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United States Department of Agriculture

Yield and cost differences of soil health practice adoption in corn and soybean fields

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Disclaimer: The findings and conclusions in this presentation are those of the author and should not be construed to represent any official USDA or U.S. Government determination or policy.

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Motivation

- Soil Health, Regenerative Agriculture, Climate-Smart Agriculture, Sustainable Agriculture ...
- Many **social benefits** that result from changing conventional farm production practices have been identified
- The **private benefits and costs** of changing production practices depend on the context in which they are adopted



Overview

- **Data source:** Agricultural Resource Management Survey (ARMS)
Field-level survey data (Phase 2 of ARMS)
 - Corn: 2010, 2016 
 - Soybeans: 2012, 2018 
- **Soil Health (SH) practices:**
 - Reduced tillage (“conservation tillage”)
 - Cover crops
 - Nutrient management plan on field



Data on SH Practices in ARMS

- Reduced tillage (“conservation tillage”)
 - NRCS soil tillage intensity ratings (STIR) calculated based on all reported field operations
 - STIR < 80 classified as reduced tillage
- Cover crop
 - Indicates a cover crop was planted in the field the prior fall
- Nutrient management plan (NMP)
 - Current (written) NMP on the field covering fertilizer and/or manure

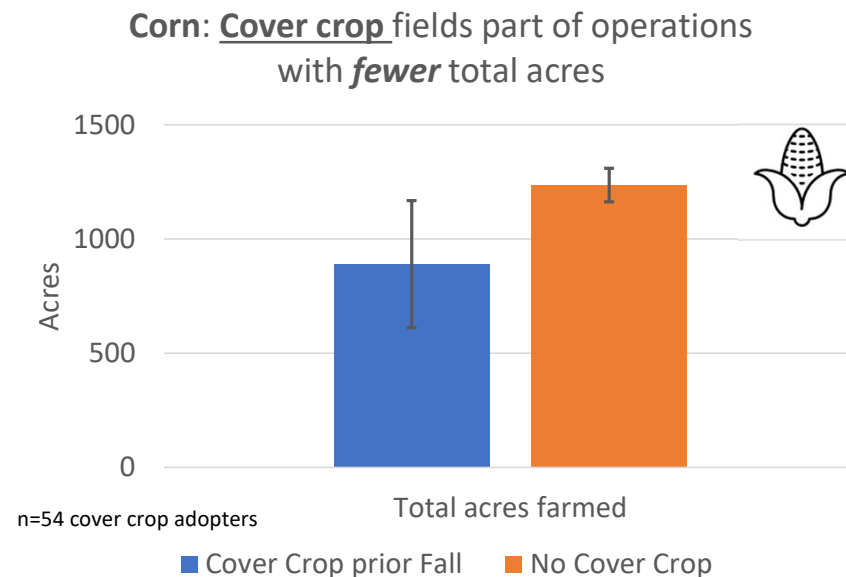
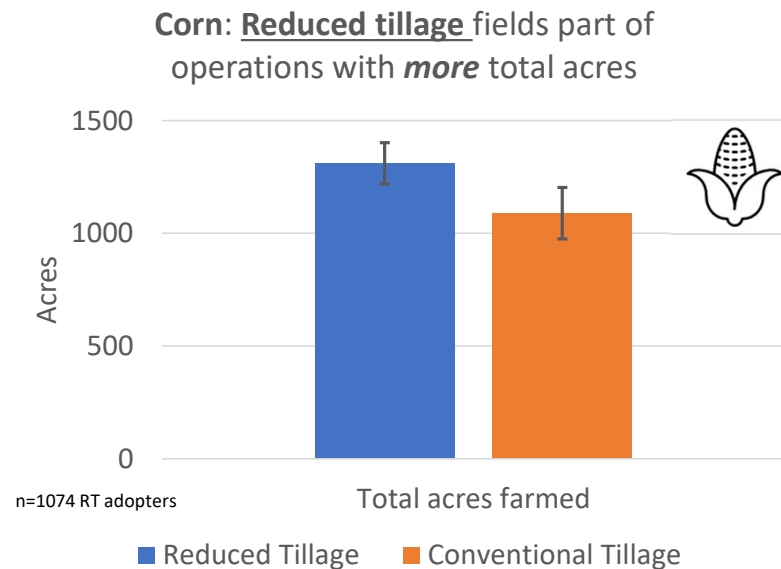


What do field-level data tell us when comparing *fields* with and without soil health practices?

- Crop yield
- Production costs
- Operator and farm characteristics
- Receipt of conservation program payments



How do farm operations that adopt soil health practices differ from those that do not?



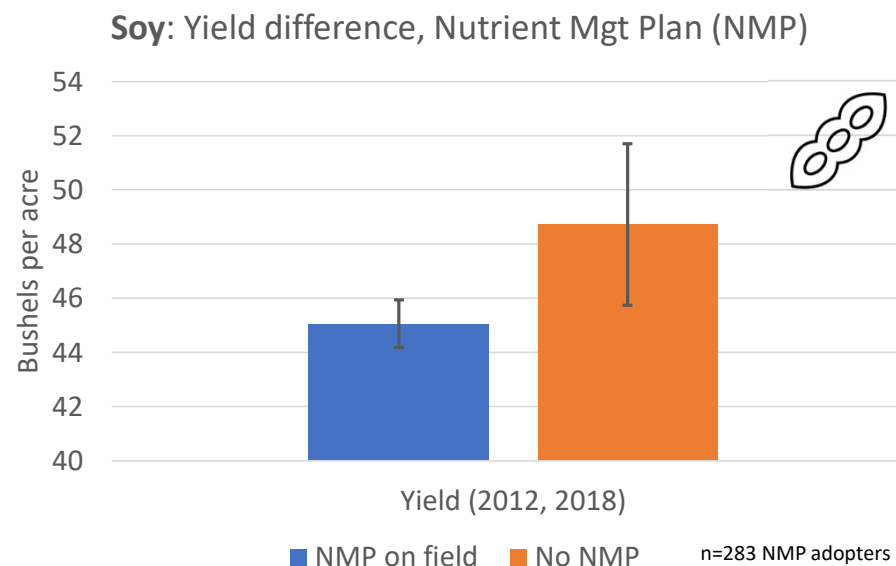
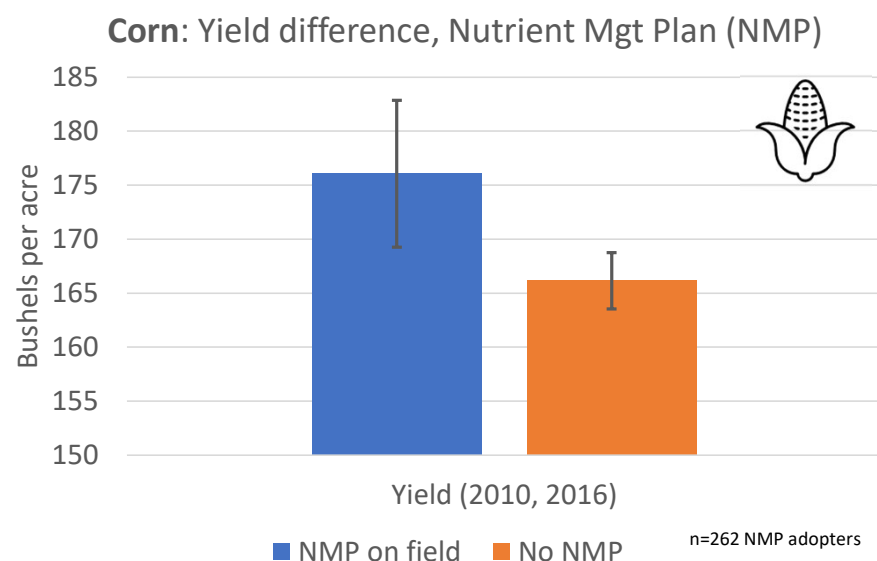
- No significant difference in farm size (total acres) for **soybean** fields that adopted any soil health practices studied

Note: Difference in means statistically significant ($p \leq 0.05$)

Source: ARMS Phase 2&3 (2010,2012,2016, 2018)



Do fields with soil health practices have different yields compared to fields that do not?



- No significant yield difference for corn or soybeans in fields that adopt reduced tillage *or* cover crops

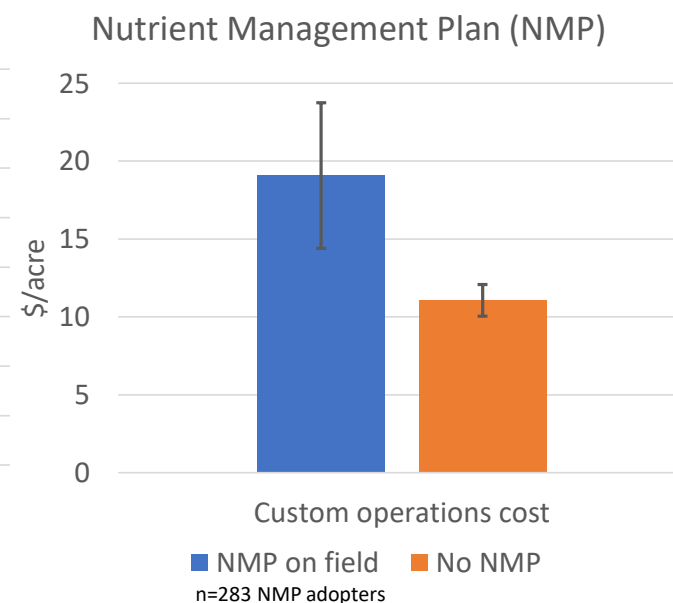
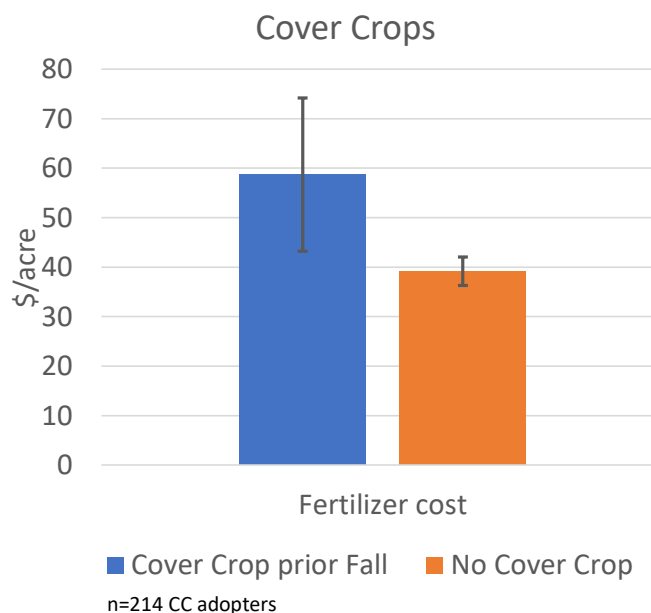
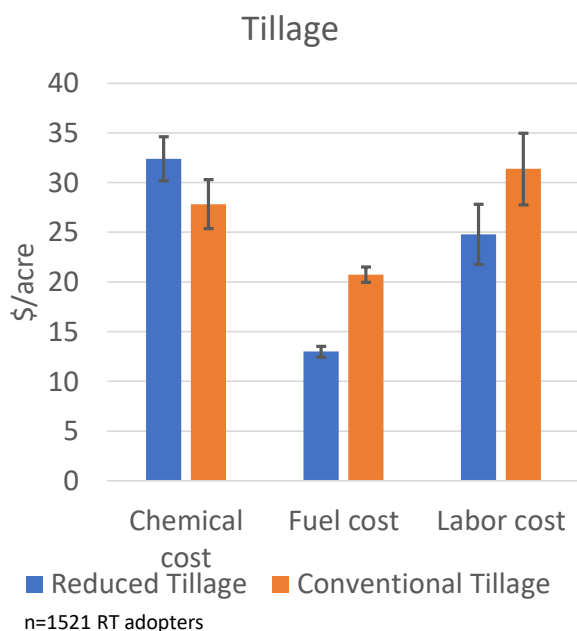
Note: Difference in means statistically significant ($p \leq 0.05$)

Source: ARMS Phase 2 (2010, 2012, 2016, 2018)



How do production costs differ in fields that adopt SH practices compared to those that do not? [1/2]

Soybean Fields

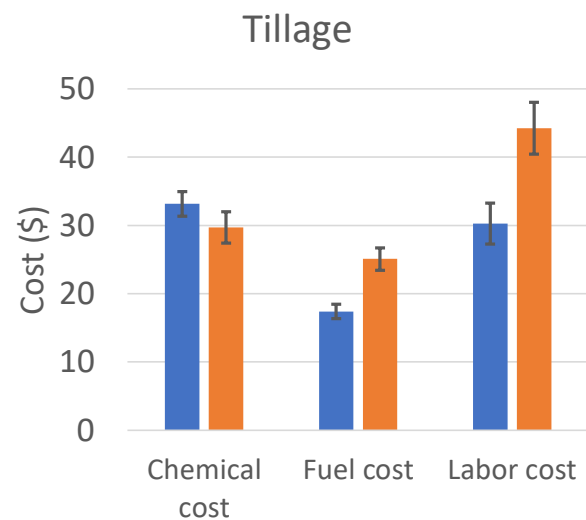


Note: Difference in means statistically significant ($p \leq 0.05$)
Source: ARMS Phase 2 (2012, 2018)



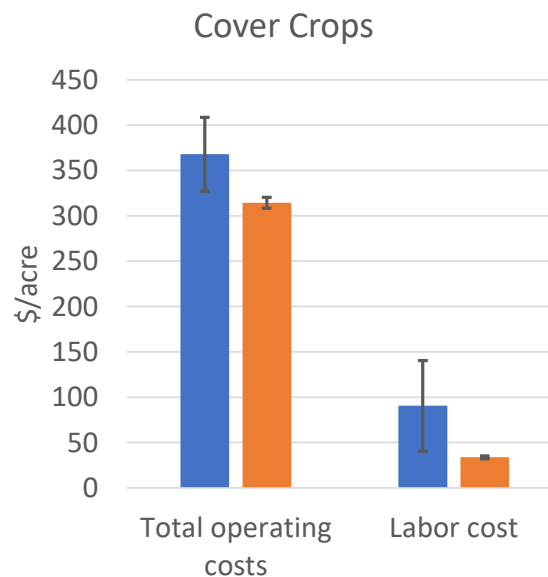
How do production costs differ in fields that adopt SH practices compared to those that do not? [2/2]

Corn Fields



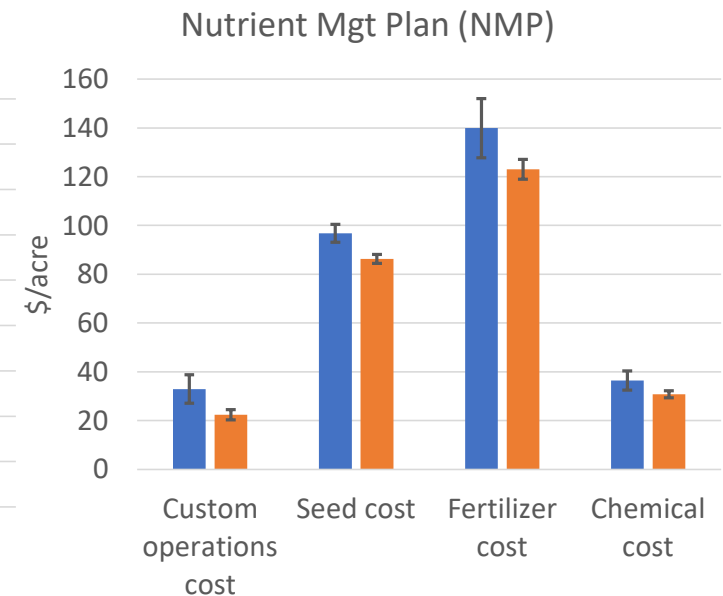
n=1074 RT adopters

■ Reduced Tillage ■ Conventional Tillage



n=54 cover crop

■ Cover Crop prior Fall ■ No Cover Crop



n=262 NMP adopters

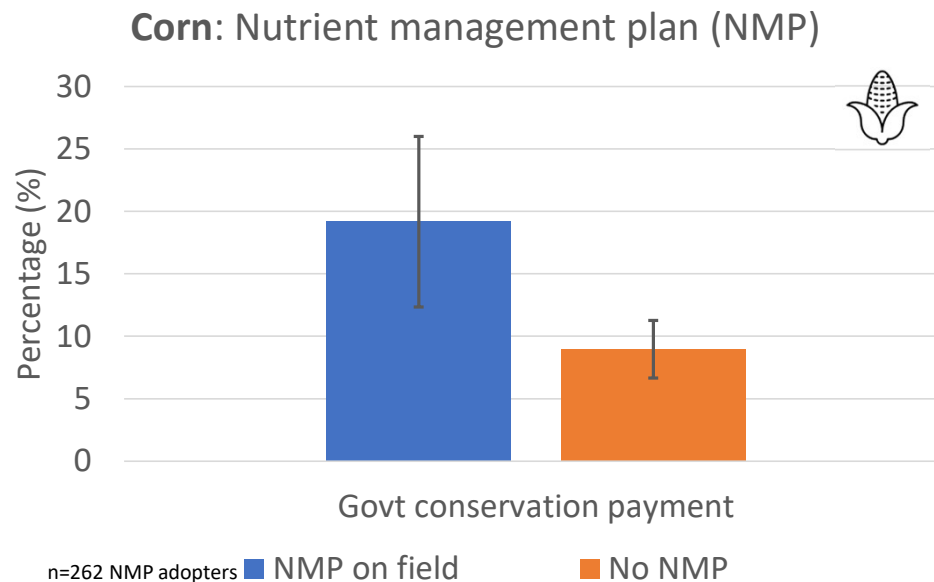
■ NMP on field ■ No NMP

Note: Difference in means statistically significant ($p \leq 0.05$)

Source: ARMS Phase 2 (2010, 2016)



How many fields that adopt SH practices receive government conservation program payments?



- Share of fields receiving conservation program payments not significantly different for other SH practices *or* for any SH practice in soybean fields

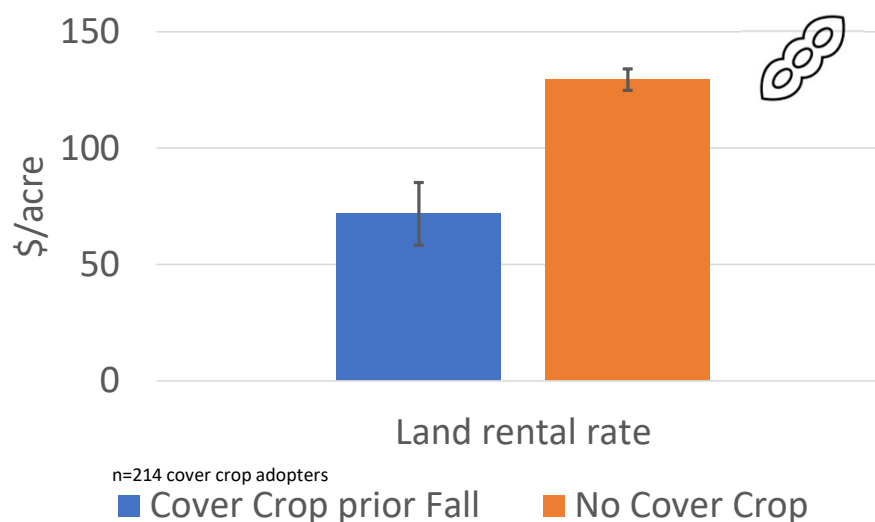
Note: Difference in means statistically significant ($p \leq 0.05$)

Source: ARMS Phase 2 (2010,2012,2016, 2018)



Does land ownership matter for SH practice adoption?

Soy: Cover crops used on land with lower opportunity cost



- Tenure (owning the field) and land rental rate were not significantly different for other SH practices studied

Note: Difference in means statistically significant ($p \leq 0.05$)
Source: ARMS Phase 2 (2010, 2012, 2016, 2018)



Take-aways from ARMS data on SH practices

Reduced Tillage

Corn & Soy:

- 1) No statistically significant yield differences
- 2) Higher chemical costs on fields using RT
- 3) Lower labor and fuel costs on fields using RT

Corn:

RT on fields that are part of larger operations (1310 v. 1088 acres)

Cover Crops

Corn & Soy:

No statistically significant yield differences

Corn:

Higher labor costs on fields with CC

Soy:

- 1) Higher fertilizer costs on fields with CC
- 2) Lower land rent on fields with CC

Nutrient Management Plans

Corn & Soy:

Higher custom operations cost on fields w/ NMPs

Corn fields have higher:

- 1) Yield (+10 bu/ac)
- 2) Chemical, fertilizer, seed costs
- 3) Overall share receiving govt conservation payment

Soy:

Lower yield (-3.7 bu/ac)

Note: Difference in means statistically significant ($p \leq 0.05$)

Source: ARMS Phase 2 (2010, 2012, 2016, 2018)



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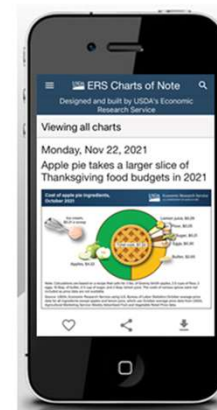
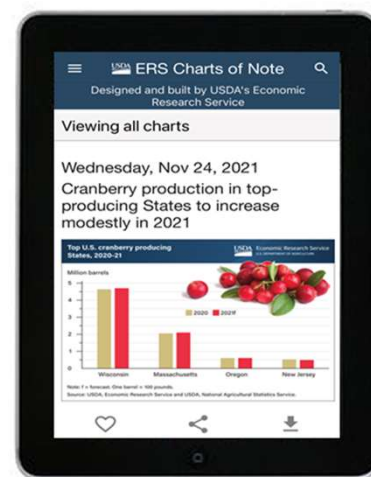


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Questions?

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