Cover Crop Research at Louisiana State University

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Agronomist

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Cover Crops – Need a Game Plan

- Cover crops, just like any other crop, must be managed so they can accomplish your reasons for planting them.

- What goal you would like to accomplish by using a cover crop?
  - Erosion control
  - Nutrient cycling
  - Increase organic matter
  - Biomass production for weed suppression

- Once the goal is identified then you can implement a game plan to manage the cover crop accordingly.

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Some Concerns with Cover Crops

- Terminating cover crops and winter vegetation in the spring.
  - Producers have had issues terminating some cover crops especially wheat.
  - Glyphosate resistance Italian ryegrass poses another concern.

- When can I terminate cover crops and not reduce yields?
  - Physical competition from dead cover crop.
  - Nutrient availability. Early season P issues??
    - Also, soils could remain a little cooler and retain surface moisture longer than no cover crop fields, all leading to potential early season P deficiency.

- Are some cover crops better than others? Can some cover crops reduce yields?

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Use of Fall Applied Residual Herbicides in Cover Crops

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Use of Fall Applied Residual Herbicides in Cover Crops

- 4 cover crops were evaluated:
  - Cereal rye (120 lb/a)
  - Tillage Radish (8 lb/a)
  - Crimson Clover (20 lb/a)
  - Austrian Winter Pea (30 lb/a)
- Herbicides evaluated:
  - Zidua @ 2 oz/a
  - Zidua @ 4 oz/a
- Herbicide Application Timing:
  - 1 Week After Emergence
  - 3 Week After Emergence
- Cover crops planted October 25, 2017 and October 30, 2018

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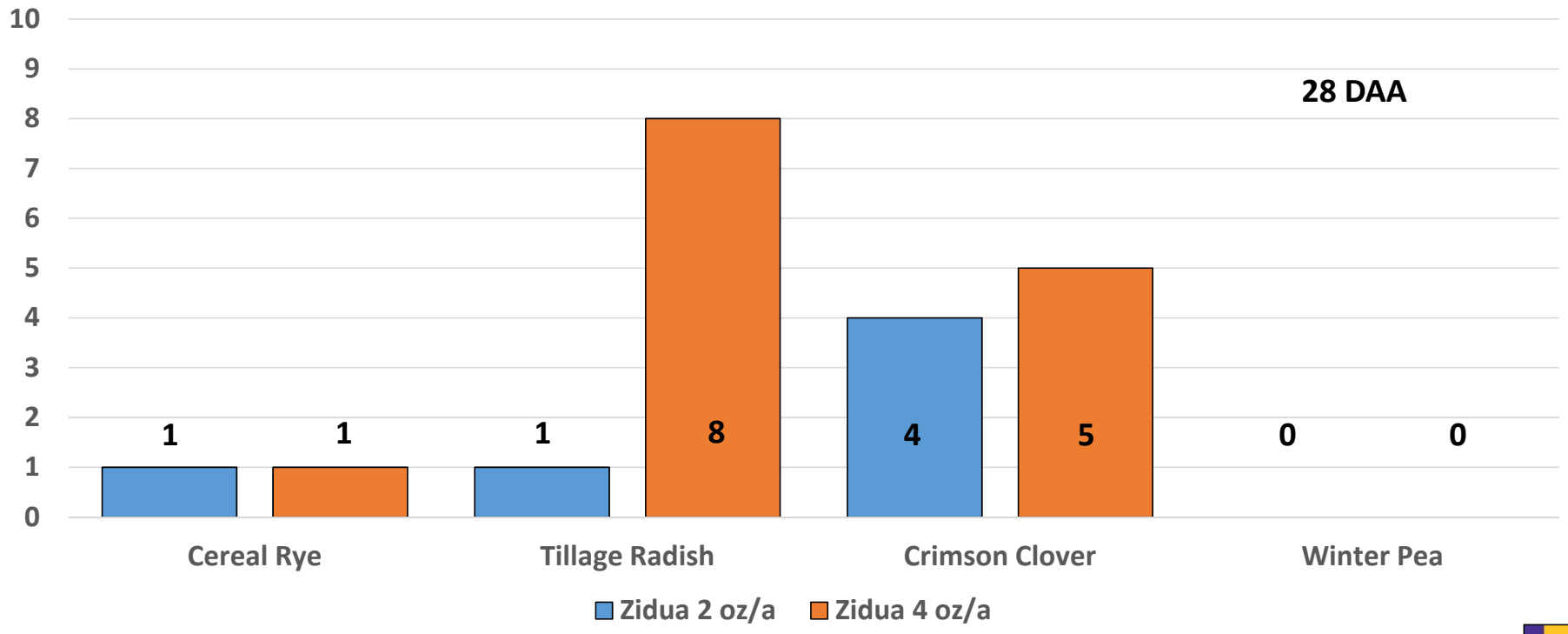
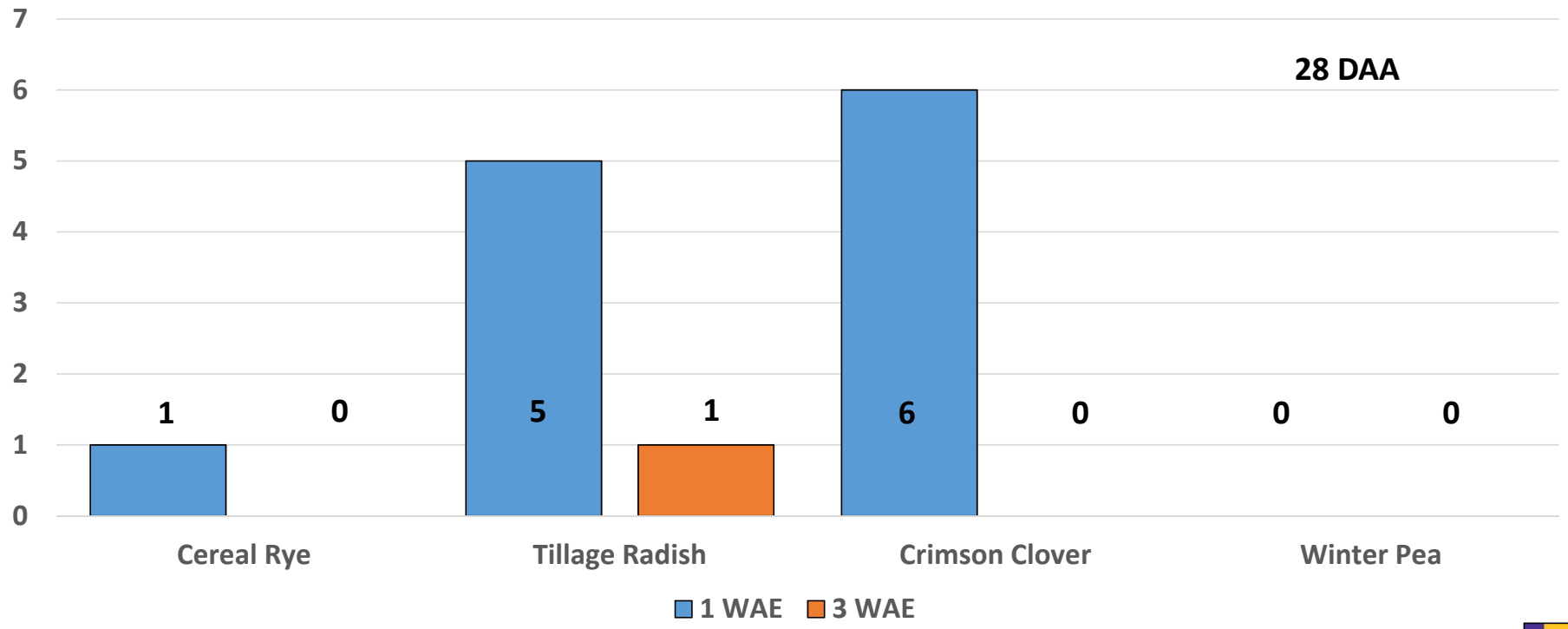
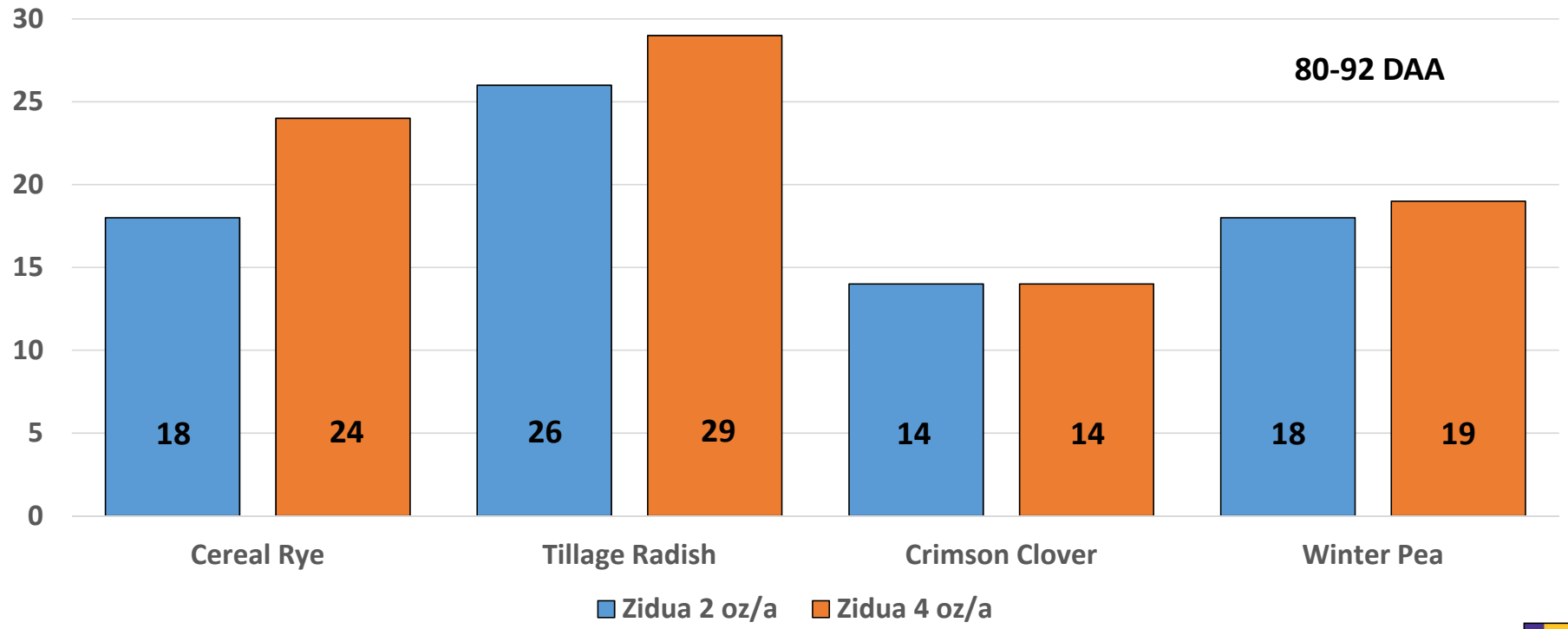
NERS 2018: Cover Crop Injury



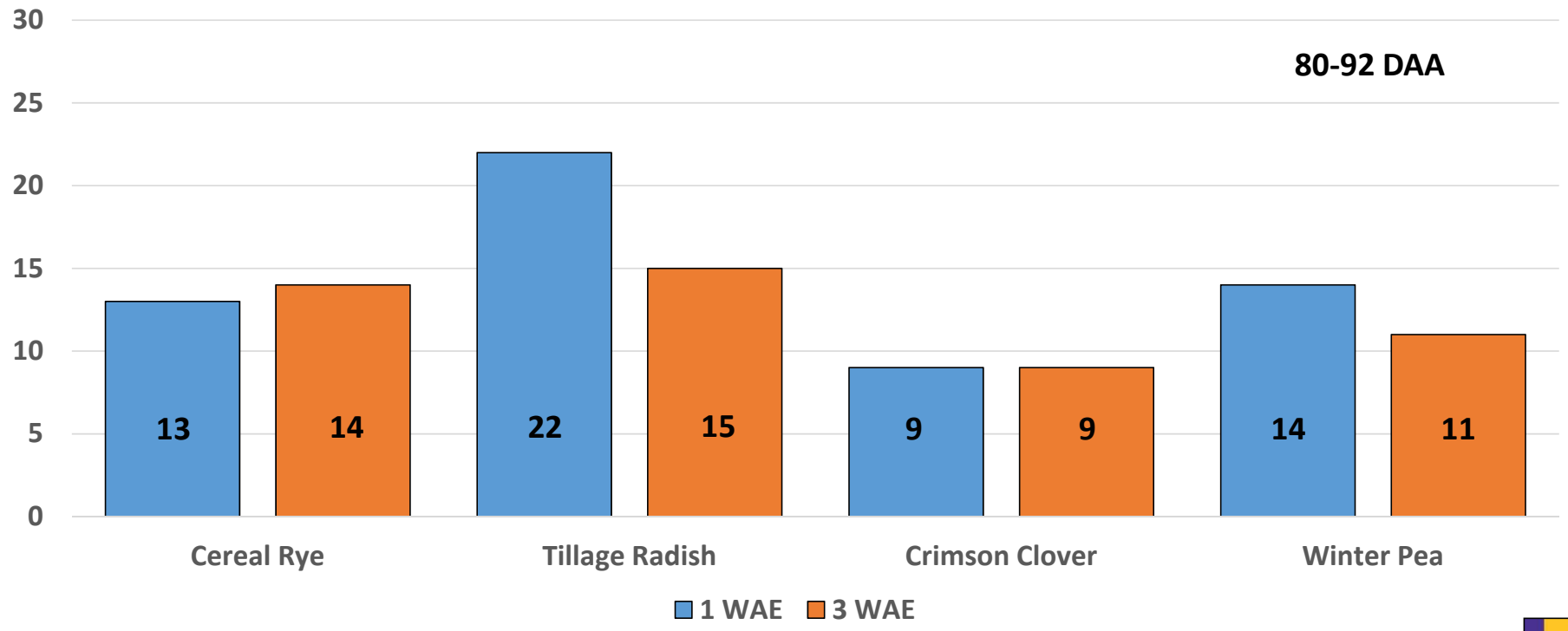
NERS 2018: Cover Crop Injury



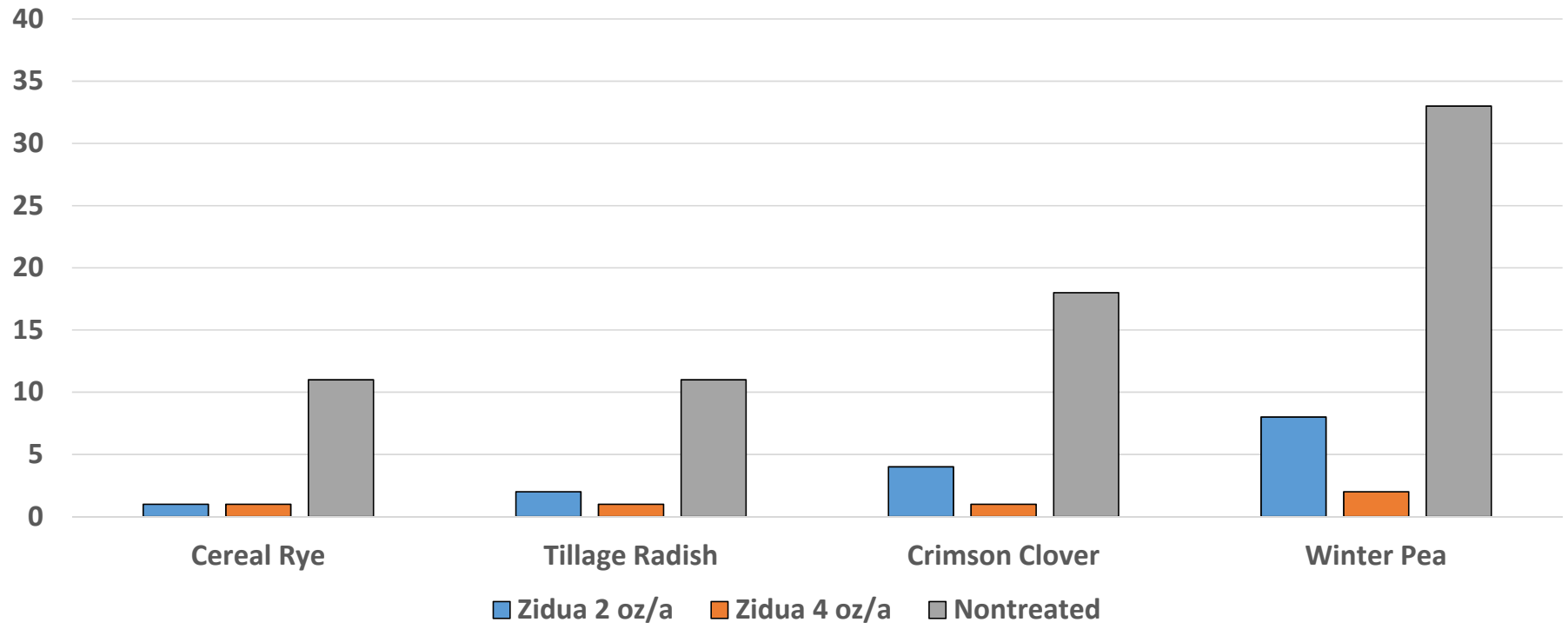
NERS 2019: Cover Crop Injury



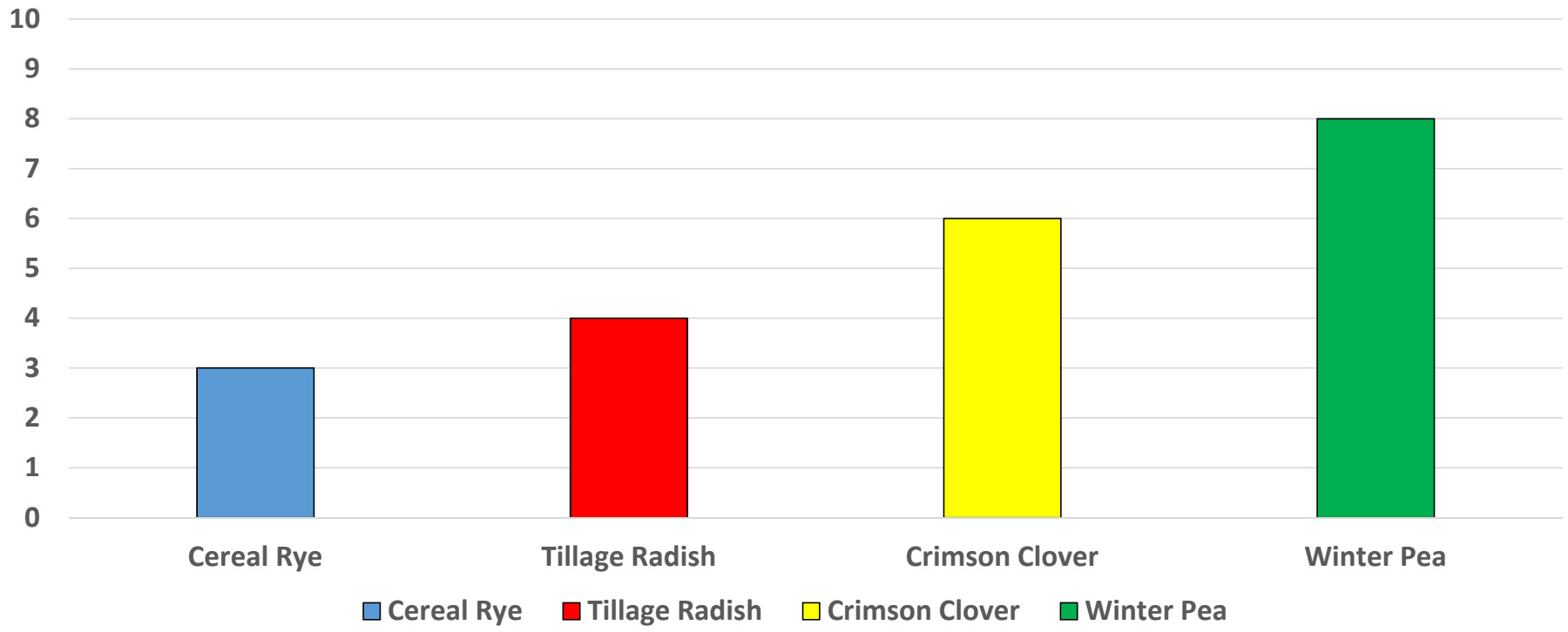
NERS 2019: Cover Crop Injury



NERS 2019 Weed Ground Cover



NERS 2018 Weed Ground Cover



Summary for Cover Crop Injury

2018

- Injury was minimal < 10% for all cover crops.
  - Winter pea was not injured by Zidua.
  - Tillage radish and crimson clover most sensitive to Zidua.
  - 4 oz/a rate tended to be more injurious.
- Injury was minimal at Dean Lee location in 2018 as well.

2019 (fall and winter extremely wet)

- Greater injury than in 2018.
- All cover crops were injured significantly. Injury ranged from 14-29%
- 4 oz/a rate tended to be more injurious.
- Injury was similar between application timings. Except for tillage radish.

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Overall Summary

- If winter weeds are a concern, applying Zidua/chloracetamide applied in the fall may be an option.
- Cereal rye was most competitive with weeds followed by tillage radish.
- Cover crop injury is likely in years with extreme wet weather.
  - Tillage radish was the most sensitive to injury.
- Henbit (≤ 56%) and other broadleaf weed control was not great.
- Bluegrass control was excellent.
- Plant the cover crop as early as possible. Plant into a clean seed bed. Apply Zidua/chloractamide herbicide once the cover crop is well established 1 – 3 week after emergence.

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Cover Crop Effects on Crop Production

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Cover Crop Effects on Crop Production

- Evaluate 8 cover crops in both conventional till and no-till systems in a corn soybean rotation.
  - Cereal rye
  - Black oats
  - Hairy vetch
  - Cereal rye + hairy vetch 70/30 ratio.
    - 70/30 ratio
    - 30/70 ratio
  - Black oats + hairy vetch 70/30 ratio.
    - 70/30 ratio
    - 30/70 ratio
- Examine long-term benefits of cover crops.

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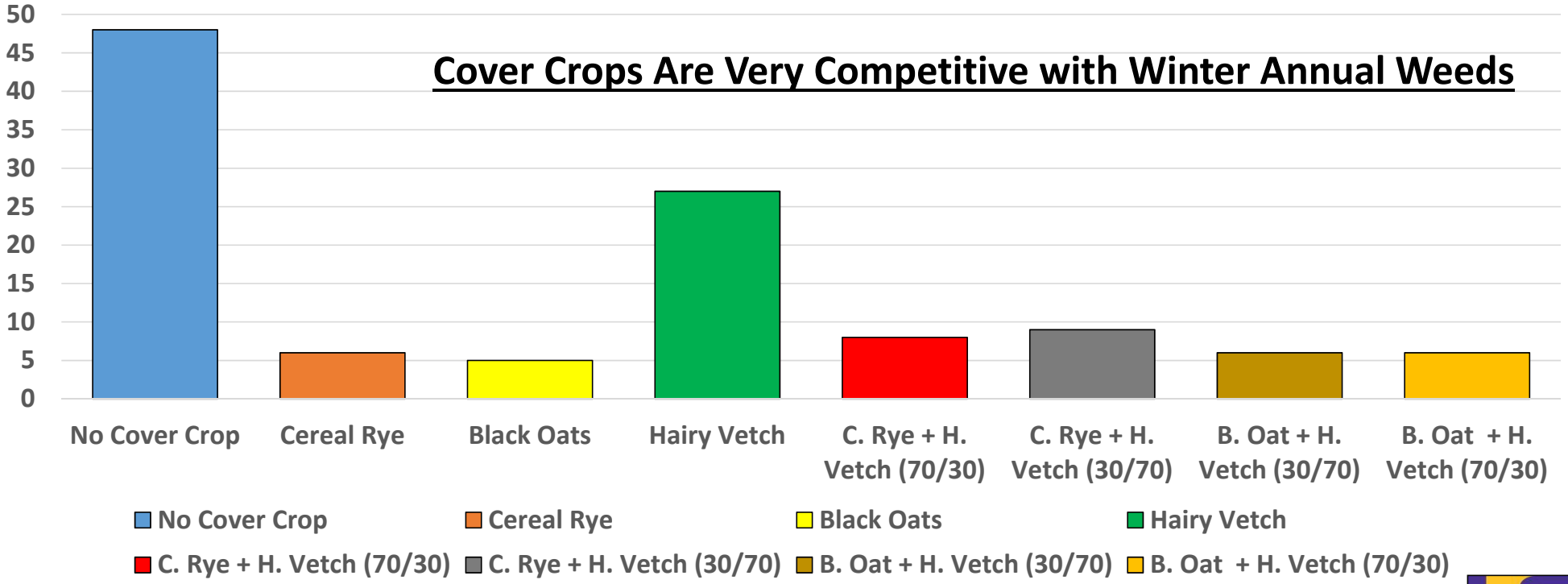
NERS 2018: Winter Weed Ground Cover



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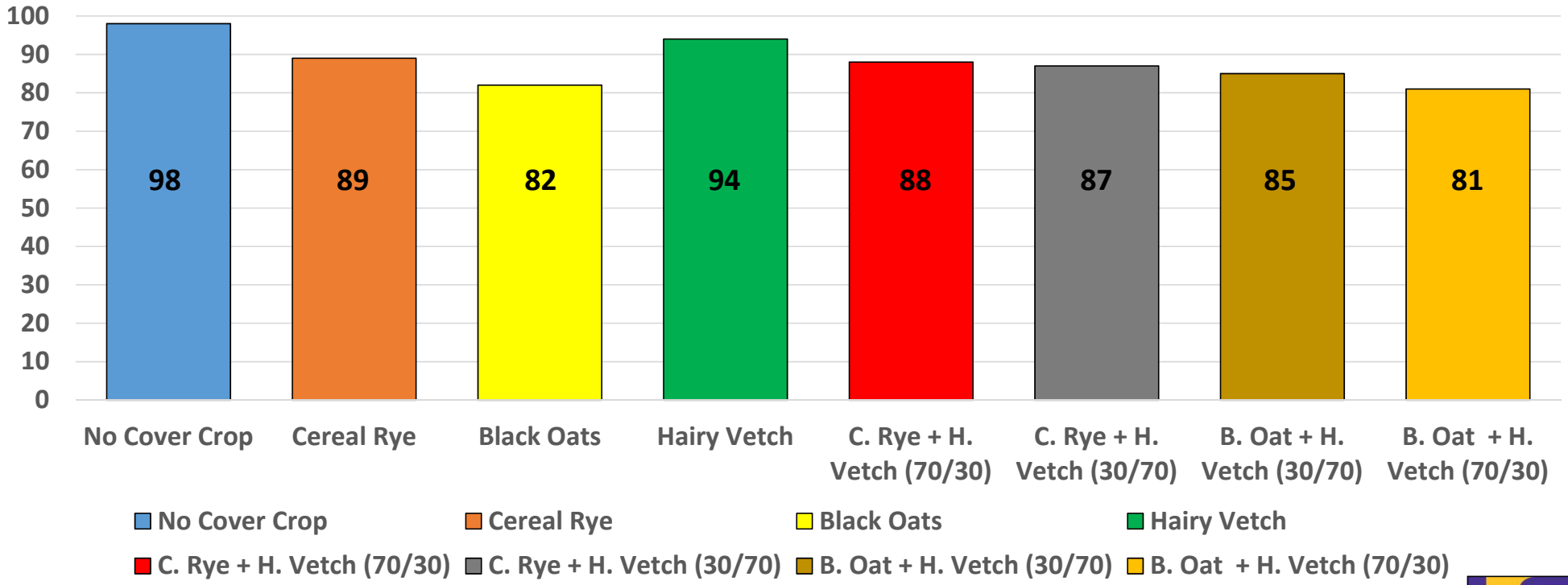
NERS 2018: Crop Plant Stand



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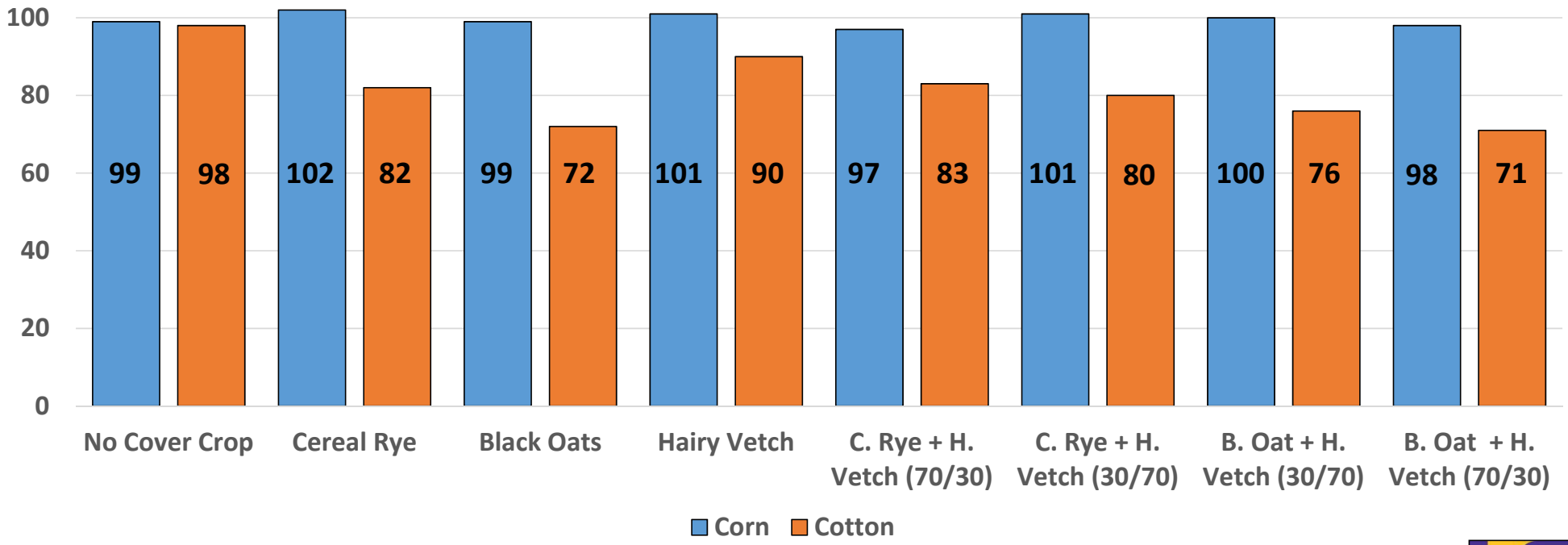
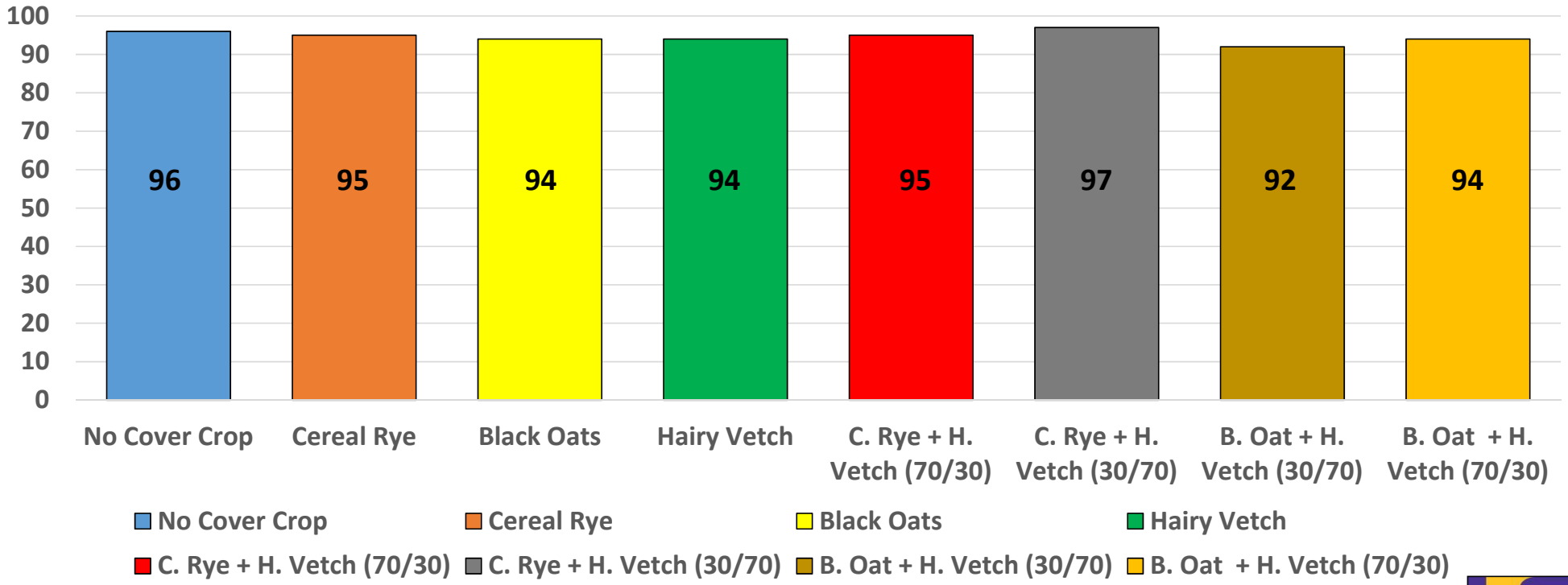


NERS 2019: Crop Plant Stand



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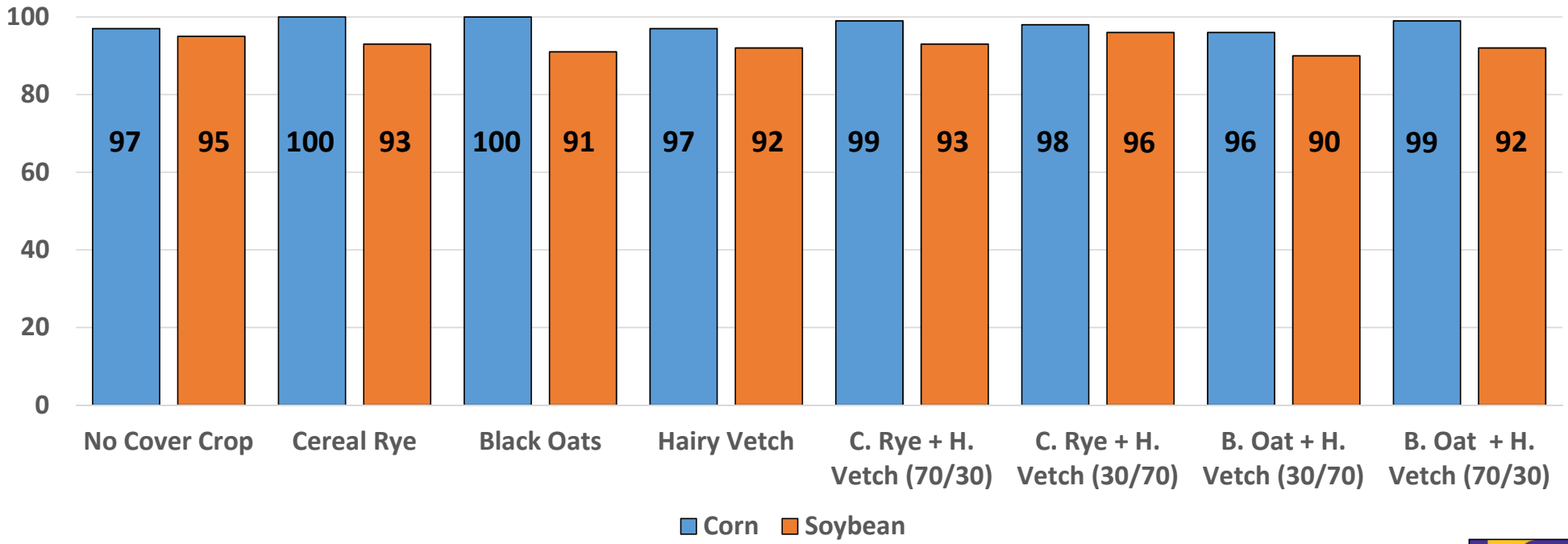
Crop Plant Stand 2019



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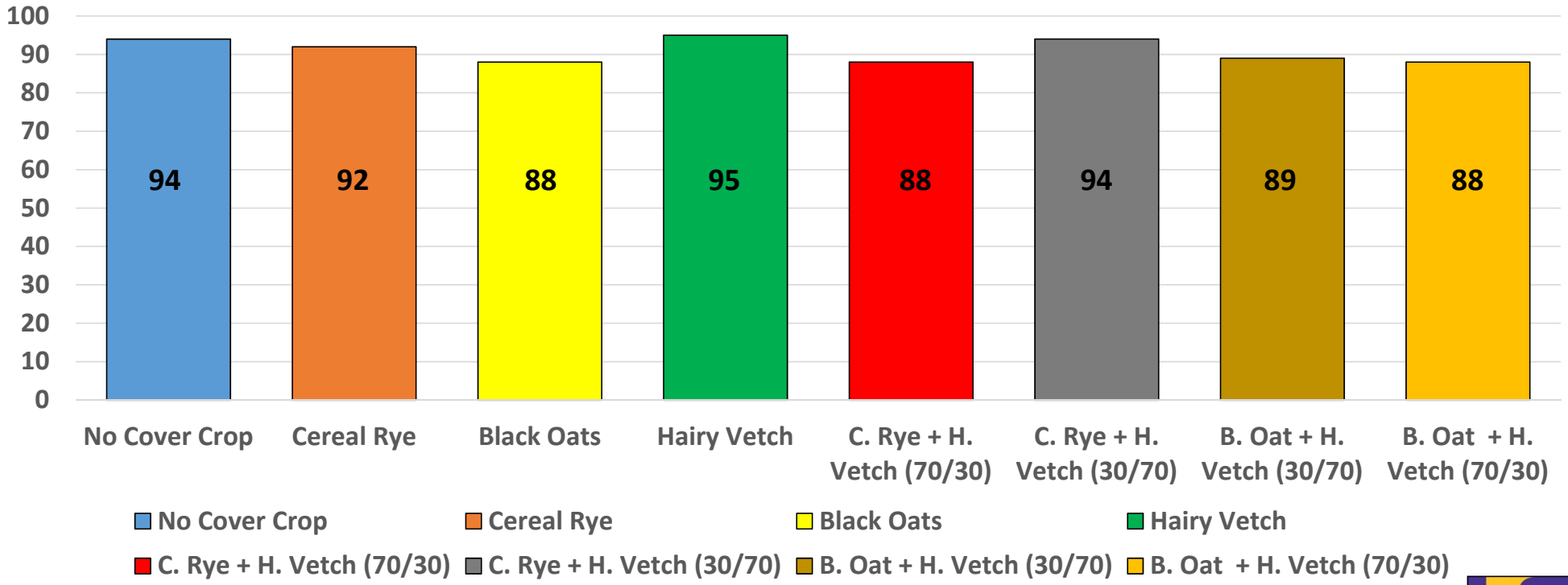
NERS 2018: Crop Yield



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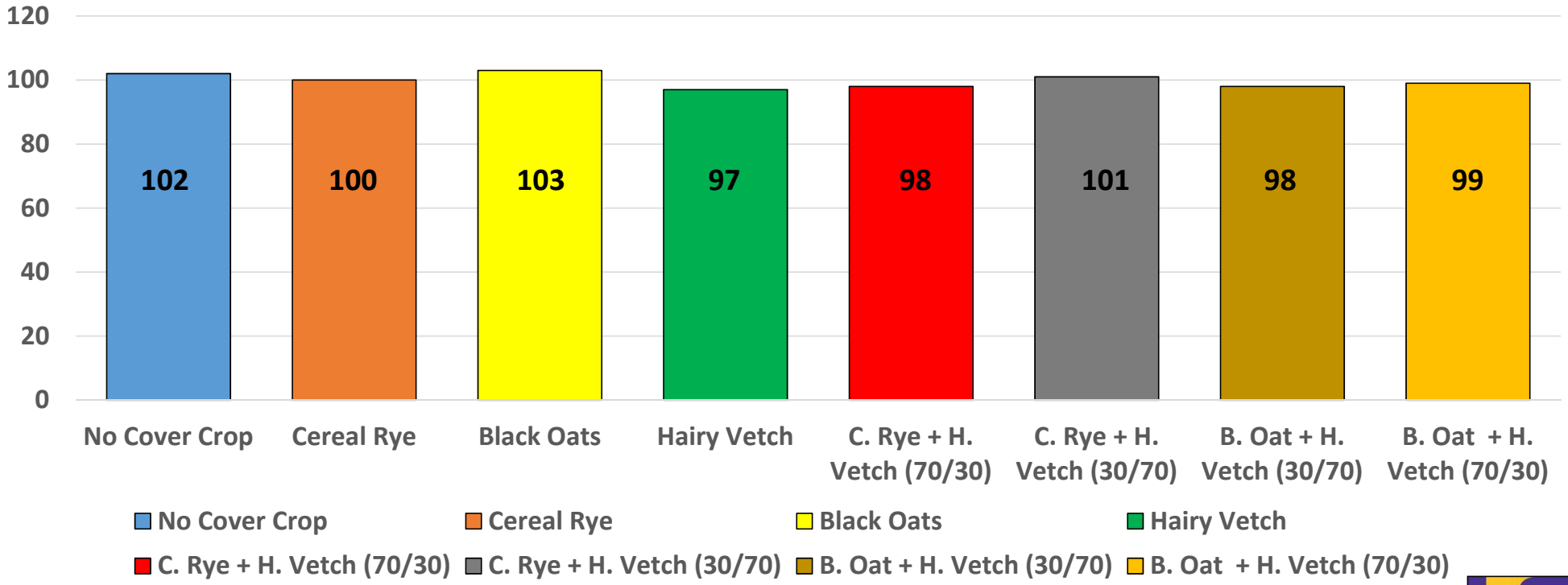

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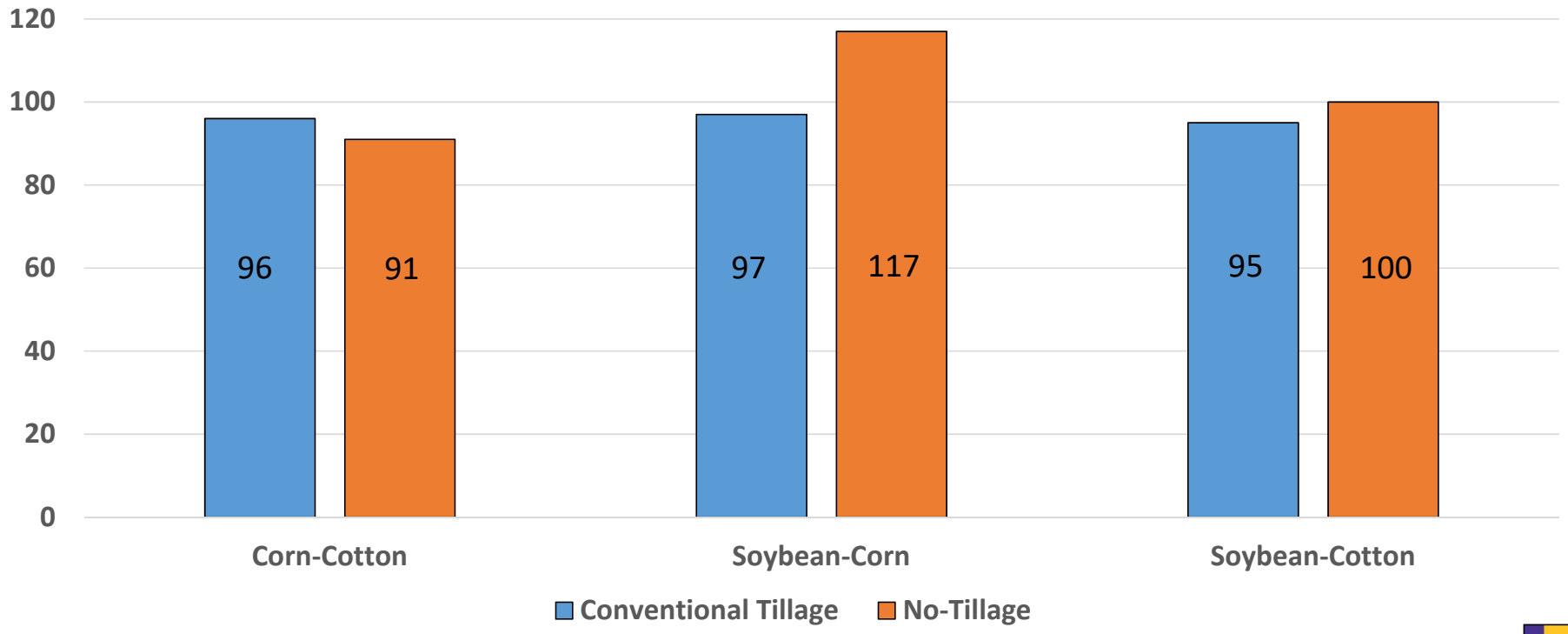

Summary Plant Stand

2018

- Most cover crops negatively affected main crop plant stand, but yield was not affected.
- Cotton plant stand was more sensitive to cover crops than corn plant stand.
- Soybean-Cotton rotation yield was significantly less than Corn-Cotton and Soybean-Corn.

2019

- Cover crops did not affect main plant crop stand nor crop yield.
- Soybean plant stand was more sensitive than corn to establishment.
- Soybean-Corn rotation yielded significantly greater than Corn-Cotton and Soybean-Corn.

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Summary Yield

2018

- Cover crops did not affect crop yield.
- Soybean-Cotton rotation yield was significantly less than Corn-Cotton and Soybean-Corn.

2019

- Cover crops did not affect crop yield.
- Soybean-Corn rotation yielded significantly greater than Corn-Cotton and Soybean-Corn.

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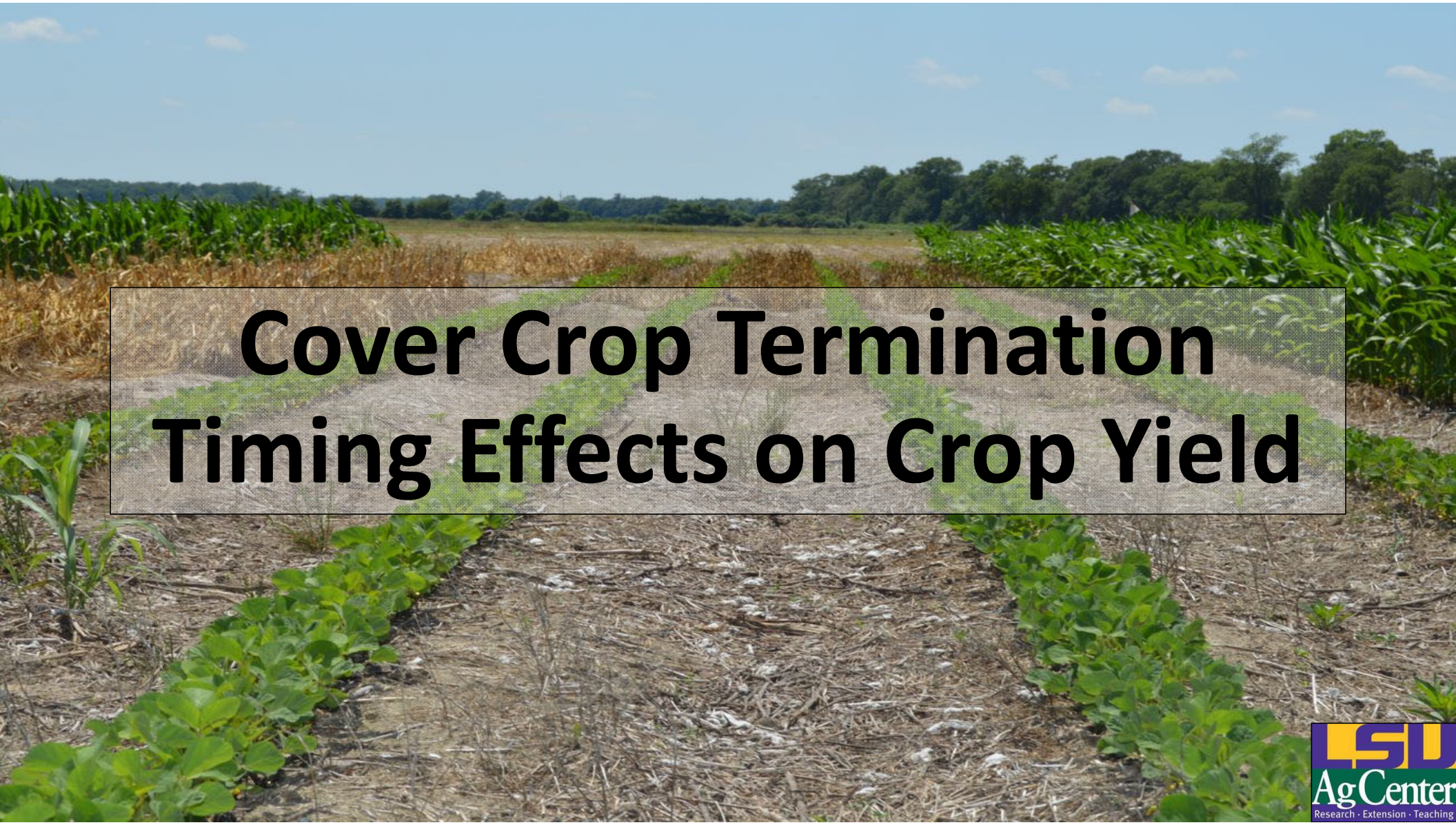
Cover Crop Termination
Timing Effects on Crop Yield
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Cover Crop Termination Timing Effects on Crop Yield

- Examine cover crop termination date in a no-till and conventional tillage system.
- Crop rotation of corn and soybean
- Cover crop
  - Black oats + hairy vetch
  - No cover crop
- Termination of cover crops:
  - 2, 4, and 6 wk prior to planting and at planting
- Corn: 3/24/18 & 3/22/19
- Soybean: 4/19/18 & 4/14/19
- Cotton: 5/14/18 & 4/30/19

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Corn 2018
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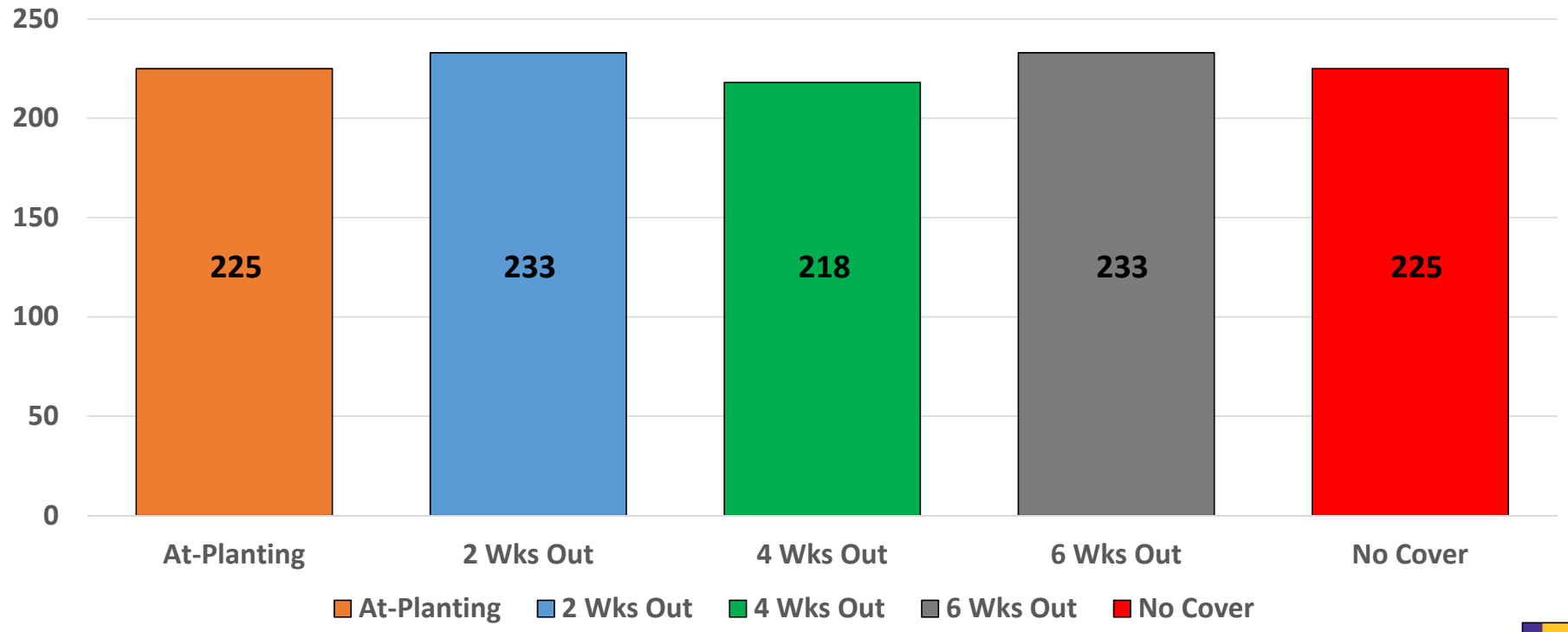
Termination Timing Affect on Corn Yield 2018



Contrast for Corn 2018

Contrast	Difference Between	Pr > |t|
Conventional Tillage to **No-Tillage**	28	<.0001
No Cover Crop to **Cover Crop**	-2.03	0.7025
Conventional Tillage No Cover Crop to **Conventional Tillage Cover Crop**	-0.91	0.9037
No-Tillage No Cover Crop to **No-Tillage Cover Crop**	-3.15	0.6751
Conventional Tillage No Cover Crop to **No-Tillage Cover Crop**	26.25	0.0026

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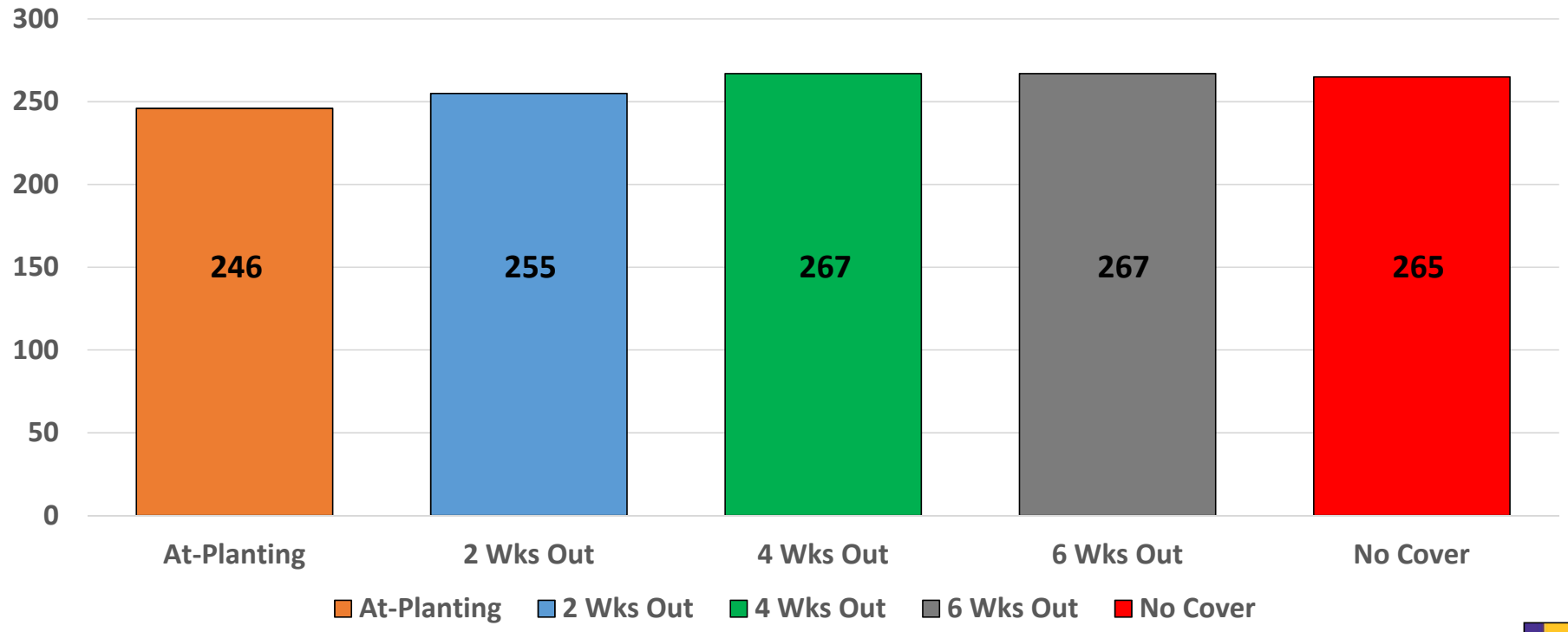
Corn 2019

Termination Timing Affect on Corn Yield 2019



Contrasts for Corn 2019

Contrast	Difference Between	Pr > |t|
Conventional Tillage to **No-Tillage**	0.69	0.9042
No Cover Crop to **Cover Crop**	5.99	0.3835
Conventional Tillage No Cover Crop to **Conventional Tillage Cover Crop**	9.81	0.3176
No-Tillage No Cover Crop to **No-Tillage Cover Crop**	2.17	0.8203
Conventional Tillage No Cover Crop to **No-Tillage Cover Crop**	8.97	0.3539

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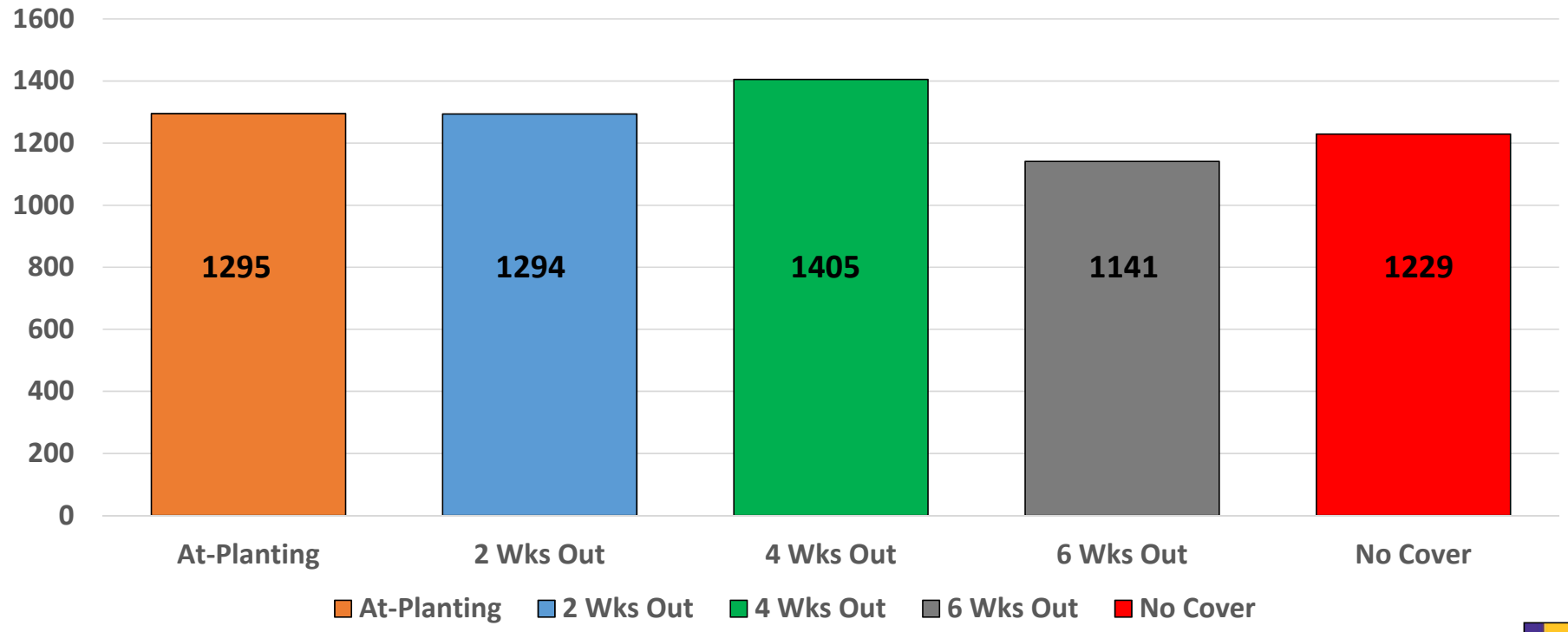
Cotton 2018

Termination Timing Affect on Cotton Yield 2018



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Contrasts for Cotton 2018

Contrast	Difference Between	Pr > |t|
Conventional Tillage to **No-Tillage**	150.41	0.0136
No Cover Crop to **Cover Crop**	-58.7	0.3779
Conventional Tillage No Cover Crop to **Conventional Tillage Cover Crop**	-100.16	0.2544
No-Tillage No Cover Crop to **No-Tillage Cover Crop**	-17.24	0.8622
Conventional Tillage No Cover Crop to **No-Tillage Cover Crop**	66.83	0.4347

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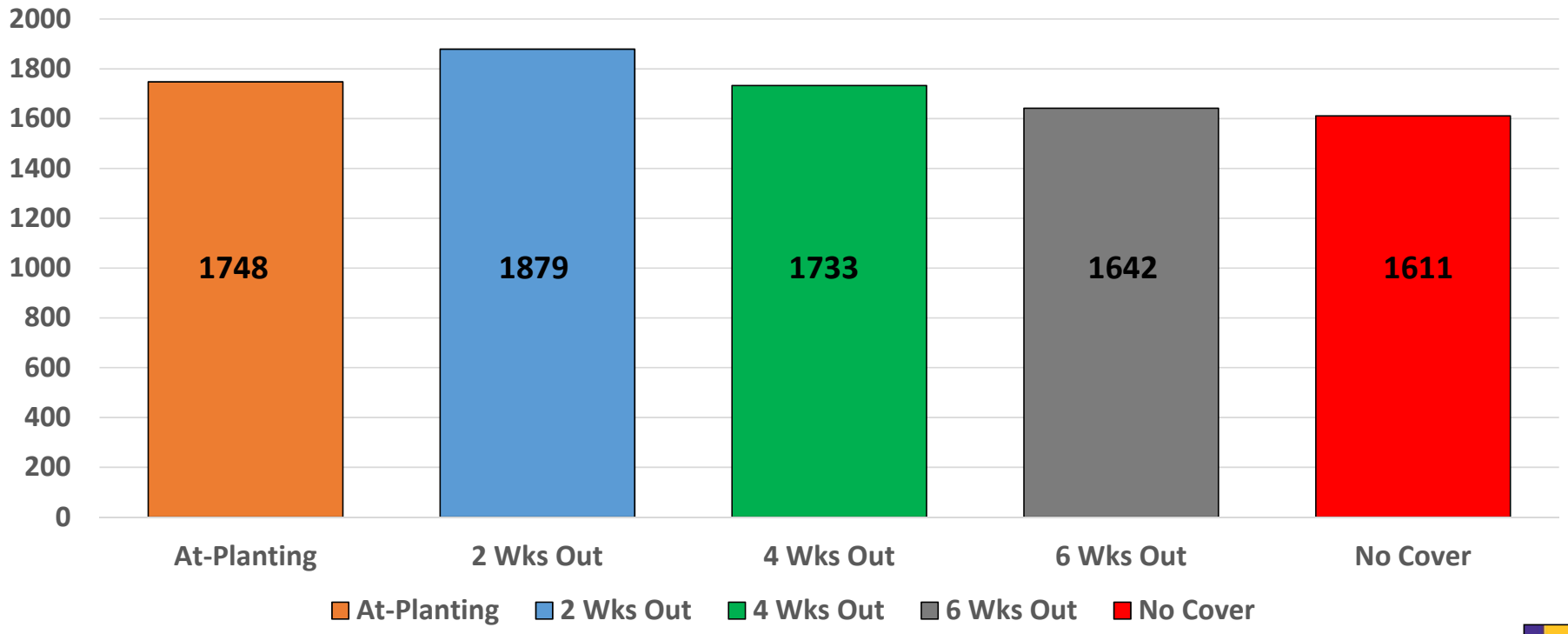
Cotton 2019

Termination Timing Affect on Cotton Yield 2019



Contrast for Cotton 2019

Contrast	Difference Between	Pr > |t|
Conventional Tillage to **No-Tillage**	-68.36	0.1859
No Cover Crop to **Cover Crop**	-134.88	0.0461
Conventional Tillage No Cover Crop to **Conventional Tillage Cover Crop**	-53.31	0.5227
No-Tillage No Cover Crop to **No-Tillage Cover Crop**	-216.45	0.0343
Conventional Tillage No Cover Crop to **No-Tillage Cover Crop**	-154.30	0.0676

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Soybean 2018 & 2019

Termination Timing Affect on Soybean Yield 2018 & 2019

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Contrast for Soybean 2018 & 2019

Contrast	Difference Between	Pr > |t|
Conventional Tillage to **No-Tillage**	10.56	<.0001
No Cover Crop to **Cover Crop**	2.55	0.2260
Conventional Tillage No Cover Crop to **Conventional Tillage Cover Crop**	2.81	0.3162
No-Tillage No Cover Crop to **No-Tillage Cover Crop**	2.28	0.4196
Conventional Tillage No Cover Crop to **No-Tillage Cover Crop**	13.27	<.0001

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Summary Corn

Corn 2018

- Termination timing did not affect yield.
- Conventional tillage > No-tillage. (Phosphorus)

Corn 2019

- Termination timing did not affect yield but there was a trend for higher yields with earlier termination timings.
- Tillage did not affect yield.

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Summary Cotton

Cotton 2018

- No trend for termination timing affect.
- Conventional tillage > No-tillage.
- Yield advantage of 150 lb lint/a for conventional tillage.
- Yield advantage of 59 lb lint/a for cover crop.

Cotton 2019

- No trend for termination timing affect.
- Tillage system did not affect yield.
- Yield advantage of 135 lb lint/a for cover crop.
- No-tillage cover crop 154 lb lint/a yield advantage over Conventional tillage NO cover crop

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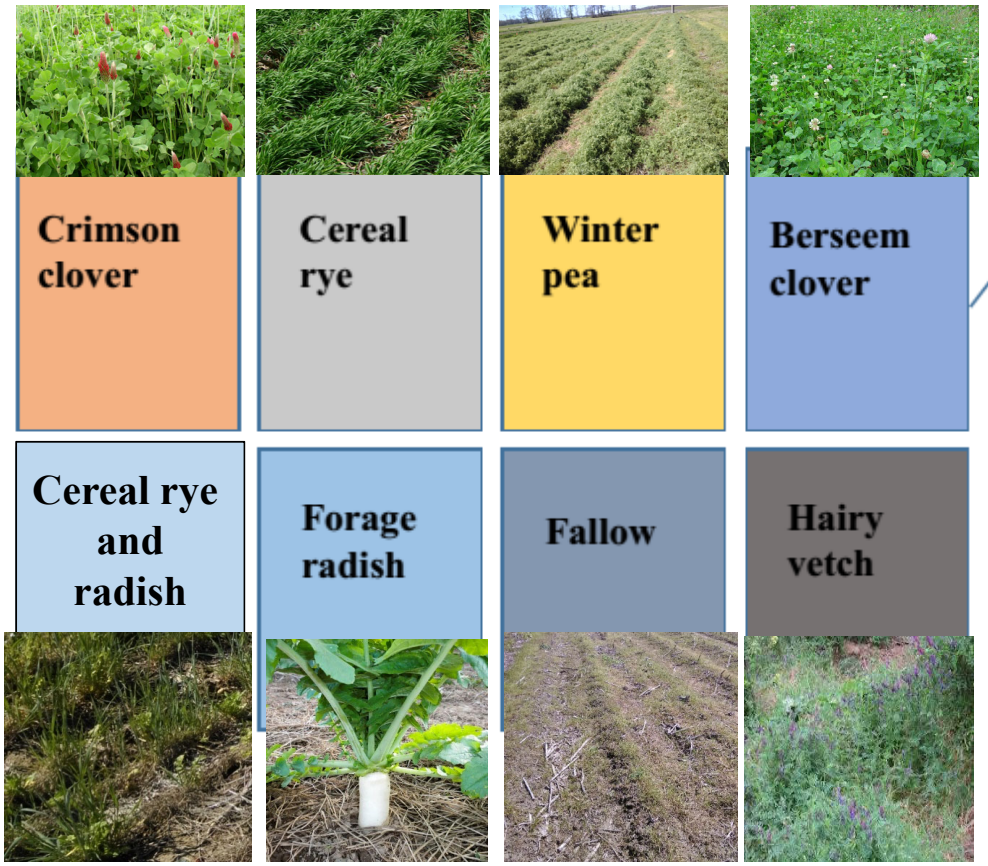
Summary

Soybean 2018 & 2019

- Termination timing did not affect yield but there was a trend for higher yields with earlier termination timings.
- Conventional tillage > No-tillage; 11 bu/a yield advantage.
- Conventional tillage with NO cover crop 13 bu/a yield advantage.

EXPERIMENTAL DESIGN - 1

Split-plot



- **Main plot: cover crops**
  - Legumes
  - Non-legumes
- **Sub plot: nitrogen rates**
  - 0, 90,179, 269 kg ha^{-1}

N_2	N_4	N_1	N_3
N_3	N_1	N_4	N_2
N_4	N_3	N_1	N_2
N_1	N_2	N_3	N_4

- **Soil sampling** (Total 512 samples)
  - Spring 2017 (128 samples)
  - Fall 2017 (128 samples)
  - Spring 2018 (128 samples)
  - Fall 2018 (128 samples)

Cover Crops and Nitrogen Management

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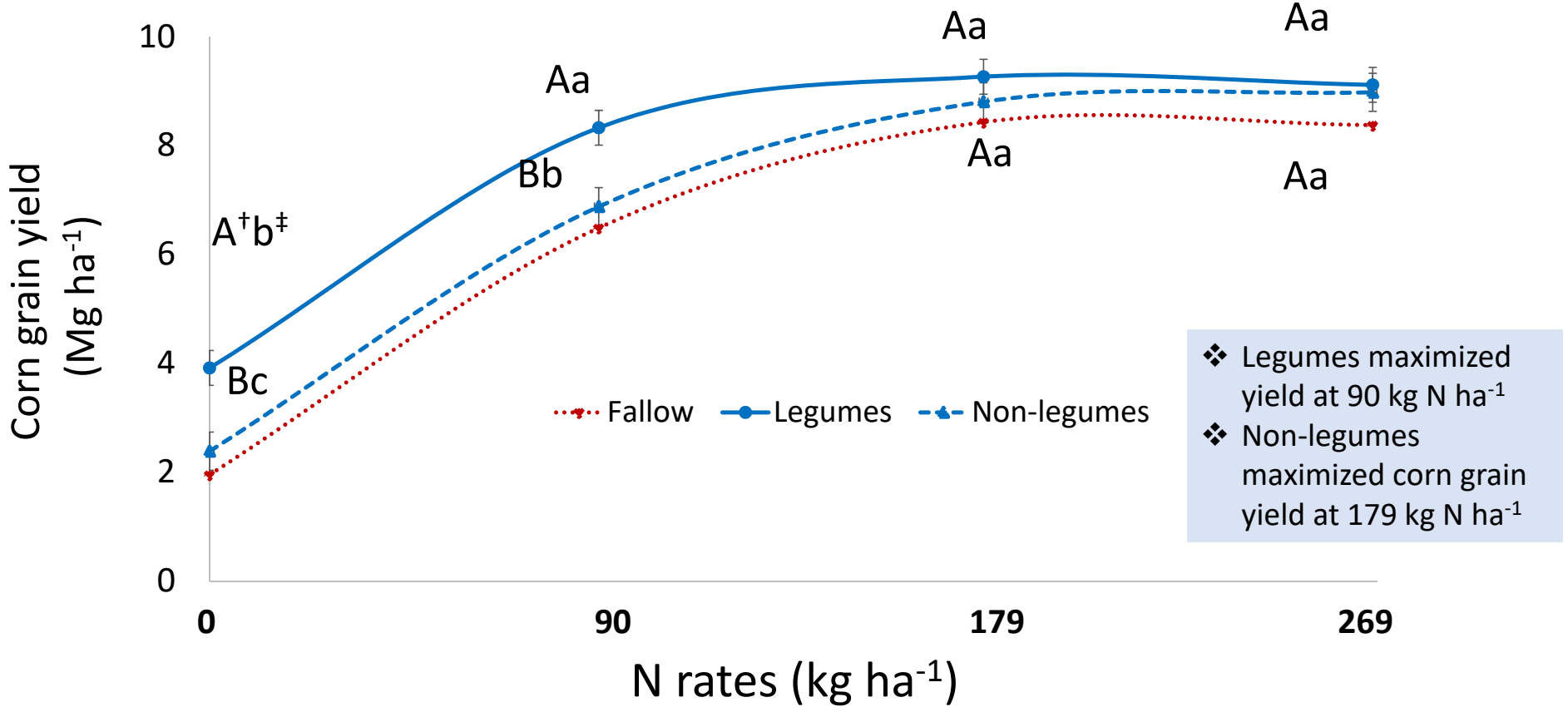
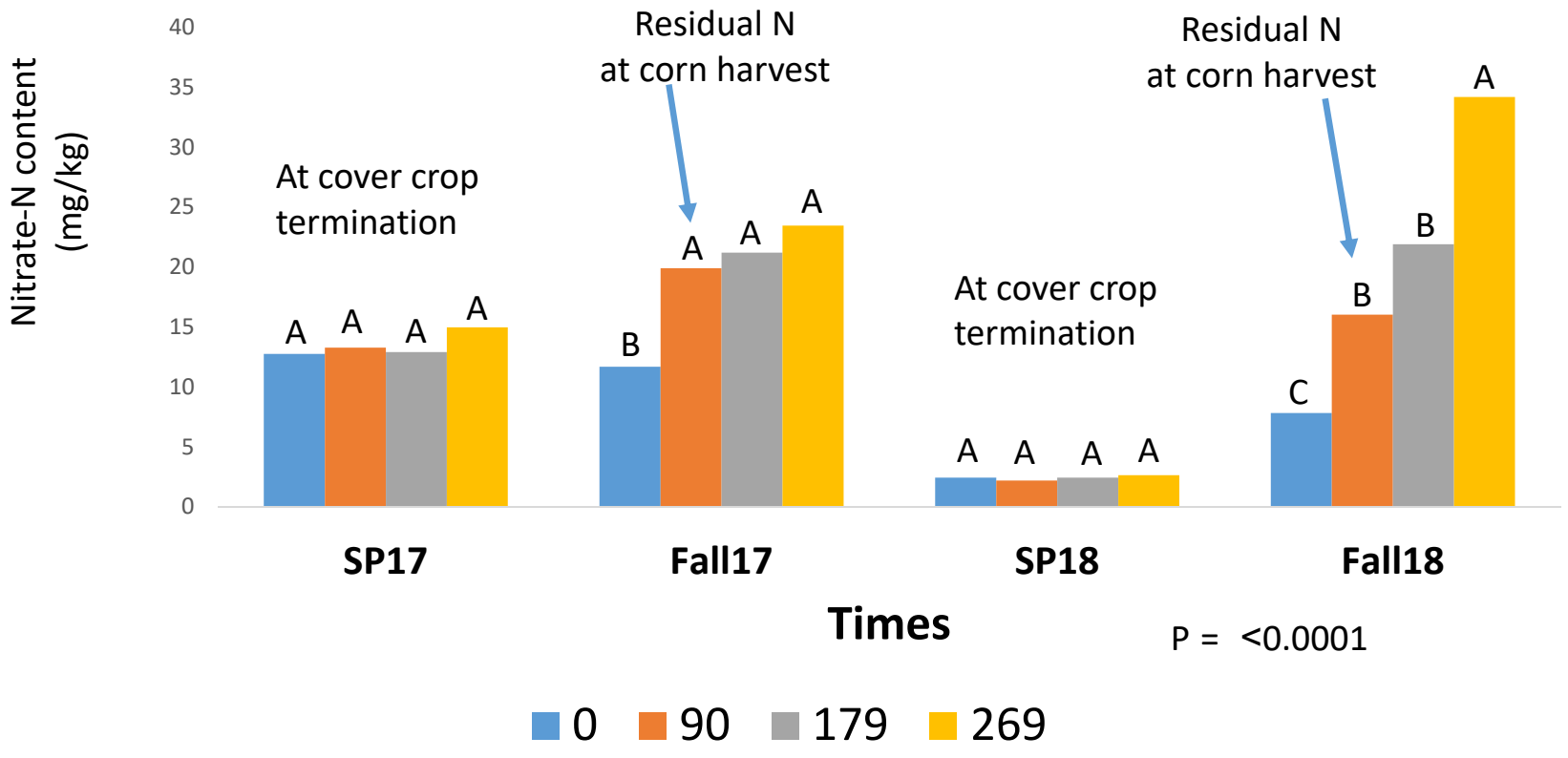
RESULTS – CORN GRAIN YIELD



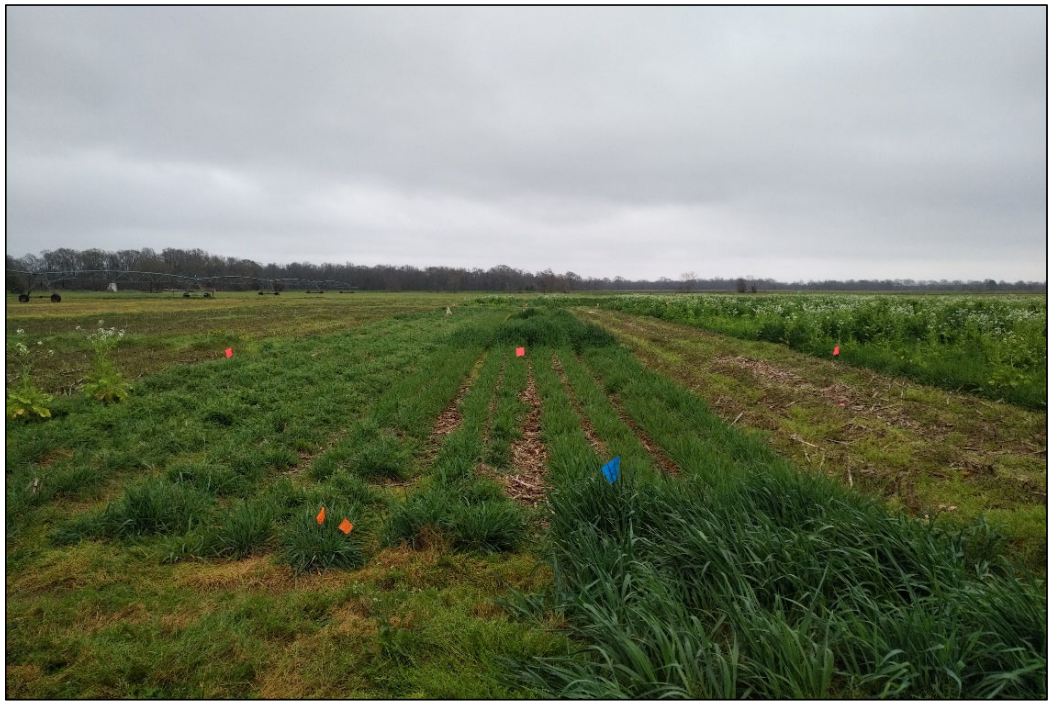
- Legumes maximized yield at 90 kg N ha^{-1}
- Non-legumes maximized corn grain yield at 179 kg N ha^{-1}

P=0.04

RESULTS – SOIL NITRATE-N



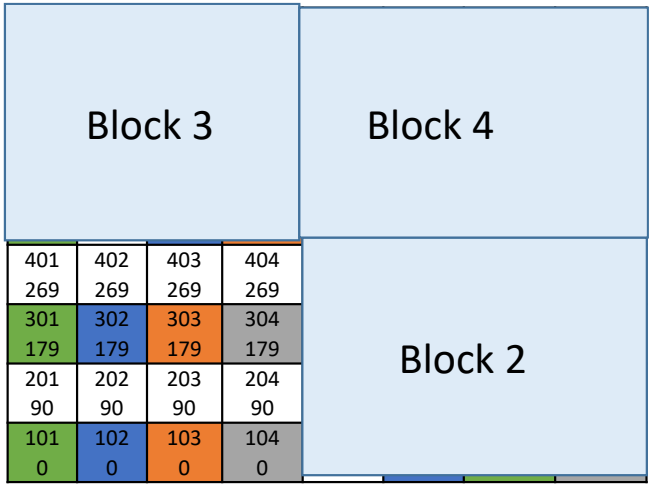
Cover Crop Biomass Degradation



EXPERIMENTAL DESIGN - 2

Split plot in RCBD

Site: Dean Lee Research Station



Mixed cover crop treatments

Trt 1 – Fallow control
Trt 2 – Black oats + Austrian winter pea
Trt 3 – Winter wheat + Berseem clover
Trt 4 – Cereal rye + Crimson clover + Radish

- 192 soil and biomass samples

Site: Macon Ridge Research Station

Mixed cover crop treatments

~~Sunn hemp +~~ Cereal rye + Hairy vetch
Cereal rye + Black oats
Fallow
Black oats + Wheat + Hairy vetch + Radish
Black oats + Crimson clover +Radish
Cow pea + Wheat + Crimson clover
Wheat
~~Sunn Hemp +~~ Crimson clover + Hairy vetch + Radish

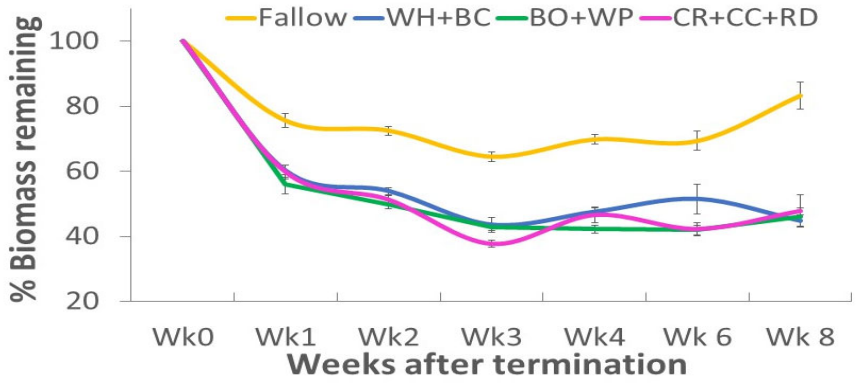
- 384 soil and biomass samples

COVER CROP DEGRADATION

The impact of mixed winter cover crops and nitrogen addition on biomass production, degradation and nitrogen cycling

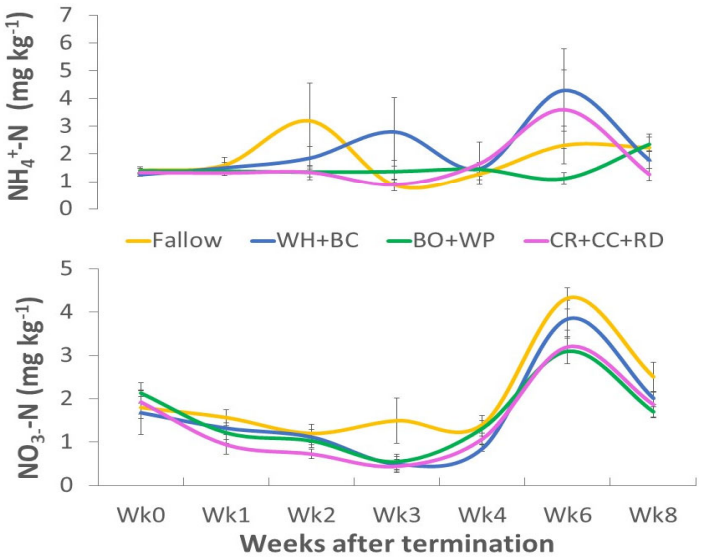
Percent biomass remaining over times

- At week 8 about 50 % of the biomass still remained in all mixed cover crop treatments.
- Fallow had the highest % biomass remaining.

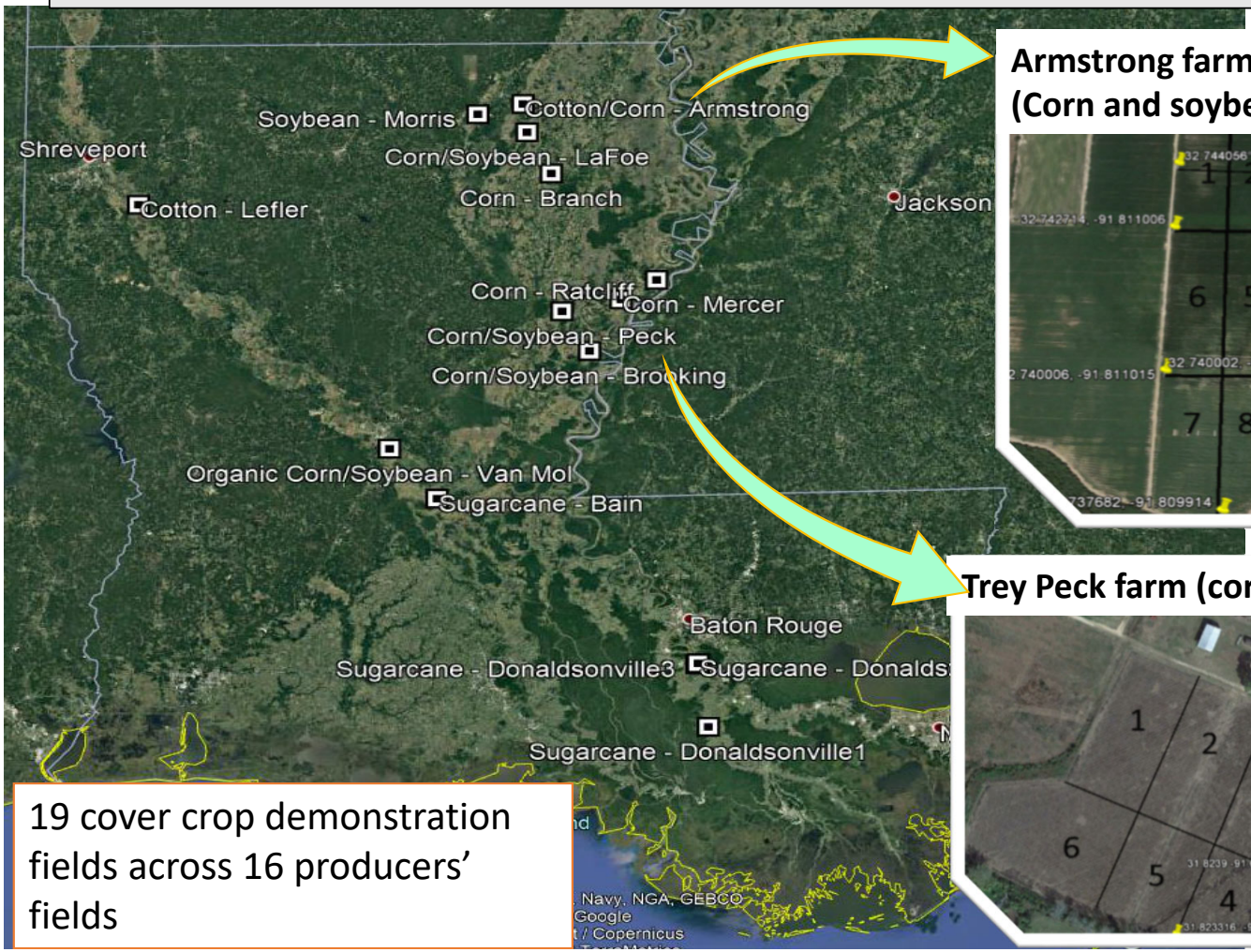


Soil Inorganic N

- Overall, soil NH_4^+-N and NO_3^--N availability increased at week 6 after cover crop termination.
- Soil NH_4^+-N content fluctuated over time while soil NO_3^--N showed constantly pattern for all treatments.



2016 CIG Project Sites



19 cover crop demonstration fields across 16 producers' fields

Armstrong farm (Corn and soybean)

Trey Peck farm (corn)

Final Thoughts

- Cover crops can provide benefits to cropping systems and should be managed for their specific goal.
- If winter weeds are a concern, applying Zidua/chloracetamide in the fall may be an option.
- Cereal cover crops are very competitive with winter weeds.
- Plant the cover crop as early as possible. Plant into a clean seed bed. Apply Zidua/chloractamide herbicide once the cover crop is well established 1 – 3 week after emergence.
- Cover crops can affect main crop plant population.
  - Cotton and soybean population more affected than corn.

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Final Thoughts

- Tillage system and crop rotation sequence impacted main crop plant population and crop yield.
- In one study, cover crops did not affect main crop yield.
- In another study, a cover crop positively affected cotton yield.
- For soybean and corn (one year) there was a yield advantage of conventional tillage and NO cover crop over no-tillage and cover crop.
- Termination timing did not affect corn and soybean yields.
- There was no clear trend of termination timing affect on cotton yield.

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Final Thoughts

- Legume cover crops are supplying substaintial amounts of N to our crops.
  - Yield was maximized at 80 lb N per acre.
  - Yield was maximized at 160 lb N per acre for no cover and non-legumes.
- Cover crops are scavenging soil residual nitrogen.
- Ammonium- and Nitrate-N increased by 6 wks after cover crop termination.

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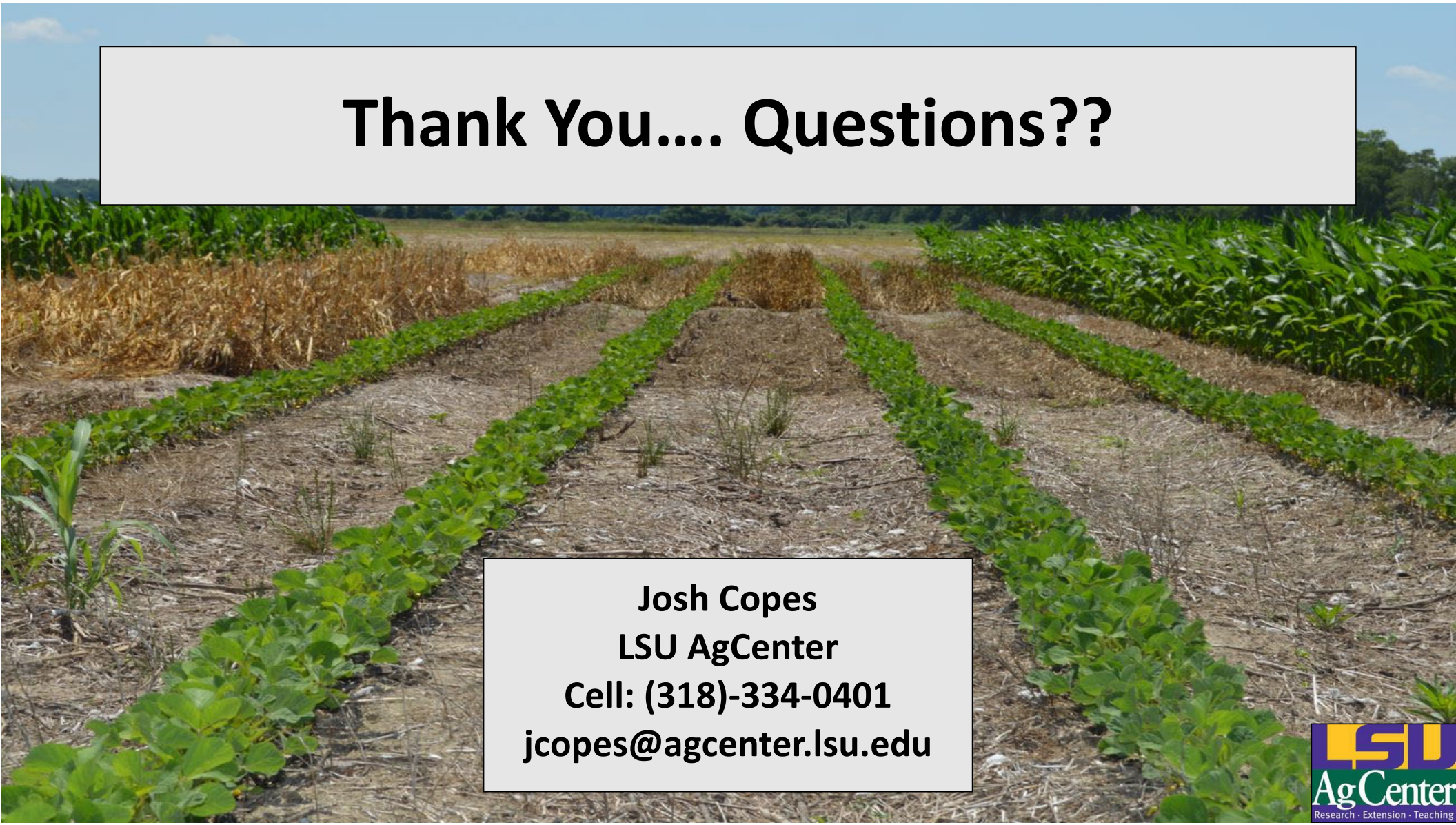
Thank You…. Questions??



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