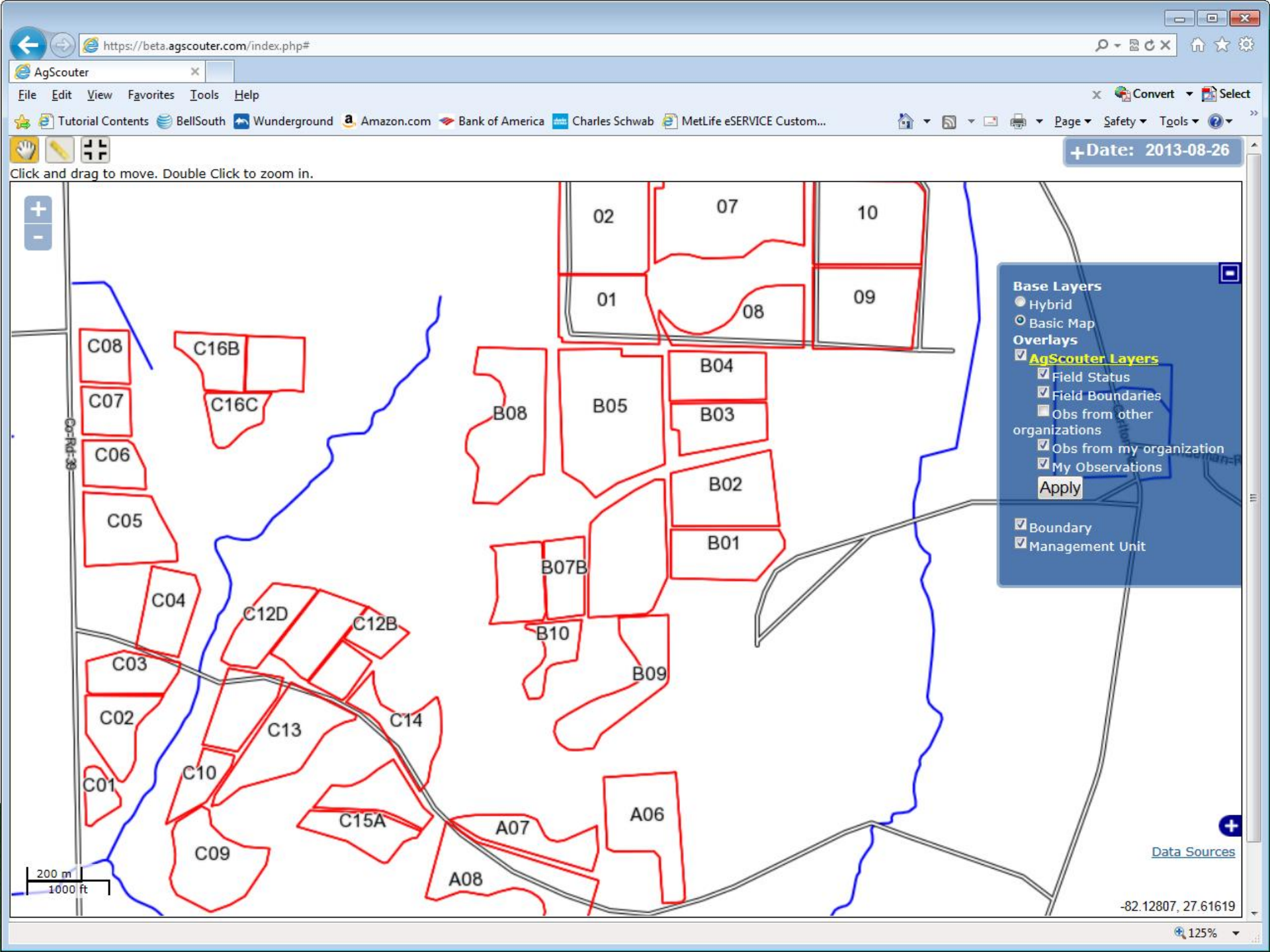
















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## Farm Manager

### Select a Field

Location	GCC Test	
Grower	Farm Op 15_03B	
Management Units		
Farm	-- Farm --	
Field	-- Field --	

Upload Boundary

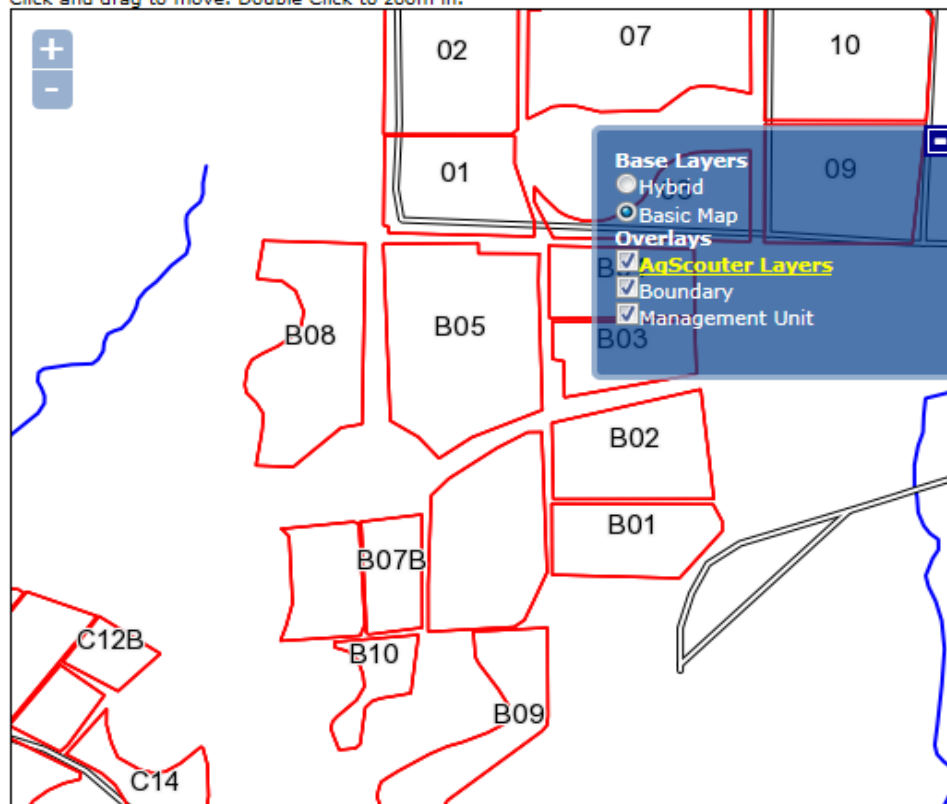
### Draw a Field Boundary

Please select a field.



Click and drag to move. Double Click to zoom in.

+Date: 2013-08-28







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Farm Manager

Select a Field

Location-- Location --

Grower-- Grower --

Management Units

FarmFarm Op 15\_03B

Field-- Field --

Upload Boundary

Draw a Field Boundary  
Please select a field.

CREATE A NEW MANAGEMENT UNIT

NameExample 1

FarmFarm Op 15\_03B

Field-- Field --

B01

B02

B03

B04

B05

B06

B07

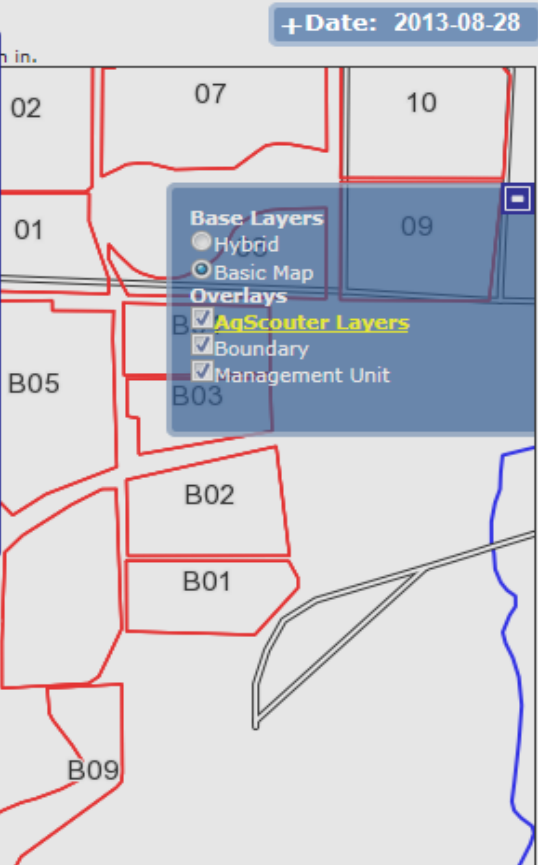
B07B

B08

B09

B10

CANCEL







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Farm Manager

Select a Field

Location -- Location --

Grower -- Grower --

Management Units

Farm Farm Op 15\_03B

Field B09

Upload Boundary

Draw a Field Boundary

To draw a field boundary, first select a field from the "Select a Field" above. Then using the map to the right, click the draw icon. Then, click on the map around the edges of your field.

Area 17.00 Ac

Select a Planting Date

Planting Date -- Planting Date --

CREATE A NEW MANAGEMENT UNIT

Name Example 1

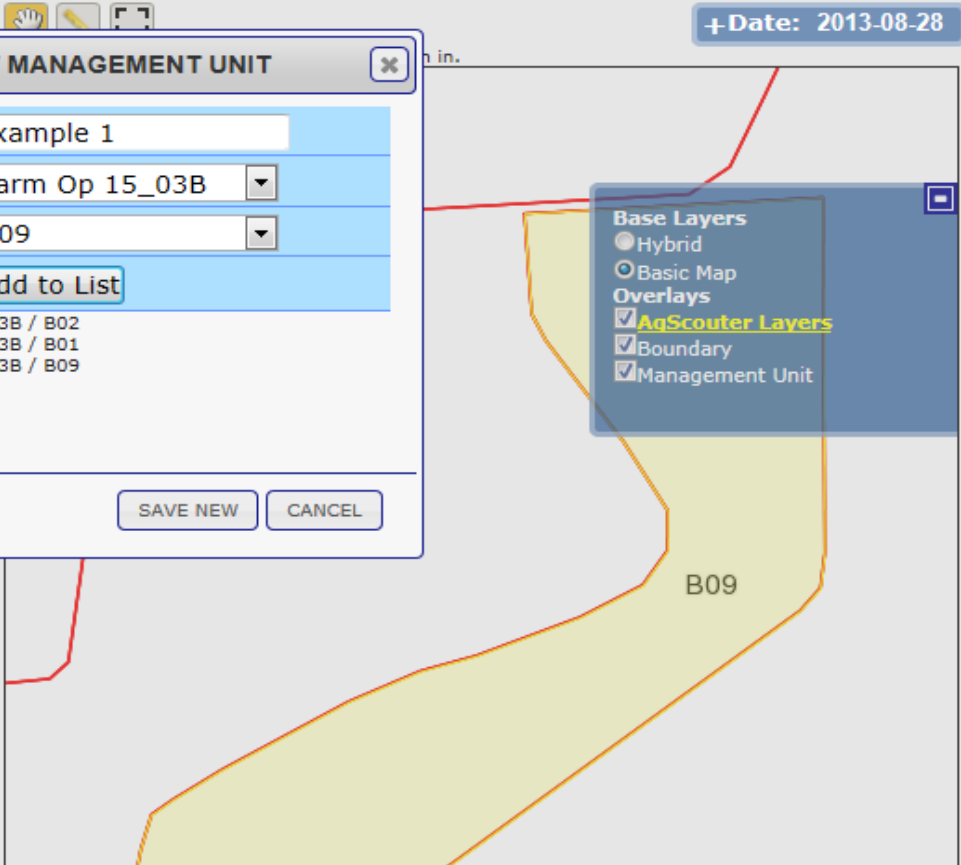
Farm Farm Op 15\_03B

Field B09

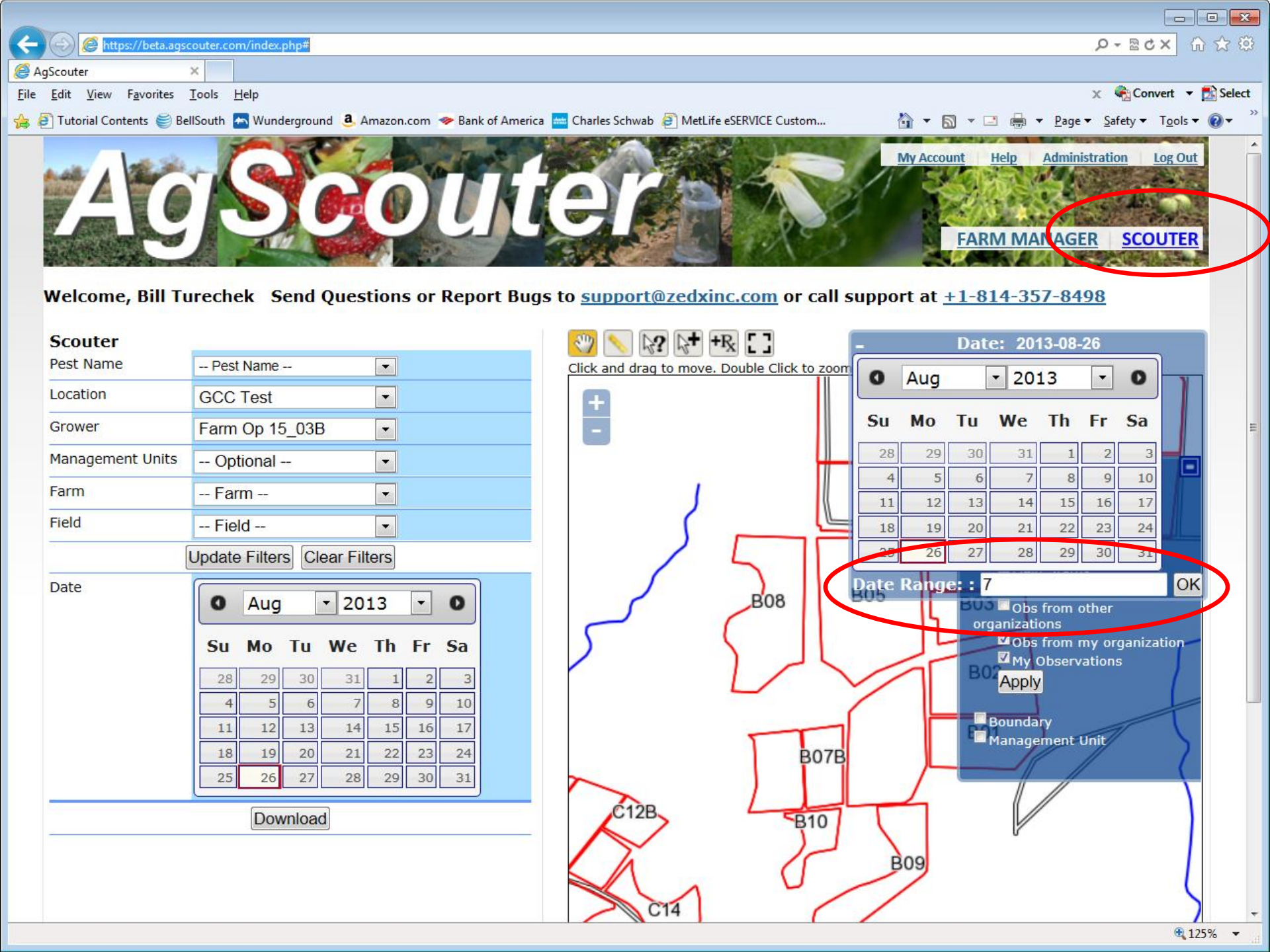
Add to List

☒ Farm Op 15\_03B / B02  
☒ Farm Op 15\_03B / B01  
☒ Farm Op 15\_03B / B09

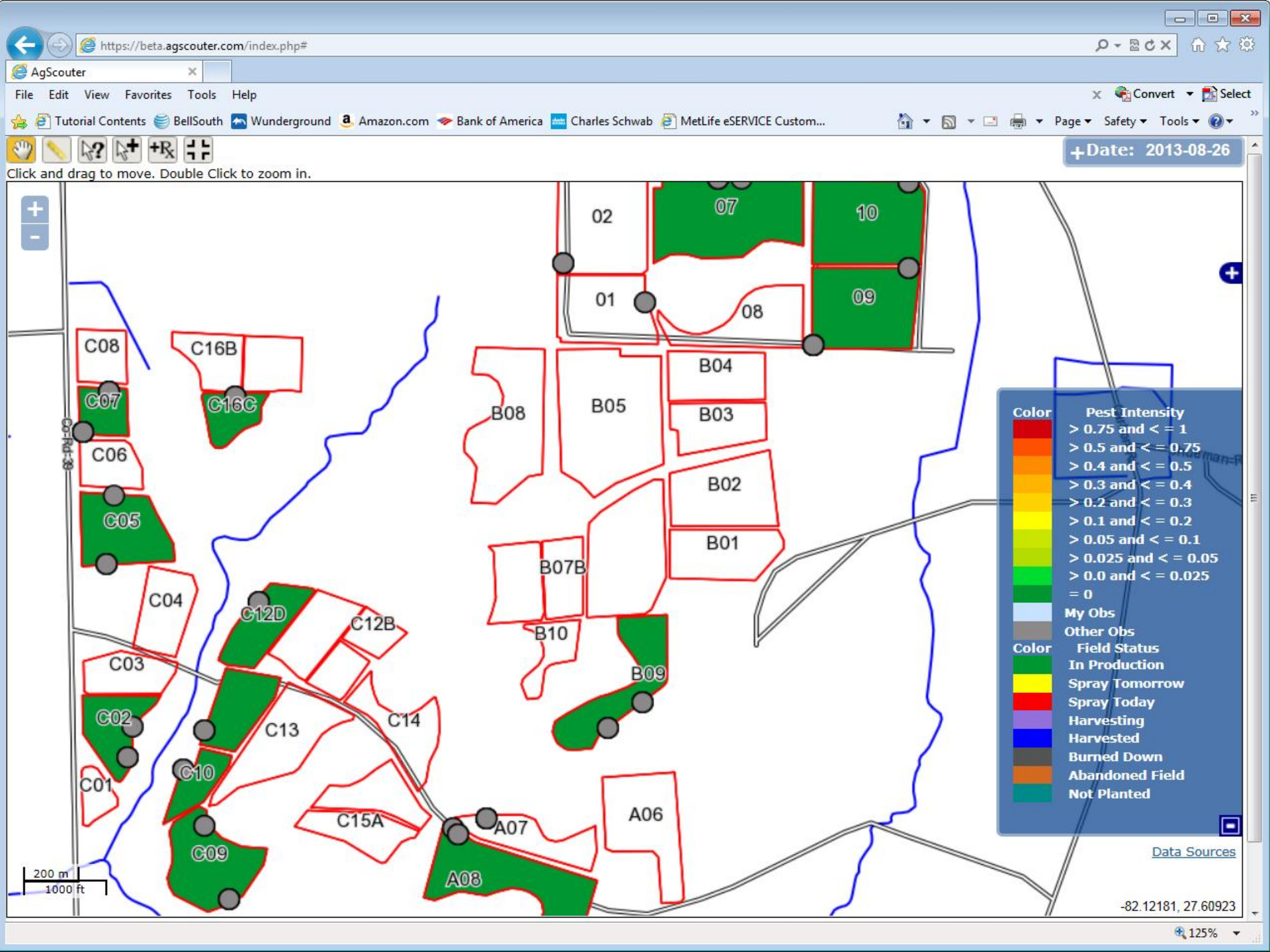
SAVE NEW CANCEL















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### Scouter

Pest Name **Tomato Yellow Leaf Curl Viru**  
Location GCC Test  
Grower Farm Op 15\_03B  
Management Units -- Optional --  
Farm -- Farm --  
Field -- Field --

Update Filters Clear Filters

Date

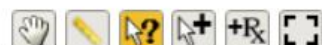
Aug 2013

Su	Mo	Tu	We	Th	Fr	Sa
28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

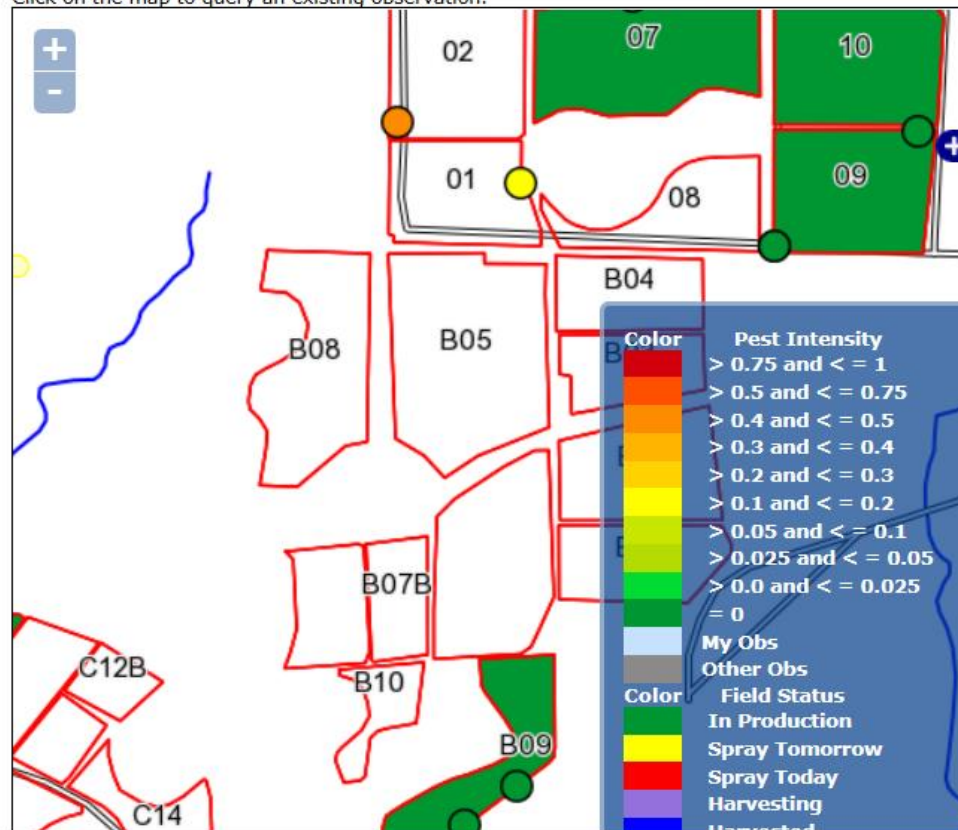
### Observations for the queried point.

Actions  
Grower  
Farm  
Field  
Date

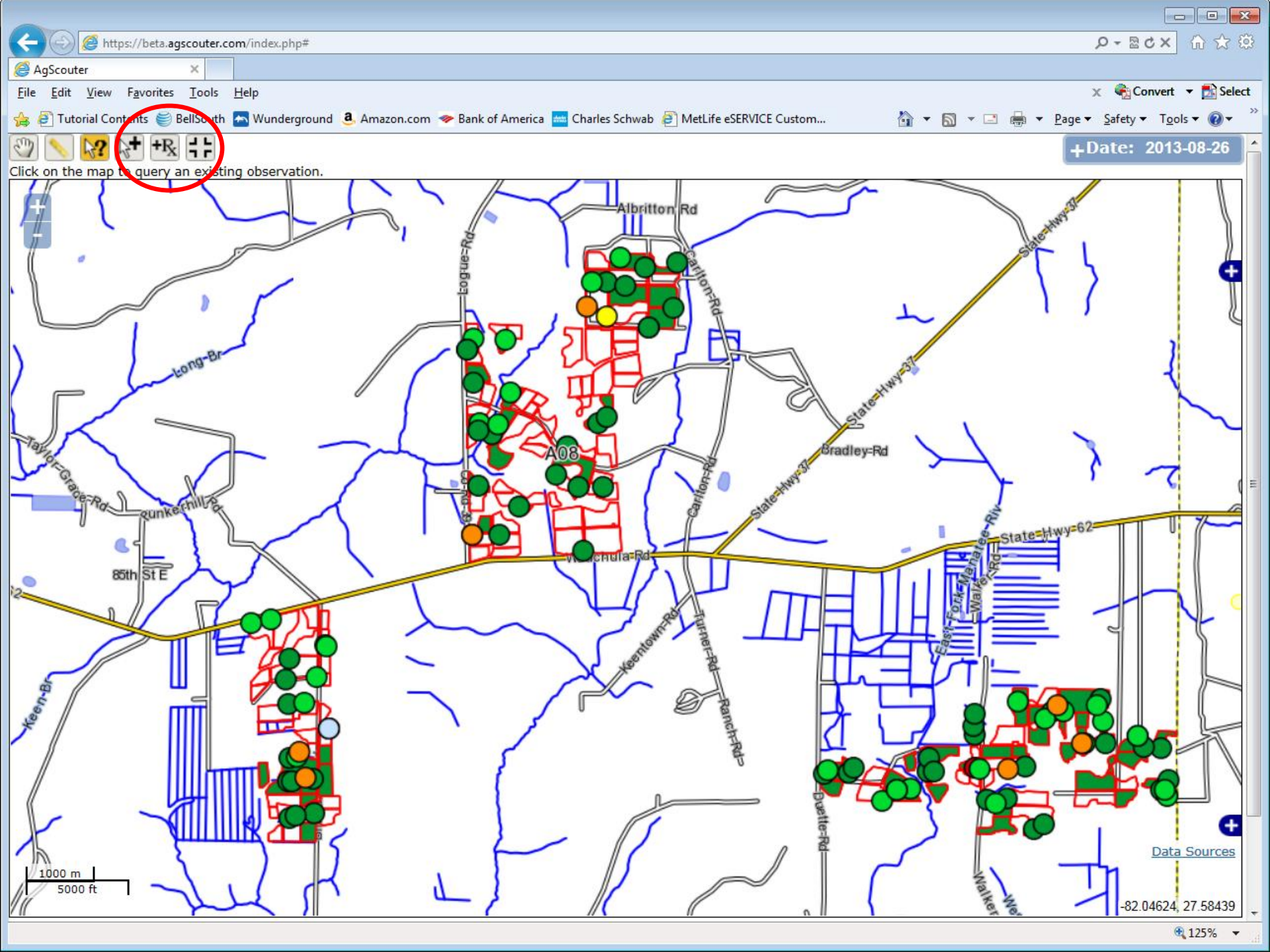
Farm Op Badcock  
Farm Op Badcock  
02  
2011-09-20



Click on the map to query an existing observation.









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**Scouter**

Pest Name: -- Pest Name --

Location: GCC Test

Grower: Farm Op 15\_03

Management Units: Example 1

Farm: -- Farm --

Field: -- Field --

Date: Aug

Update Filters

Download

ADD RECOMMENDATION

PRODUCT

Application

Insecticide

Trade Name

Brigade 2EC

Amount

2

fl oz

Cost

-- Units --

EPA#

279-3313

REI

12

PHI

Pest Type

Insect

Target Pest

-- Target Pest --

X

Insect/Aphids

COMMENTS

Options

DELIVERY

Email Delivery

william.turechek@ars.usda.gov

Create report after saving.

SAVE CHANGES

CANCEL

+1-814-357-8498

+Date: 2013-08-28

07 10 09

Base Layers

- Hybrid
- Basic Map

Overlays

- ☒ AgScouter Layers
- ☐ Boundary
- ☐ Management Unit

B03 B02 B01

Data Sources





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## Help

- REQUIREMENTS
- SOFTWARE DOWNLOADS
- HELP VIDEOS

### Software Downloads

Application	Download
<a href="#">AgScouter for Android</a>	
<a href="#">AgScouter for iPhone and iPad</a>	



http://www.youtube.com/playlist?list=PL9kEoavC4C0dqZpFkqp2nH4jzz6zQViOC

AgScouter

AgScouter Mobile Help - Y...

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ConvertSelect

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PageSafetyTools

Spotlight

CHANNELS FOR YOU

Machinima

Bad Teeth

Al Jazeera English

Country Now

Truthloader

Browse channels

Sign in now to see your channels and recommendations!

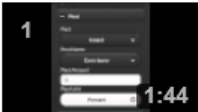
Sign in

AgScouter Mobile Help

Play allLikeShare

5 videos • 16 views

1




AgScouter Mobile - Scouter Tool

by zedxvid 20 views

How-to for Scouter tool for the AgScouter mobile application.

2




AgScouter Mobile - Editing Existing Boundaries

by zedxvid 13 views

How-to for editing exesting boundaries in Boundary Editor tool for the AgScouter mobile application.

3

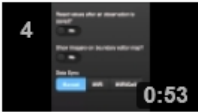


AgScouter Mobile - Adding Farms and Fields

by zedxvid 14 views

How-to for adding farms and field in Boundary Editor tool for the AgScouter mobile application.

4




AgScouter Mobile - Preferences

by zedxvid 11 views

How-to for preferences for the AgScouter mobile application.

5



AgScouter Mobile - Register Device

by zedxvid 8 views

125%



# AgScouter: Pros and Cons

## ► Cons

- Transitioning to new technology
  - Learning curve
- Open sharing of pest data
  - Privacy settings

## ► Pros

- Open sharing of pest data
- Pest information readily available for mapping and viewing
- Comprehensive pest database
- Potential for improved pest management



# Grower survey

- ▶ **Coming soon...AgScouter survey**
  - Survey is to gauge grower and industry perception on use of systems like AgScouter for pest management
  - Willingness to move this type of technology
  - Willingness to engage in area-wide management programs



# Acknowledgements

- ▶ Lisa Rouse
- ▶ Glades Crop Care
- ▶ Red Gator Inc.
- ▶ Agmart
- ▶ Gargiulo
- ▶ Immokalee Tomato Growers
- ▶ Pacific Tomato Growers
- ▶ Lipman Produce
- ▶ West Coast Tomato
- ▶ **Funding Sources**
  - NIFA-SCRI
  - NIFA-AFRI
  - Florida Specialty Crop Block Grant (GRSV)

