# Data Management for On-Farm Research with Precision Ag Tech…

## (i.e., Trials and Tribulations)


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# *Variable Rate Seeding for Soybean Production…*

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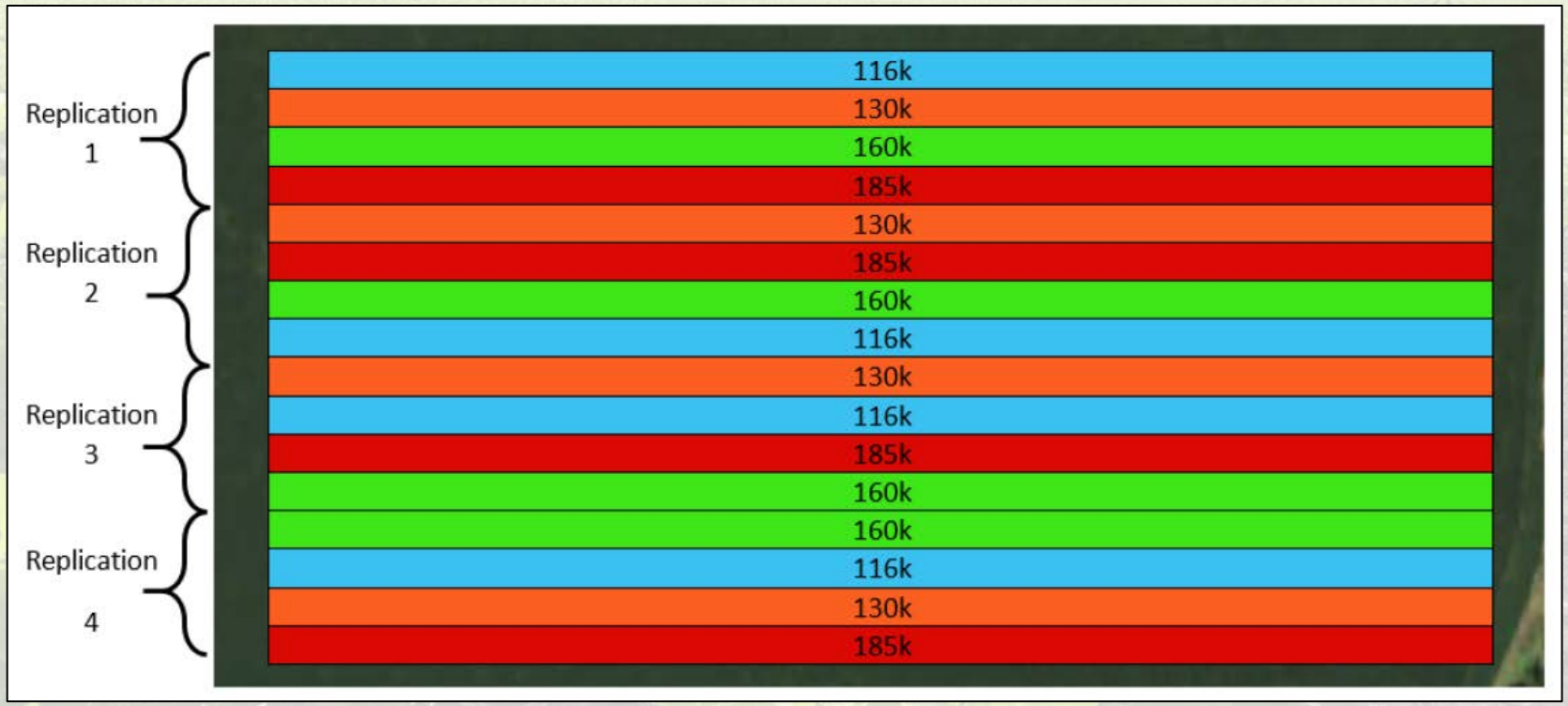
# Variable-Rate Seeding for Soybean Production

- Many producers have access to variable rate technology for soybean production
- In Nebraska, 30” and 15” row spacings are common; often corn and soybeans are planted with the same unit
- This can be challenging with most 7 ½” row spacings:

# Variable-Rate Seeding for Soybean Production

- Several options exist for creating in-field trials
- Field-length strips can be used, much simpler if manual rate adjustments are made

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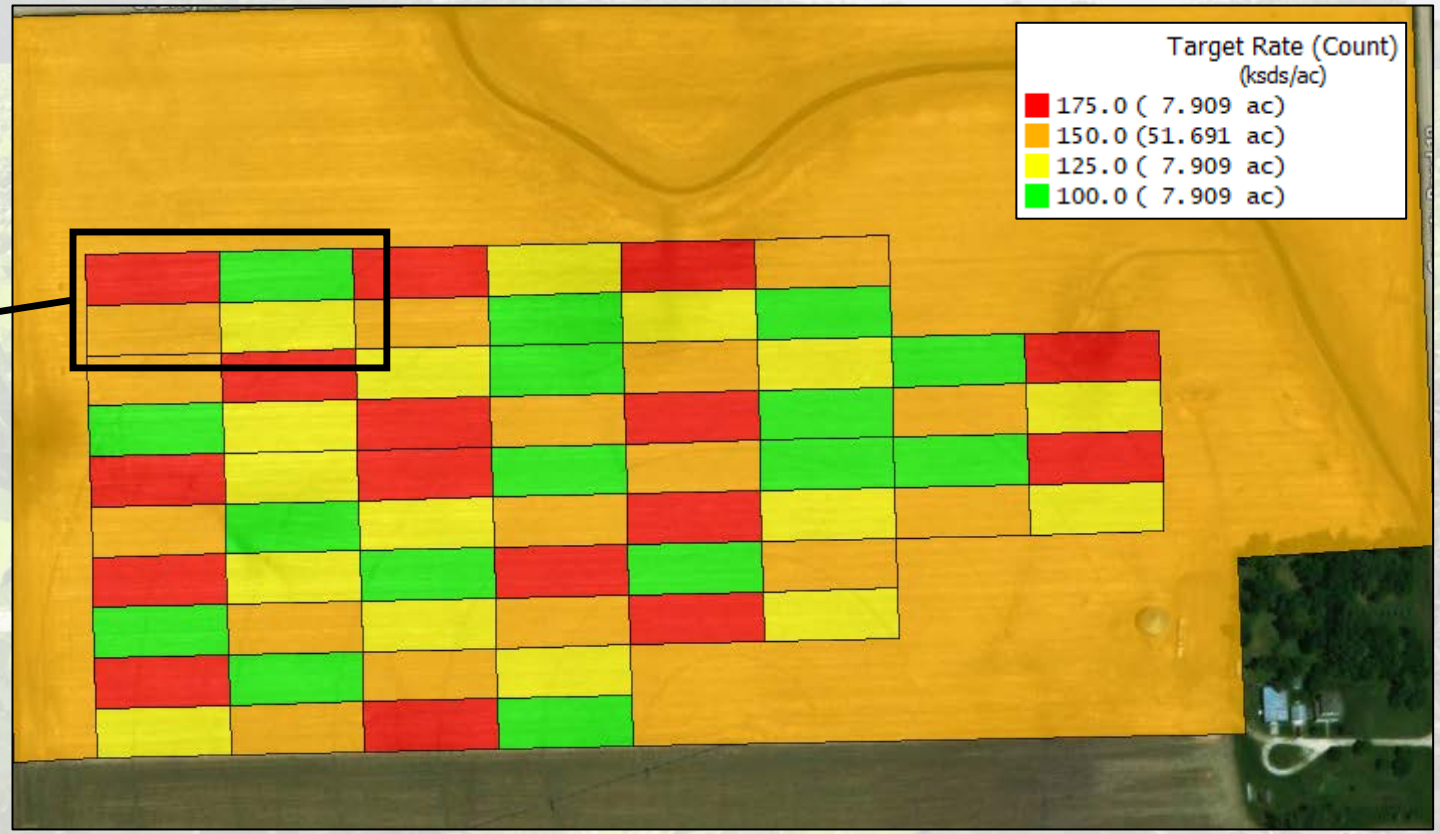
# Variable-Rate Seeding for Soybean Production

- Prescription maps may also be used to create more complex field studies:

- Each block contains 4 treatments (seeding rates)
- Sufficient gaps were included between seeding rates
- 16 total blocks were designed into this experiment

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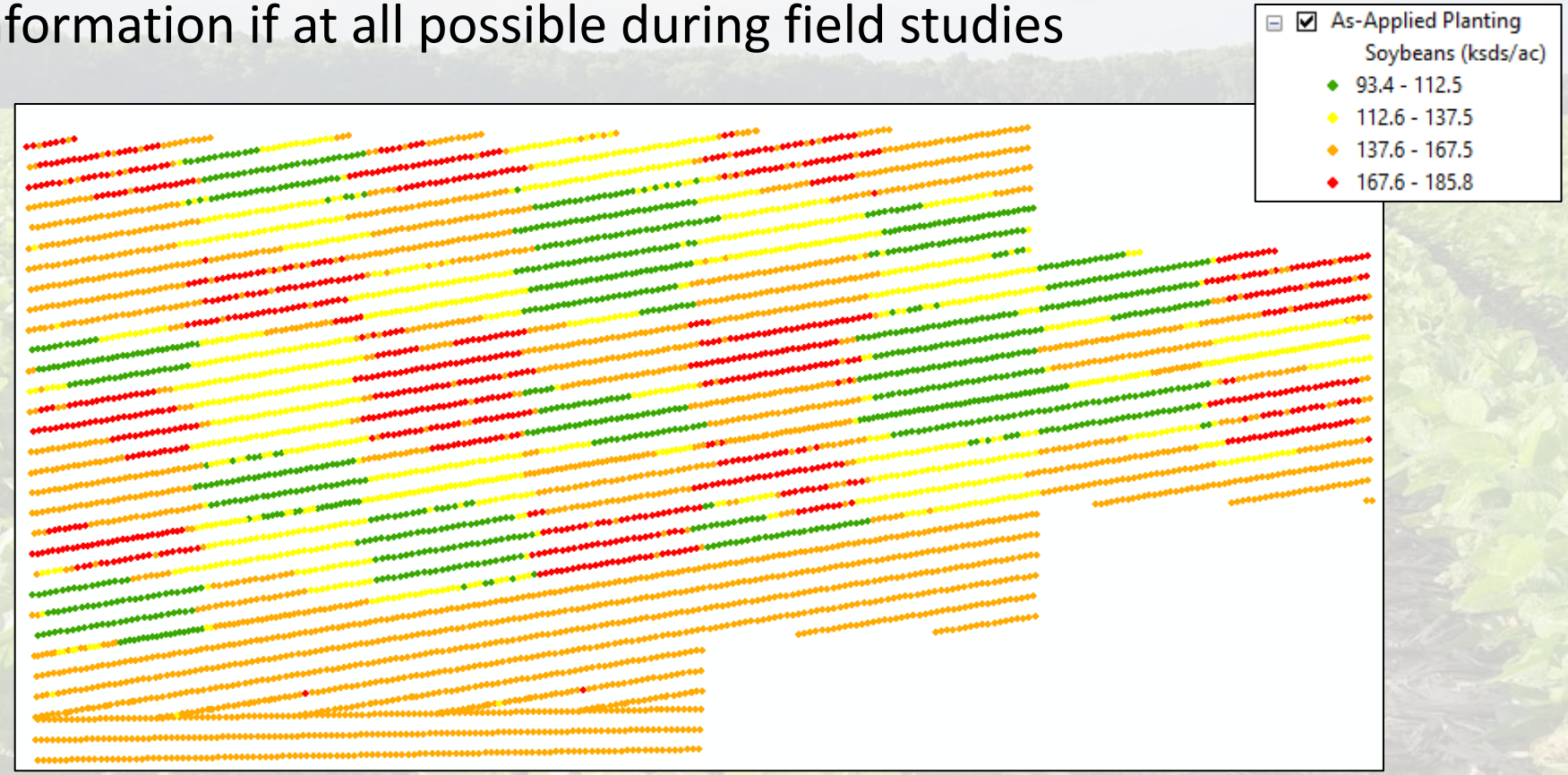
# Variable-Rate Seeding for Soybean Production

- As-applied data is a critical piece of the puzzle
- Collect this information if at all possible during field studies

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# Variable-Rate Seeding for Soybean Production

- Often control systems don't respond as we intend them to:


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# Variable-Rate Seeding for Soybean Production

- Summary of results (for this particular field):

| | Moisture (%) | Yield† (bu/ac) | Marginal Net Return‡ ($/ac) |
|---|---|---|---|
| 100,000 seeds/acre | 10.8 A* | 65 A | 441.78 A |
| 125,000 seeds/acre | 10.8 A | 64 AB | 425.51 A |
| 150,000 seeds/acre | 10.9 A | 62 B | 398.85 B |
| 175,000 seeds/acre | 10.9 A | 63 AB | 395.54 B |
| P-Value | 0.612 | 0.067 | 0.0001 |

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean and $55/unit of soybean seed.

- Of 16 intended blocks (4 treatments per block), only 8 resulted had good seed rates
- With 8 replications, we were able to detect yield differences within 3 bu/ac
- In the end, we need to consider profitability (Marginal Net Return, MNR) to ensure that we're benefitting from these applications

*Setting up on-farm research to ensure good data collection and decision support…*

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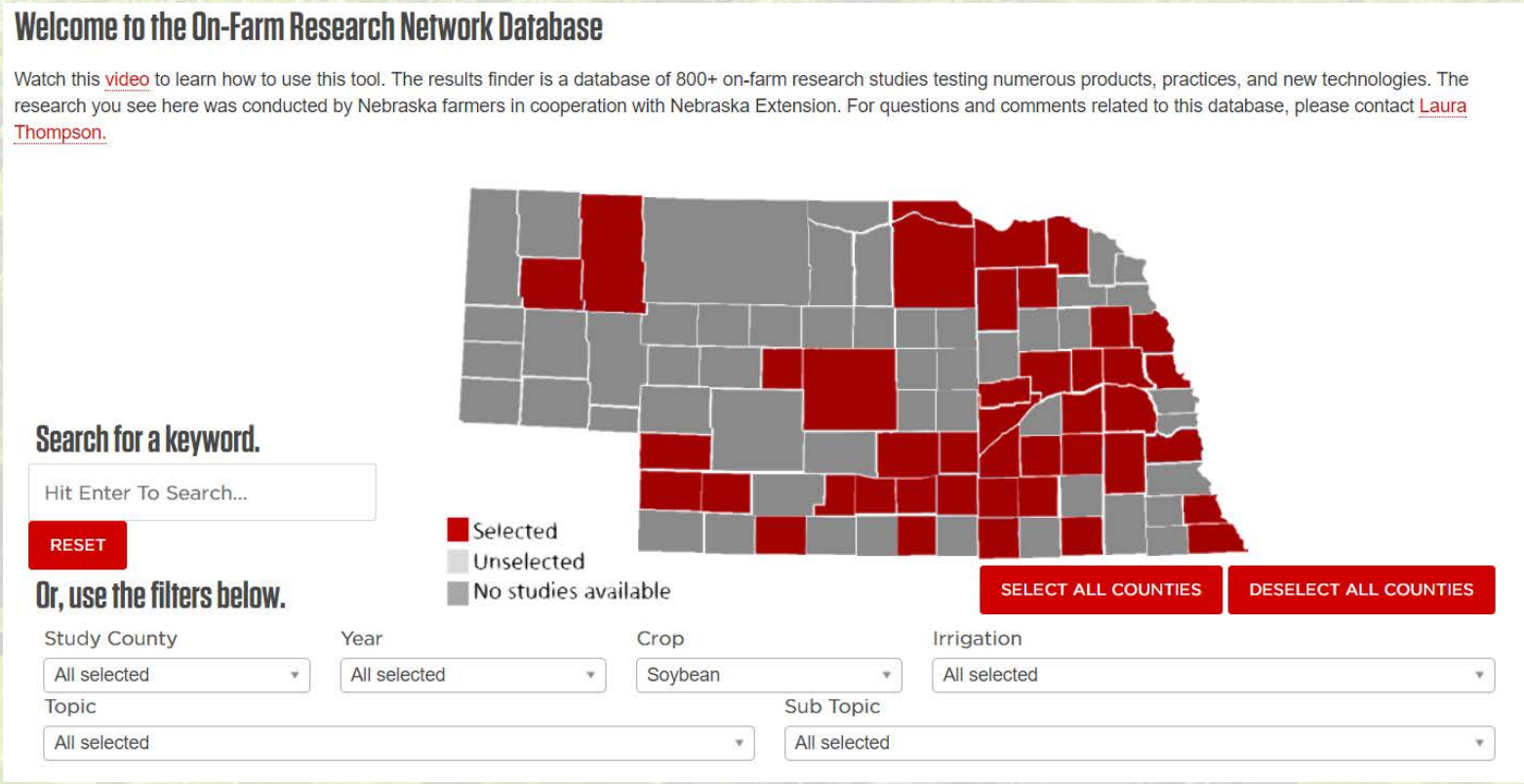
# Step 1: On Farm Research Experiments

- Decide what issue you're looking at for experimentation…do some homework on what's been done
- Remember, that the most year-to-year persistent issues are likely to show positive results if a treatment/solution exists to test

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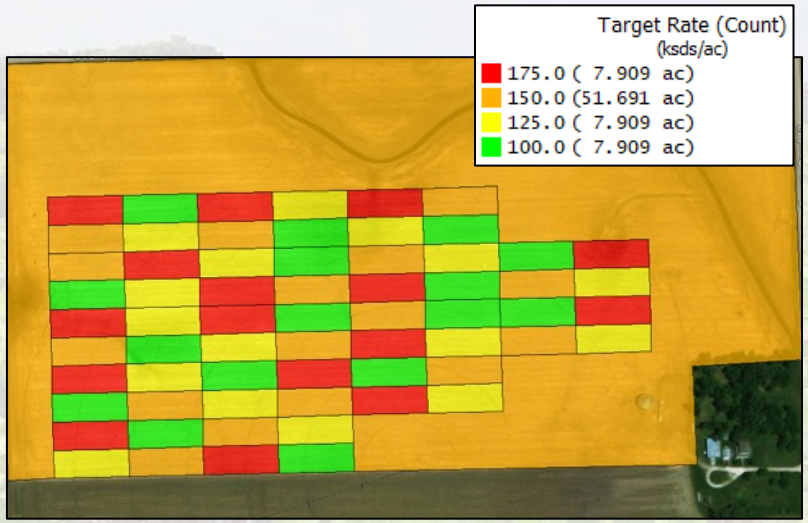
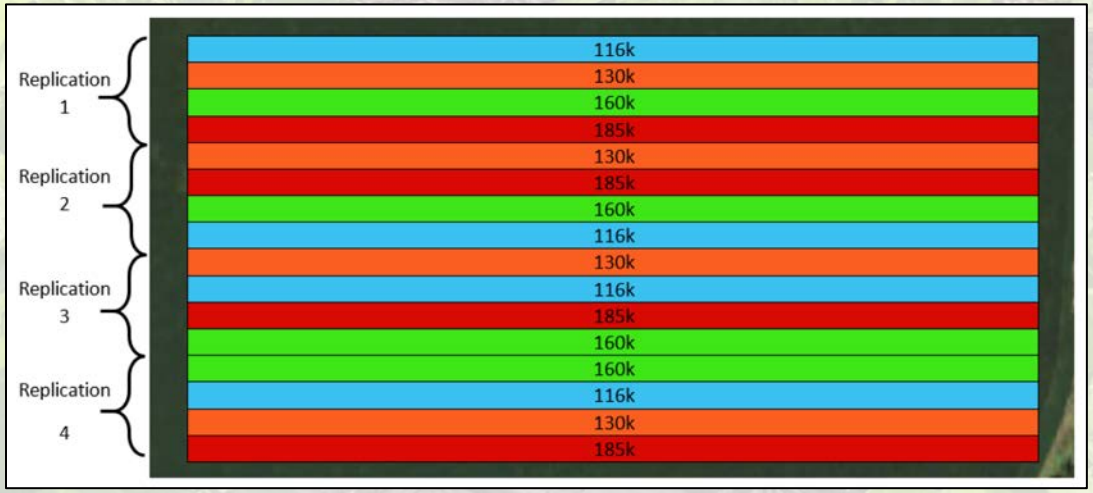
# Step 2: Experiment Setup and Design

- Design field trials must with replicated and randomized treatments organized into blocks…don't forget check strips
- Rates changes should span a wide enough range to ensure equipment can control rates at each level and a crop response can be noted
- Consider applicator/planter widths and harvester widths
- The amount of data collected (or area for each treatment) should be similar across all treatments
- Resources for learning these techniques are available at: https://cropwatch.unl.edu/on-farm-research

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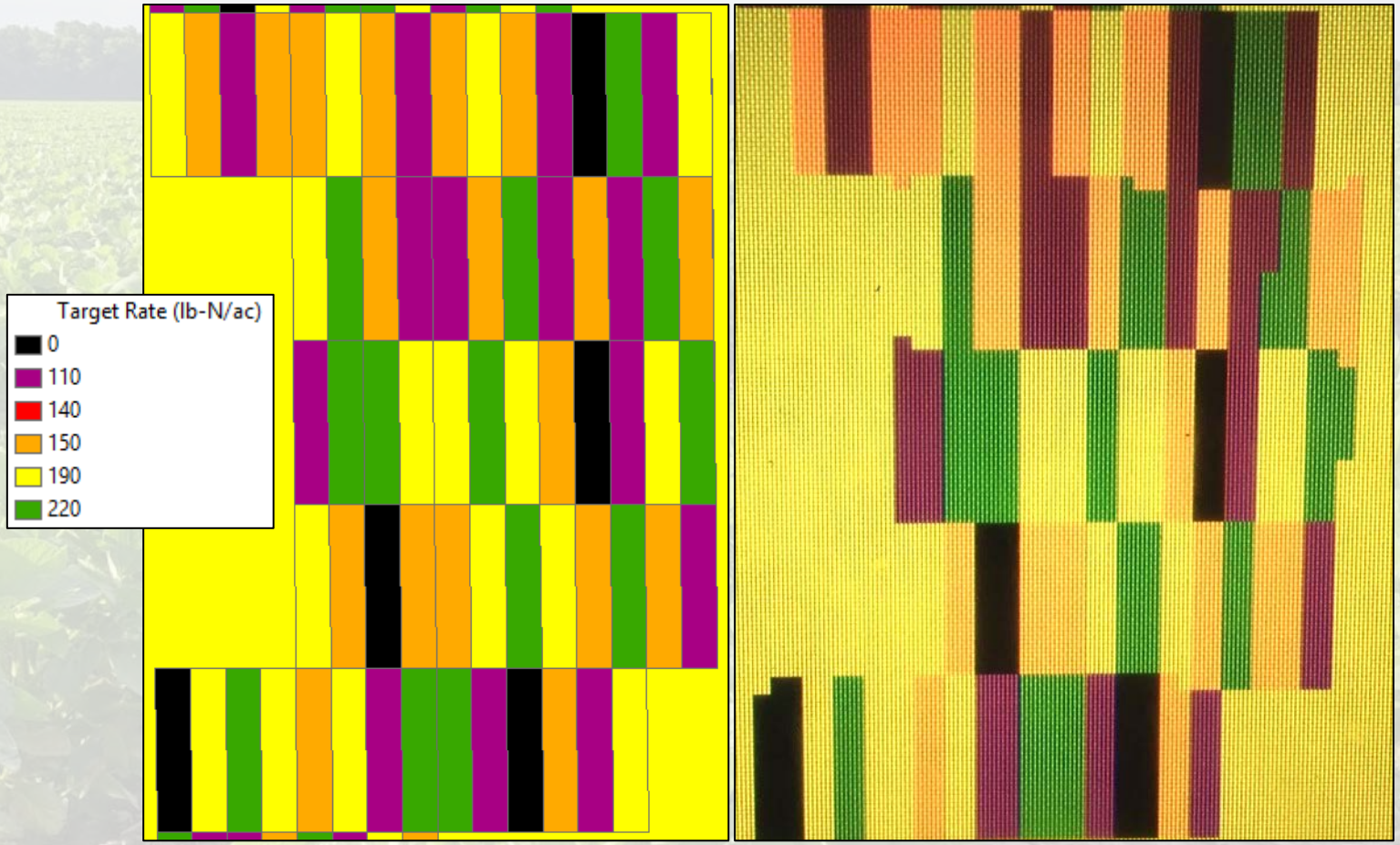
# Step 2: Experiment Setup and Design

- Trust but verify prescription (Rx) maps:

After upload to in-cab monitor…plot locations/sizes changed:

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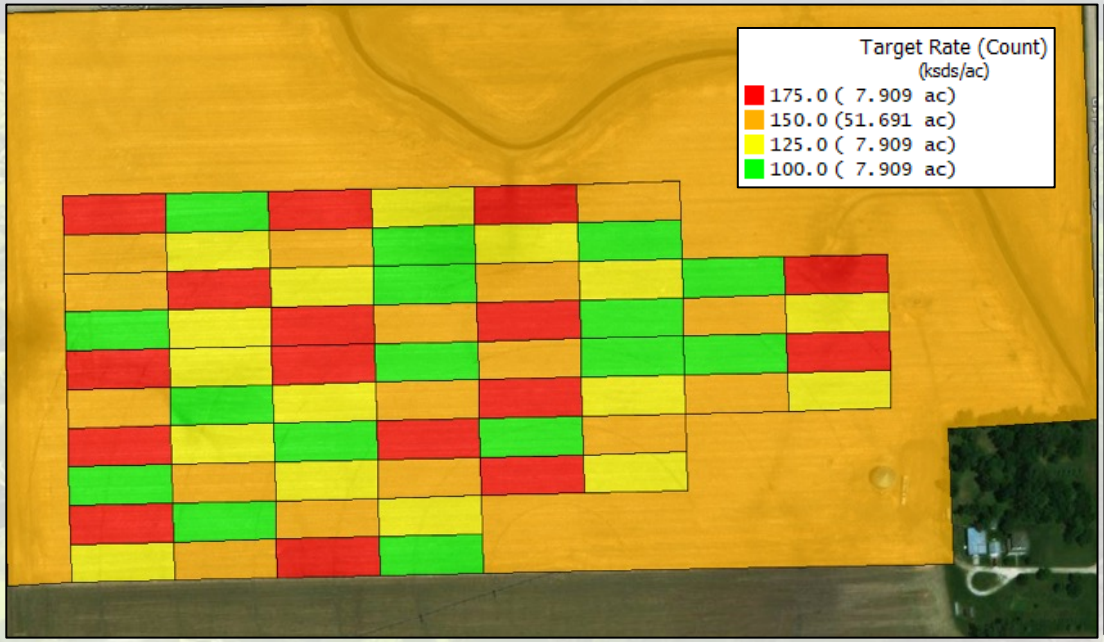
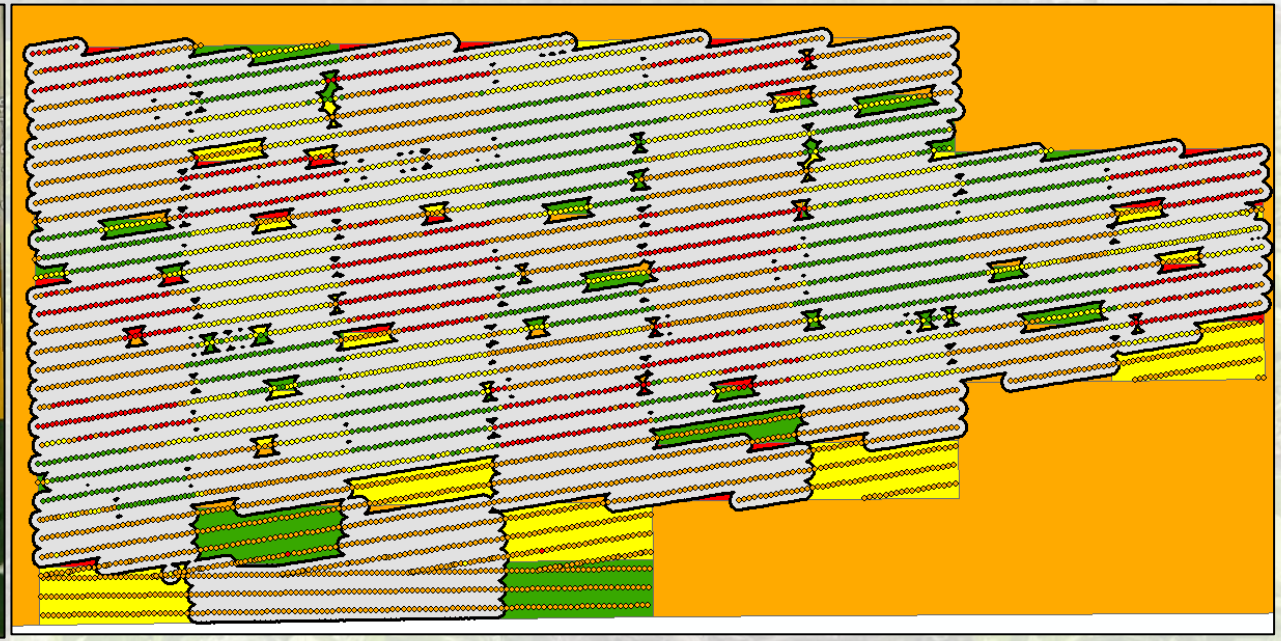
# Step 3: Data Collection

- Collect as much data as is feasible/possible
- As-applied data

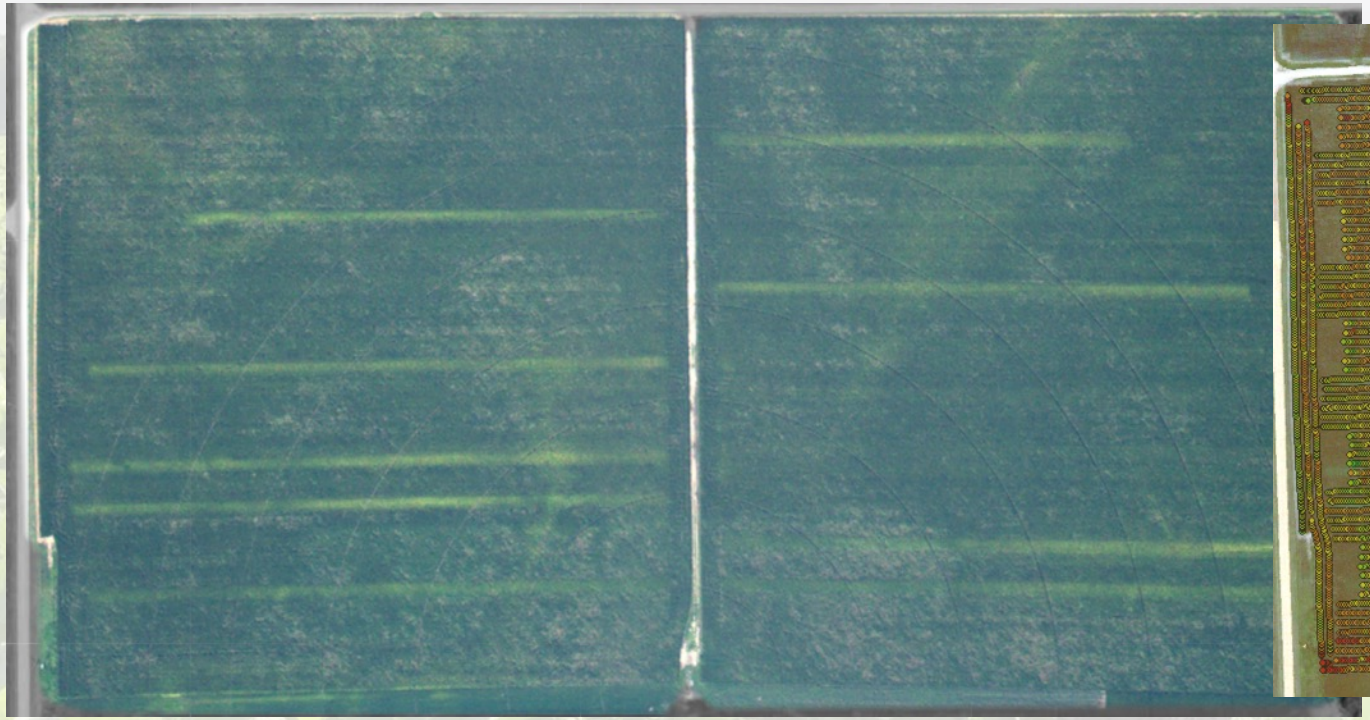


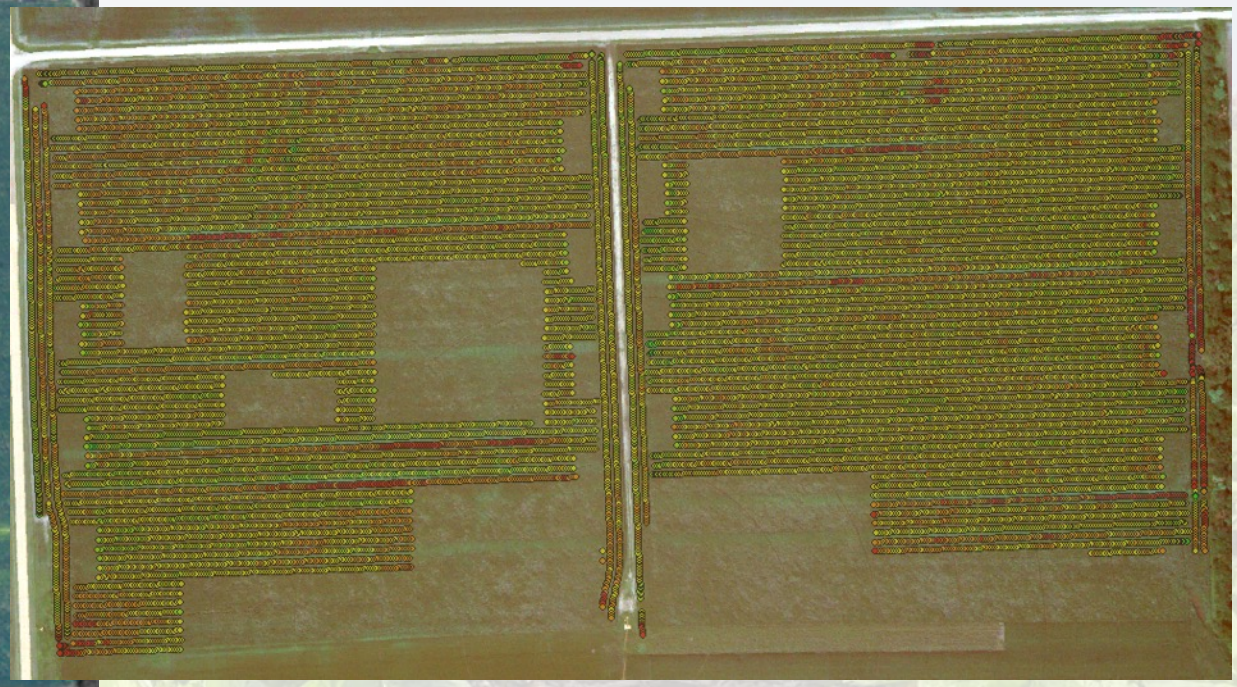



Locations in grey show where as-applied planting data matched target rates +/- 10%

# Step 3: Data Collection

- In-season scouting/imagery





Locations where severe wind damage affected crop stand

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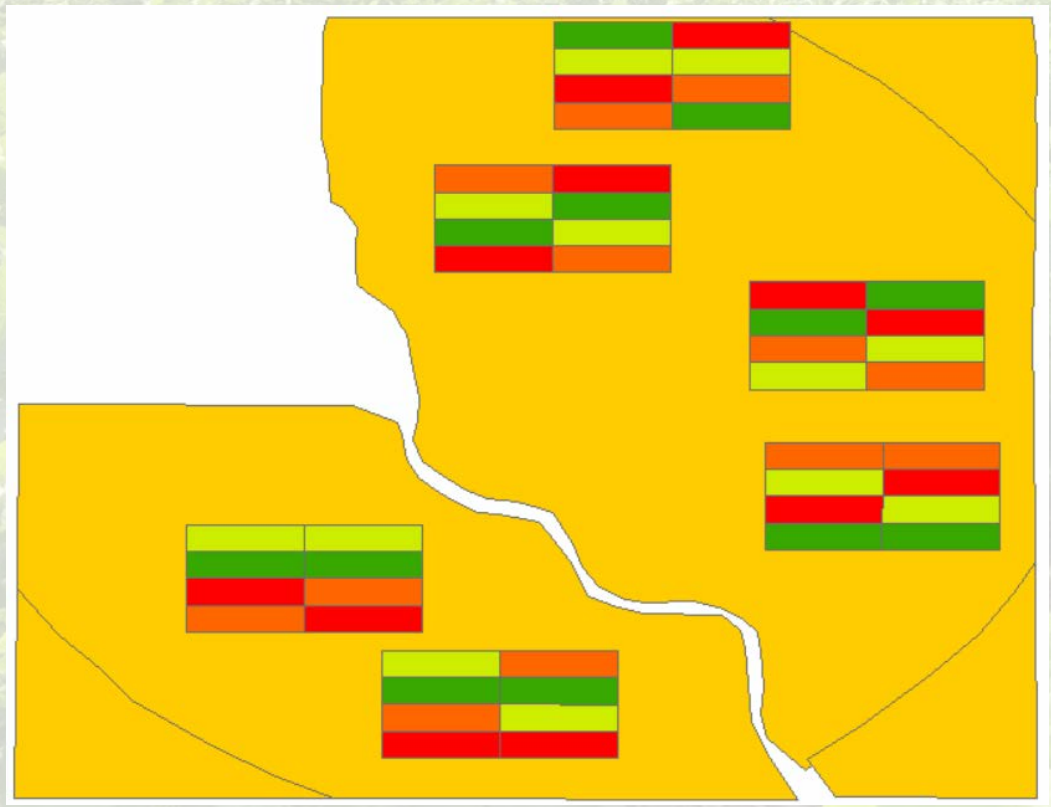
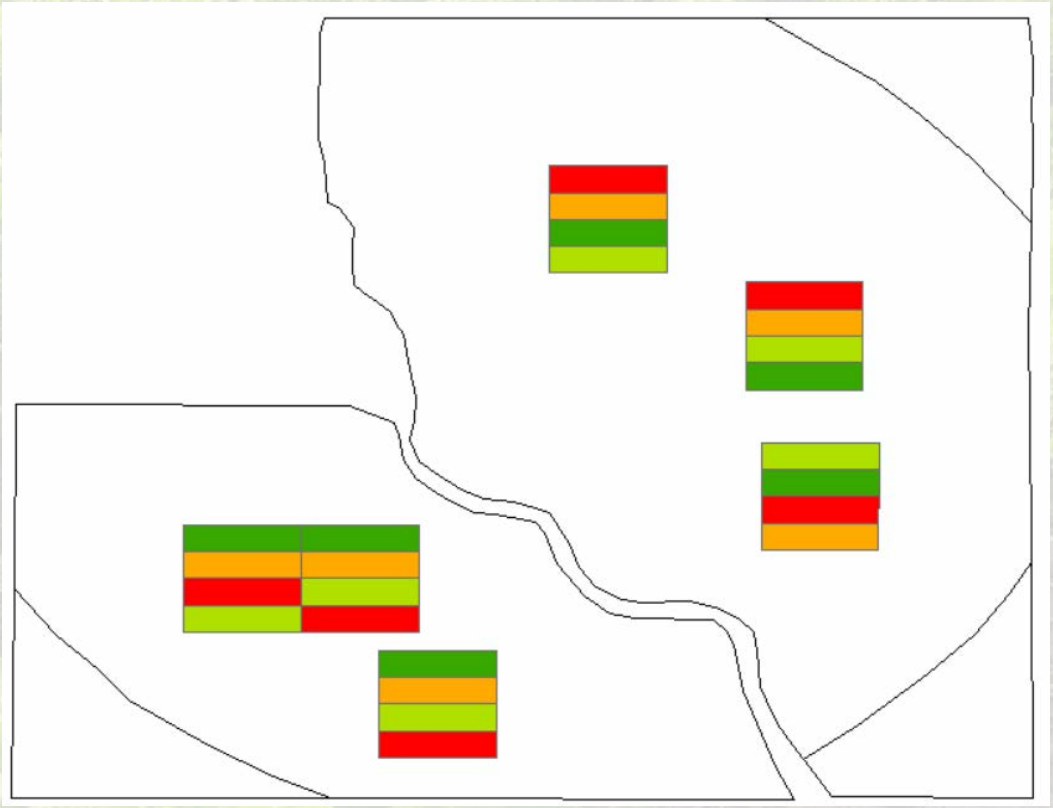
# Digital In-season Scouting Data

- Scouting Apps can tie field reports directly to test trials…SMS Mobile is an example of such an app

Create Field Trials



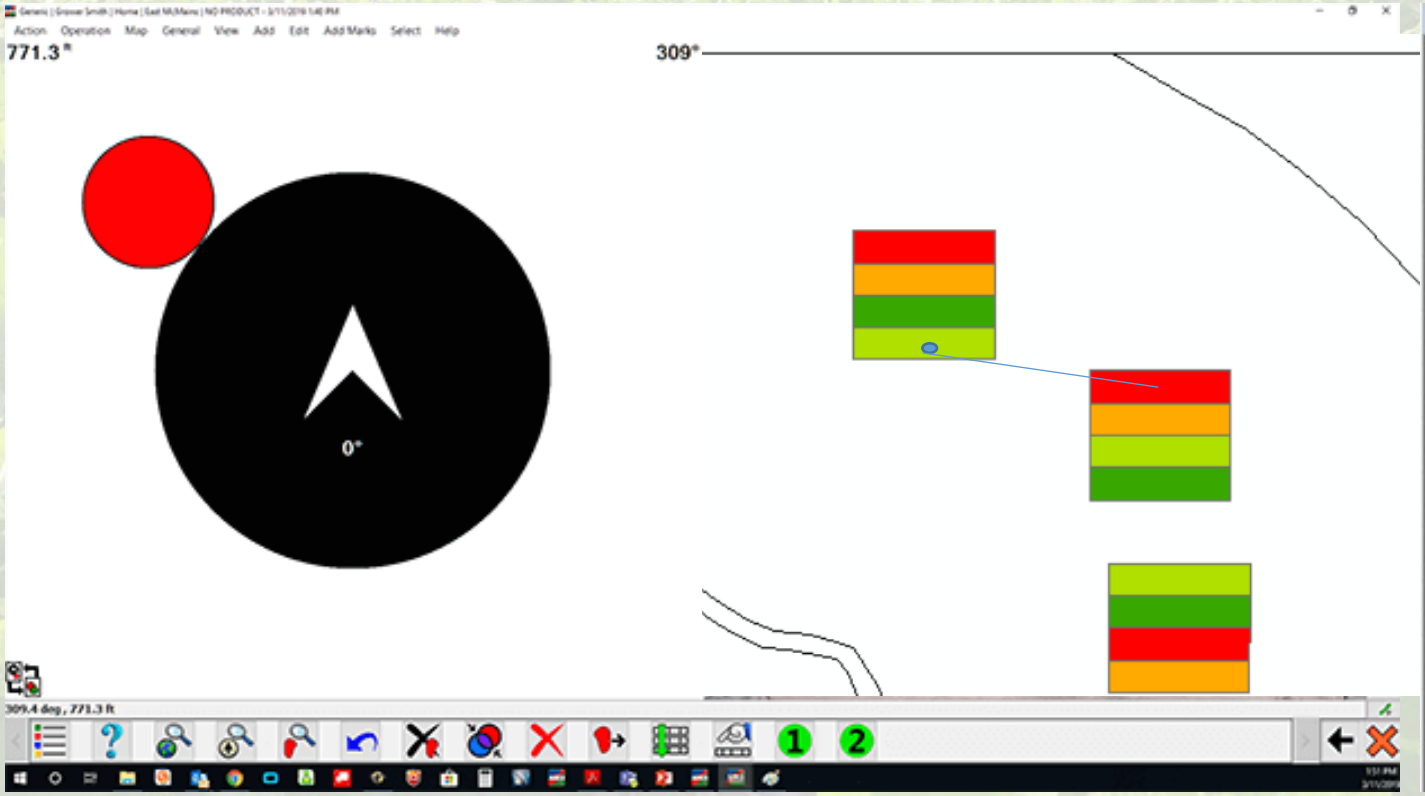
Identify Plots for Scouting



# Digital In-season Scouting Data

- The app direct you to each plot identified in your .shp scouting file
- Entries are recorded and tied to each treatment block

Direct & Distance are provided




Data is saved in the attribute table for later analysis

Batie_PreH_Scout1_SBRx_19Merge

| Crop_Stage | Crop_Hght_ | Crop_Cond | Plant_Pop_ | Crop_Damge | Rescout | Rescout_Da | Commer |
|---|---|---|---|---|---|---|---|
| VC - Cotyledon | 0 | Unknown | 86 | None | No | 6/27/2019 | |
| VC - Cotyledon | 0 | Unknown | 64 | None | No | 6/27/2019 | |
| VC - Cotyledon | 0 | Unknown | 138 | None | No | 6/27/2019 | |
| VC - Cotyledon | 0 | Unknown | 108 | None | No | 6/27/2019 | |
| VC - Cotyledon | 0 | Unknown | 84 | None | No | 6/27/2019 | |
| VC - Cotyledon | 0 | Unknown | 62 | None | No | 6/27/2019 | |
| VC - Cotyledon | 0 | Unknown | 108 | None | No | 6/27/2019 | |
| VC - Cotyledon | 0 | Unknown | 134 | None | No | 6/27/2019 | |
| None | 0 | Unknown | 0 | None | No | 6/27/2019 | |
| None | 0 | Unknown | 0 | None | No | 6/27/2019 | |
| None | 0 | Unknown | 0 | None | No | 6/27/2019 | |
| None | 0 | Unknown | 0 | None | No | 6/27/2019 | |
| None | 0 | Unknown | 0 | None | No | 6/27/2019 | |
| None | 0 | Unknown | 0 | None | No | 6/27/2019 | |
| None | 0 | Unknown | 0 | None | No | 6/27/2019 | |
| None | 0 | Unknown | 0 | None | No | 6/27/2019 | |
| VC - Cotyledon | 0 | Unknown | 140 | None | No | 6/27/2019 | |
| None | 0 | Unknown | 0 | None | No | 6/27/2019 | |
| VC - Cotyledon | 0 | Unknown | 66 | None | No | 6/27/2019 | |
| VC - Cotyledon | 0 | Unknown | 98 | None | No | 6/27/2019 | |
| None | 0 | Unknown | 0 | None | No | 6/27/2019 | |
| None | 0 | Unknown | 0 | None | No | 6/27/2019 | |
| None | 0 | Unknown | 0 | None | No | 6/27/2019 | |
| VC - Cotyledon | 0 | Unknown | 128 | None | No | 6/27/2019 | |
| VC - Cotyledon | 0 | Unknown | 68 | None | No | 6/27/2019 | |

# Digital In-season Scouting Data

- Tying these data to our in-field trials will help with future questions…pest pressure, disease, etc…until more robust imagery tools are available
- We will use the emergence counts to compare to intended and as-applied rates to ensure trial quality

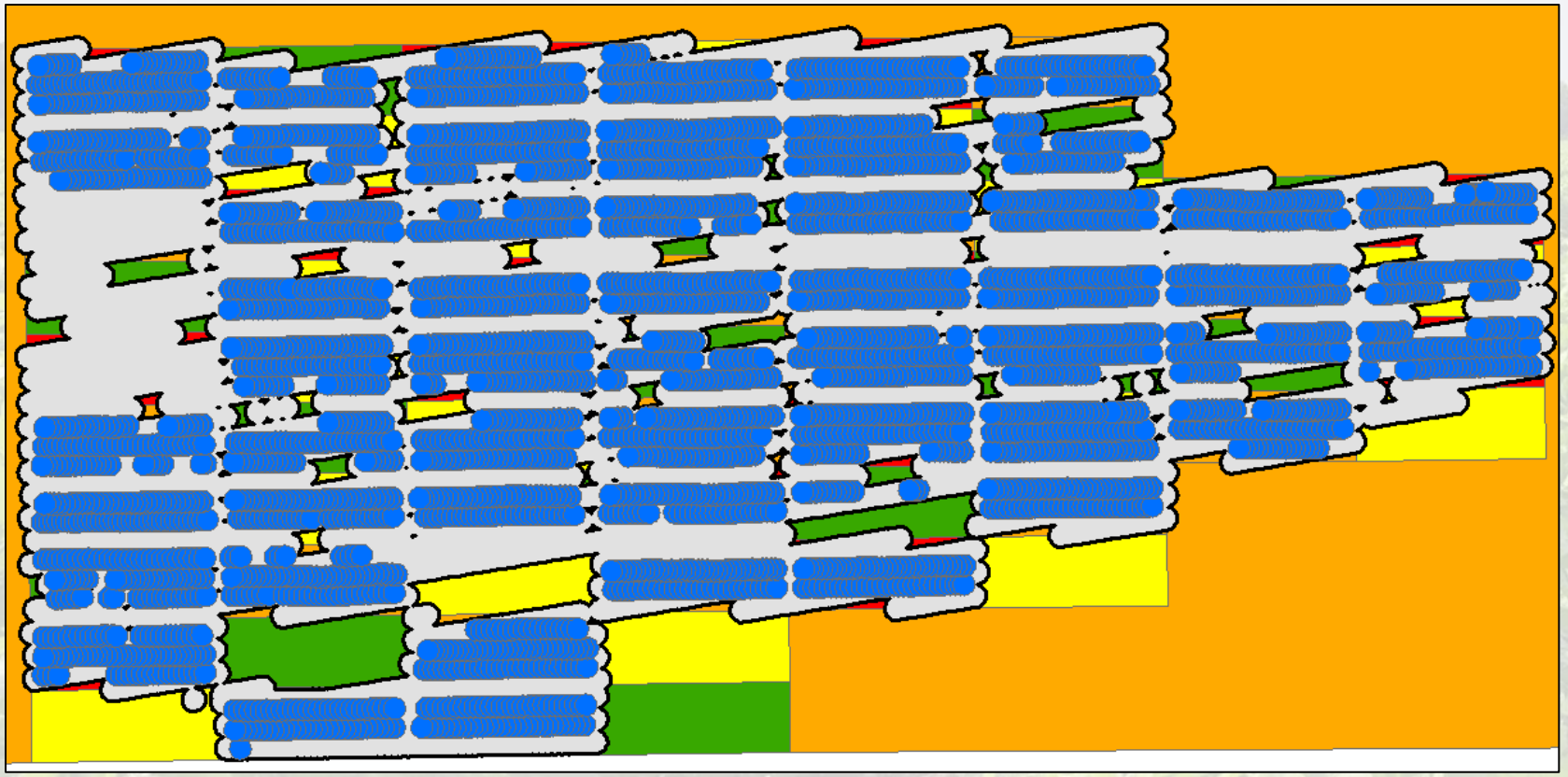
| Crop_Stage | Crop_Hght_ | Crop_Cond | Plant_Pop_ | Crop_Damge | Rescout | Rescout_Da | Comment | Elevation_ | Obsrv_ID | Date | Treatment | Tgt_Rate_s | Block_Name | Plot_Name | Population | Pop2 | StemBorer | StemBc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VC - Cotyledon | 0 | Unknown | 70 | None | No | 6/27/2019 | | 0 | 48 | 6/27/2019 | | 0 | | | 0 | 0 | 0 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 2 | 110000 | | D1S | 119 | 118 | 0 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 1 | 80000 | | D2S | 55 | 57 | 1 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 4 | 170000 | | D3S | 84 | 97 | 2 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 3 | 140000 | | D4S | 119 | 122 | 0 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 2 | 110000 | | D5S | 128 | 124 | 2 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 1 | 80000 | | D6S | 53 | 63 | 0 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 3 | 140000 | | D7S | 101 | 94 | 1 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 4 | 170000 | | D8S | 83 | 80 | 3 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 4 | 170000 | | A1N | 98 | 92 | 0 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 1 | 80000 | | A2N | 88 | 90 | 3 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 2 | 110000 | | A3N | 120 | 126 | 0 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 3 | 140000 | | A4N | 84 | 71 | 2 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 2 | 110000 | | B4N | 91 | 95 | 2 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 3 | 140000 | | B3N | 70 | 75 | 0 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 4 | 170000 | | B1N | 126 | 114 | 2 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 1 | 80000 | | B2N | 103 | 97 | 1 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 3 | 140000 | 1 | C1N | 89 | 84 | 2 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 4 | 170000 | 1 | C3N | 55 | 59 | 0 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 2 | 110000 | 1 | C2N | 96 | 101 | 0 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 1 | 80000 | 1 | C4N | 116 | 112 | 2 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 3 | 140000 | | E3S | 68 | 86 | 3 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 4 | 170000 | | E4S | 78 | 71 | 1 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 2 | 110000 | | E1S | 107 | 103 | 1 | |
| | 0 | | 0 | | | 12:00:00 AM | | 0 | 0 | 12:00:00 AM | 1 | 80000 | | E2S | 104 | 102 | 1 | |

# Step 3: Other data to collect?

- Georeferenced emergence stand counts/stalk counts at harvest
- In-field georeferenced crop scouting (typical) throughout the growing season for diseases/pests
- Aerial imagery (when feasible) can provide insights/locations of where other factors may have impacted crop performance

# Step 3: Data Collection

- Yield monitor data



Locations in blue show where yield data were harvested within appropriately planted areas

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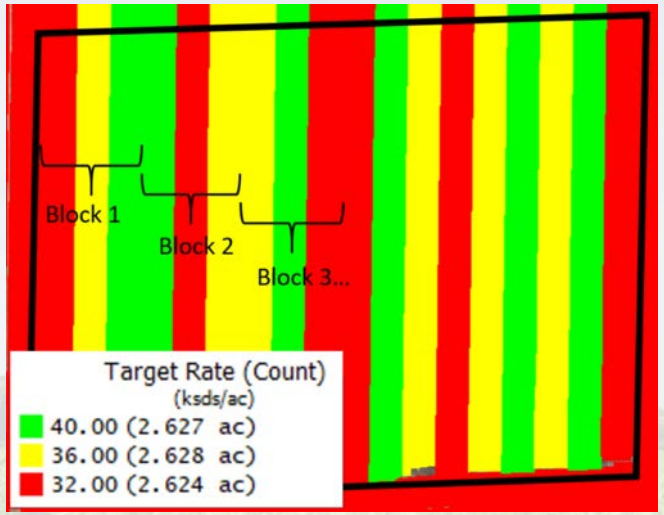
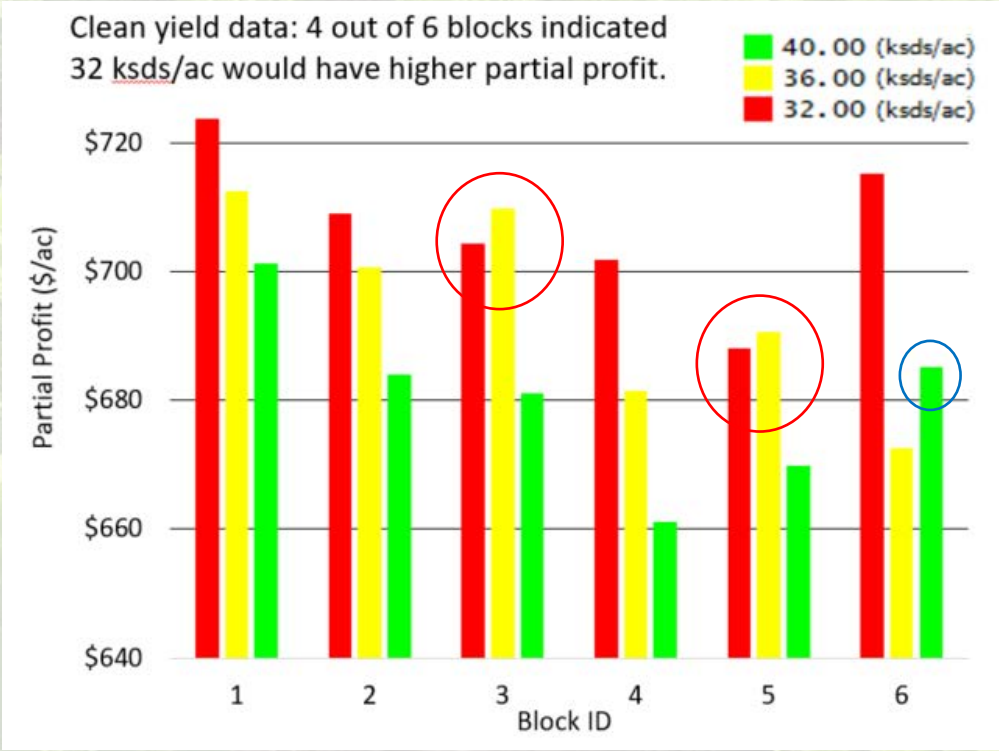
# Step 4: Data Analysis/Decisions

- Yield monitor data cleaning/post-processing for error removal
- Statistical analysis for differences observed (yield, moisture, economics)




| | Raw Yield Data | | | Clean Yield Data | | |
|---|---|---|---|---|---|---|
| Target Seed Population | Avg. Yield (bu/ac) | Avg. Yield St. Dev. (bu/ac) | Partial Profit ($/ac) | Avg. Yield (bu/ac) | Avg. Yield St. Dev. (bu/ac) | Partial Profit ($/ac) |
| 32K | 237 | 27 | 690$^{A}$ | 241 | 18 | 707$^{A}$ |
| 36K | 242 | 30 | 691$^{A}$ | 243 | 20 | 695$^{B}$ |
| 40K | 239 | 34 | 663$^{B}$ | 244 | 18 | 680$^{C}$ |

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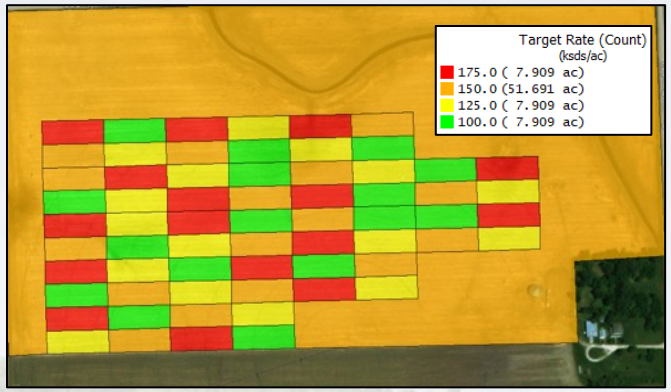
# Step 4: Data Analysis/Decisions




- Number of field trial blocks (and treatments) is important for averaging out blocks that may be outliers
- How many blocks were not representative of the average?
- How many did the highest rate represent the highest MNR?

| | Moisture (%) | Yield† (bu/ac) | Marginal Net Return‡ ($/ac) |
|---|---|---|---|
| 100,000 seeds/acre | 10.8 A* | 65 A | 441.78 A |
| 125,000 seeds/acre | 10.8 A | 64 AB | 425.51 A |
| 150,000 seeds/acre | 10.9 A | 62 B | 398.85 B |
| 175,000 seeds/acre | 10.9 A | 63 AB | 395.54 B |
| P-Value | 0.612 | 0.067 | 0.0001 |

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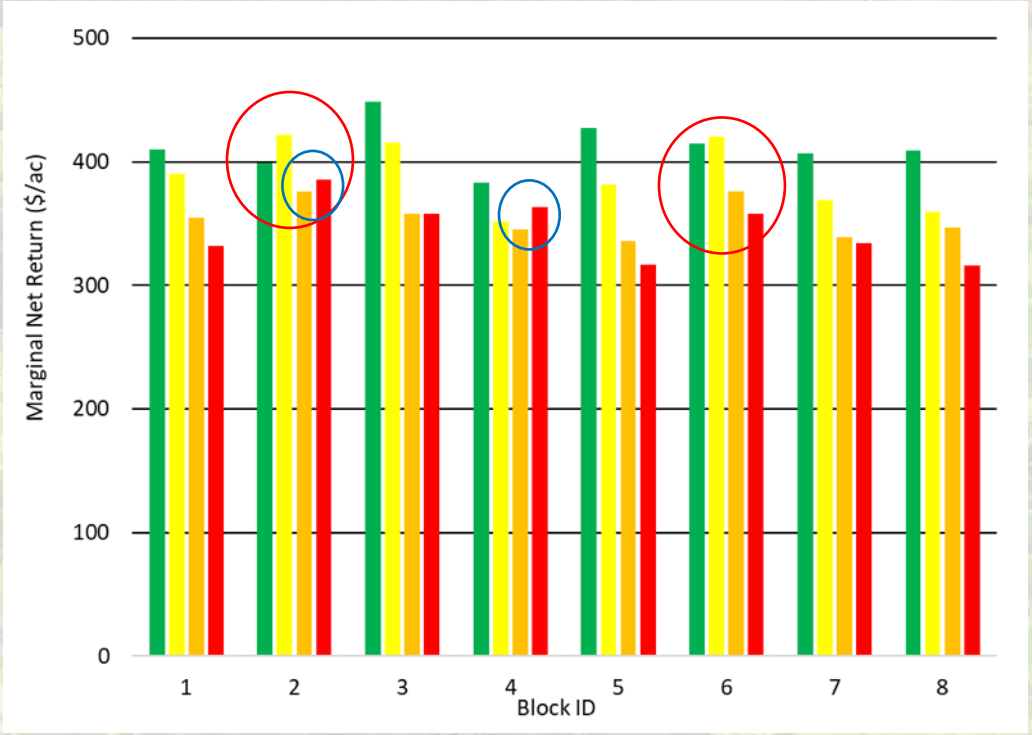
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $7.40/bu soybean and $55/unit of soybean seed.

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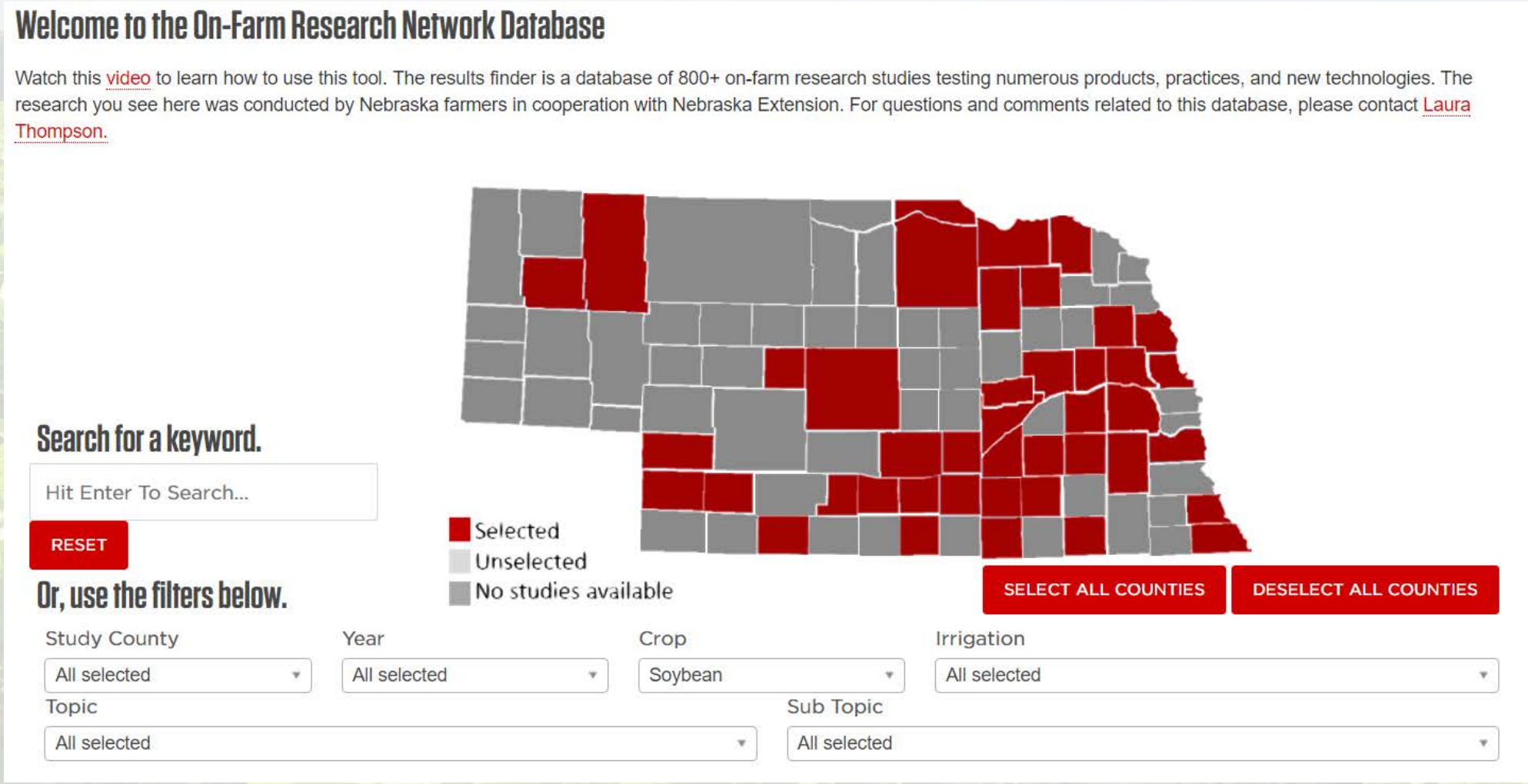
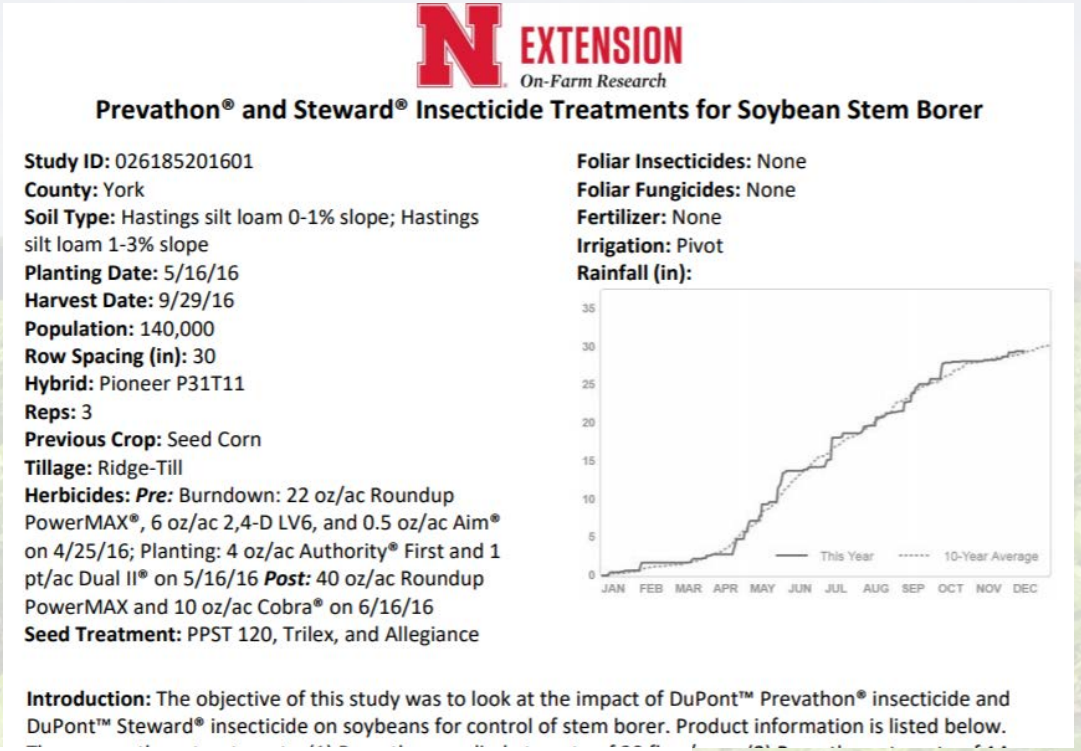
# NE Extension On-Farm Research Database

- The online database can allow for searches based on different filters



# NE Extension On-Farm Research Database

- Entries data back to the early 1990s
- Reports share as much information as possible regarding background of field site and how the study was conducted
- This level of information is critical for understanding the study and those wanting to compare their own data for benchmarking!



EXTENSION
On-Farm Research

**Prevathon® and Steward® Insecticide Treatments for Soybean Stem Borer**

**Study ID:** 026185201601
**County:** York
**Soil Type:** Hastings silt loam 0-1% slope; Hastings silt loam 1-3% slope
**Planting Date:** 5/16/16
**Harvest Date:** 9/29/16
**Population:** 140,000
**Row Spacing (in):** 30
**Hybrid:** Pioneer P31T11
**Reps:** 3
**Previous Crop:** Seed Corn
**Tillage:** Ridge-Till
**Herbicides:** ***Pre:*** Burndown: 22 oz/ac Roundup PowerMAX®, 6 oz/ac 2,4-D LV6, and 0.5 oz/ac Aim® on 4/25/16; Planting: 4 oz/ac Authority® First and 1 pt/ac Dual II® on 5/16/16 ***Post:*** 40 oz/ac Roundup PowerMAX and 10 oz/ac Cobra® on 6/16/16
**Seed Treatment:** PPST 120, Trilex, and Allegiance

**Foliar Insecticides:** None
**Foliar Fungicides:** None
**Fertilizer:** None
**Irrigation:** Pivot
**Rainfall (in):**



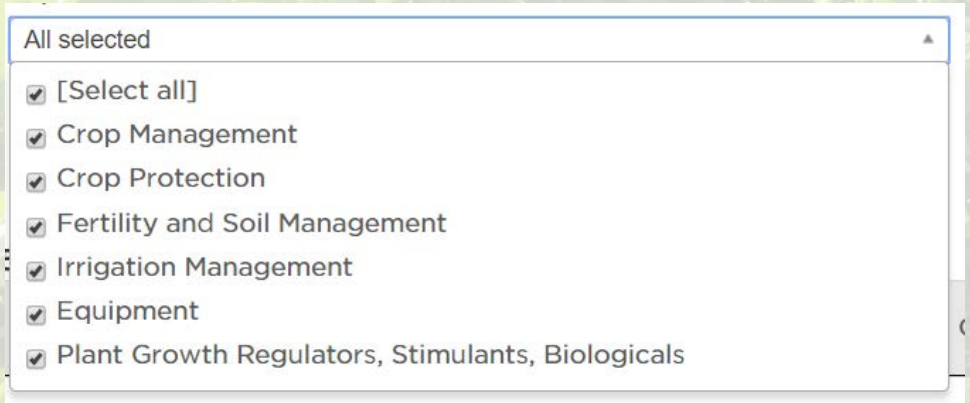
**Introduction:** The objective of this study was to look at the impact of DuPont™ Prevathon® insecticide and DuPont™ Steward® insecticide on soybeans for control of stem borer. Product information is listed below.

Showing 1 to 25 of 28 entries

| YEAR | COMPARISON | COUNTY | IRRIGATED | CROP | TOPIC | STUDY PDF |
|---|---|---|---|---|---|---|
| 1990 | Post-emergence vs Pre-plant incorporated Herbicide Program 044155199001 | Saunders | Irrigated | Soybean | **Crop Protection:** Weed management | View Study |
| 1990 | Post-emergence vs Pre-plant incorporated Herbicide Program 113155199001 | Saunders | Irrigated | Soybean | **Crop Protection:** Weed management | View Study |
| 1991 | Pre-emergence and Post-emergence vs Pre-plant incorporated Herbicide Program 044155199101 | Saunders | Irrigated | Soybean | **Crop Protection:** Weed management | View Study |
| 1991 | Pre-emergence and Post-emergence vs Pre-plant incorporated Herbicide Program 113155199101 | Saunders | Irrigated | Soybean | **Crop Protection:** Weed management | View Study |
| 1992 | Post-emergence vs Pre-plant incorporated Herbicide Program 044155199201 | Saunders | Irrigated | Soybean | **Crop Protection:** Weed management | View Study |

# NE Extension On-Farm Research Database

- Most recently, soybean seeding rate studies have been of major interest for those trying to determine most economical rates
- Since 1990, 295 studies have been accomplished with cooperating producers and published online for soybeans alone!
- Irrigated & non-irrigated conditions with a variety of production systems topics:




**Introduction:** Previous on-farm research has demonstrated that planting rates of 80,000 to 120,000 seeds/acre generally result in the highest profitability. The purpose of this study was to determine the most profitable soybean seeding rate. The populations chosen in this study are common to growers in the area. Soybeans were drilled in 10" rows on May 13, 2015.

**Results:**

| | Yield (bu/ac)† | Moisture (%) | Marginal Net Return ($/ac)‡ |
|---|---|---|---|
| 120,000 seeds/acre | 77 A* | 11.7 A | 644.16 |
| 150,000 seeds/acre | 76 AB | 11.6 A | 624.97 |
| 180,000 seeds/acre | 75 B | 11.7 A | 605.79 |
| P-Value | 0.0906 | 0.8206 | N/A |

†Bushels per acre corrected to 13% moisture.
*Values with the same letter are not significantly different at a 90% confidence level.
‡Net Return based on $8.90/bu soybeans and $48/unit seed (140,000 seeds/unit).

**Summary:** No yield increase was seen for planting higher than 150,000 seeds/acre. Based on the cost of seed, planting 120,000 seeds per acre rate maximized net returns.

# Parting thoughts…

- Consider best management practices in on-farm research as you plan such studies to get the best information possible (randomized, replicated test strips with check strips (if applicable)
- As with many applications…the most persistent year-to-year issues will provide the most opportunity for quicker returns when solutions are applied.
- Plan ahead for applicator/planter widths and harvester widths as well as potential field pass directions

# Thank You!

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precisionagriculture.unl.edu

cropwatch.unl.edu/on-farm-research

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