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

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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

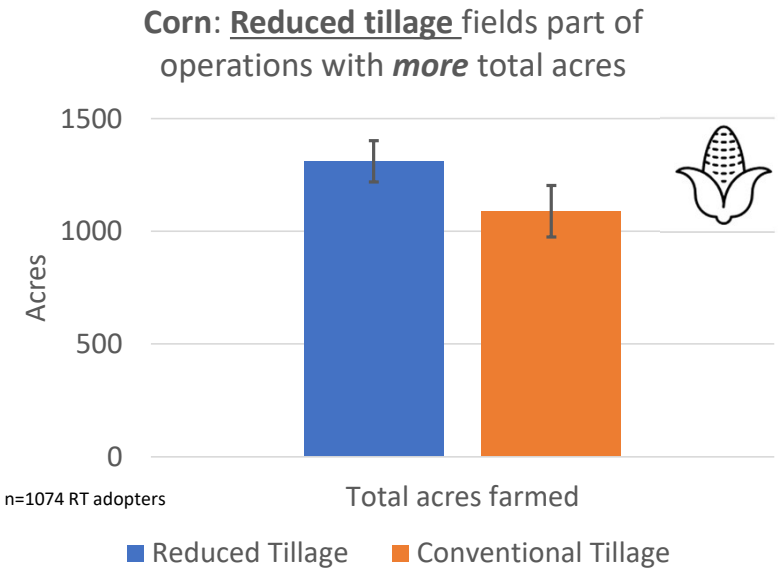
Data on SH Practices in ARMS

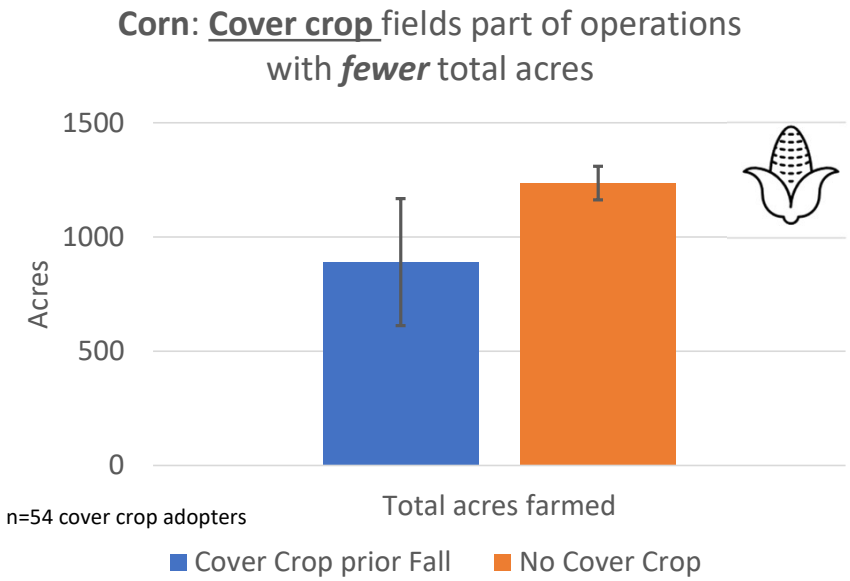
- Reduced tillage ("conservation tillage")
  - NRCS soil tillage intensity ratings (STIR) calculated based on all reported field operations
  - STIR < 80 classified as reduced tillage
- Cover crop
  - Indicates a cover crop was planted in the field the prior fall
- Nutrient management plan (NMP)
  - 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?

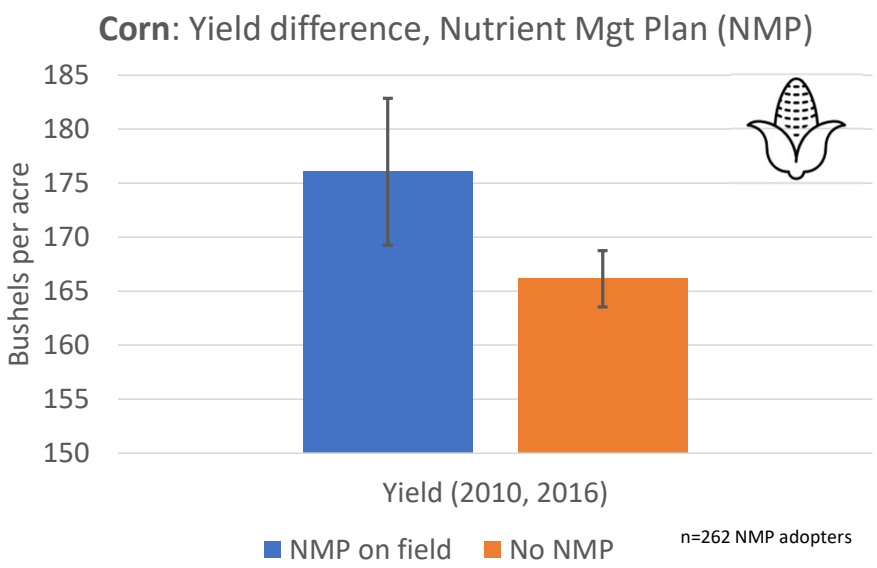


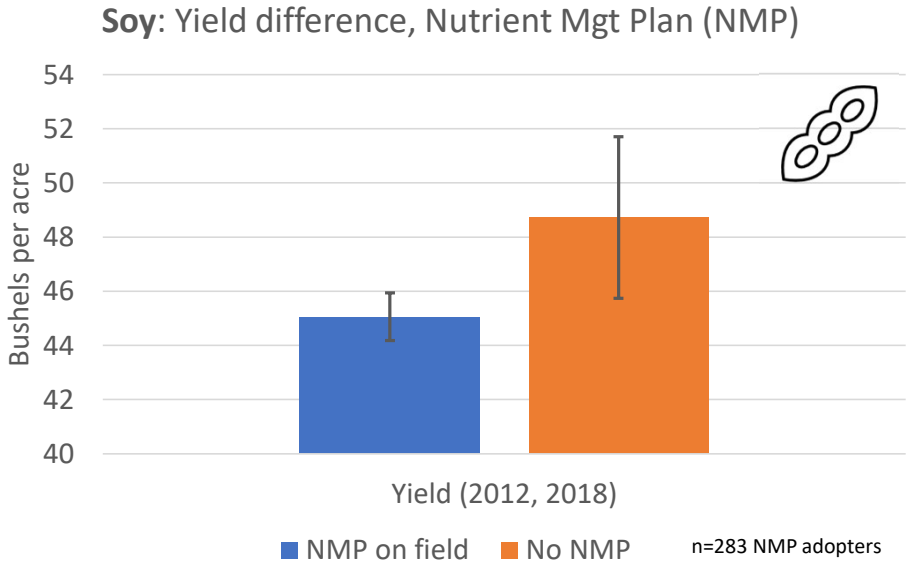


- No significant difference in farm size (total acres) for **soybean** fields that adopted any soil health practices studied

Note: Difference in means statistically significant (p≤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?



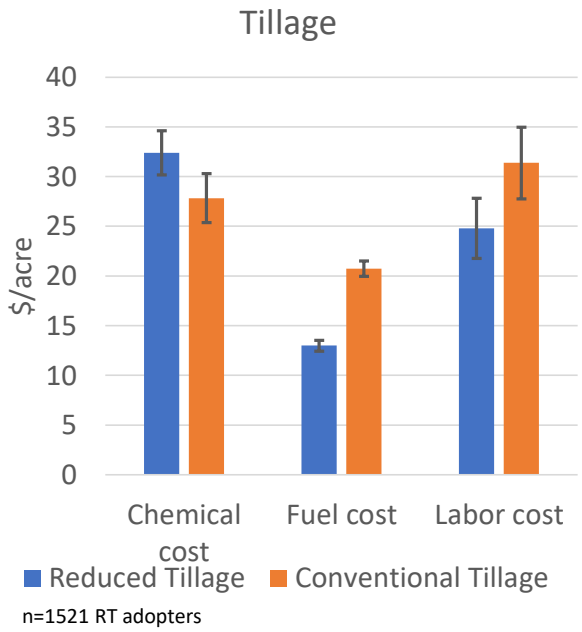


- No significant yield difference for corn or soybeans in fields that adopt reduced tillage *or* cover crops

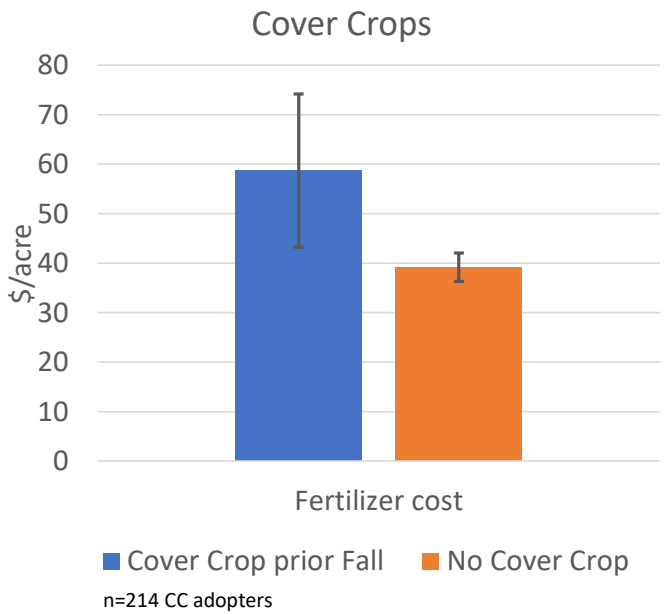
Note: Difference in means statistically significant (p≤0.05)
Source: ARMS Phase 2 (2010,2012,2016, 2018)

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

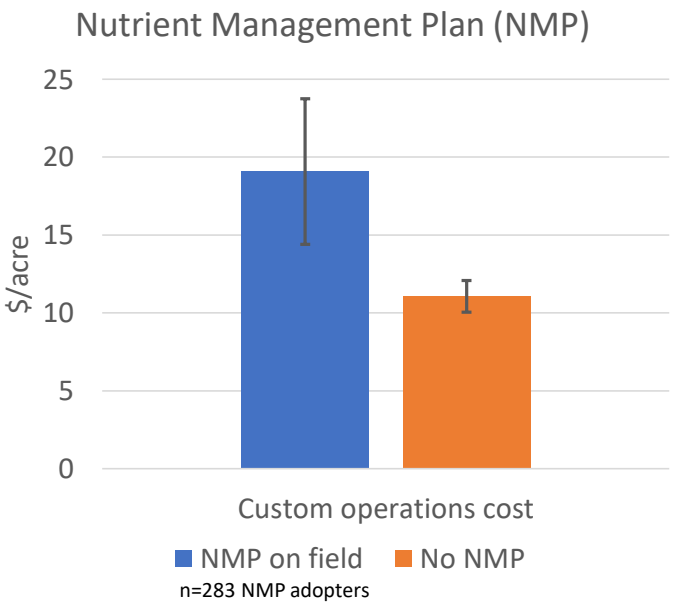
Soybean Fields



n=1521 RT adopters



n=214 CC adopters

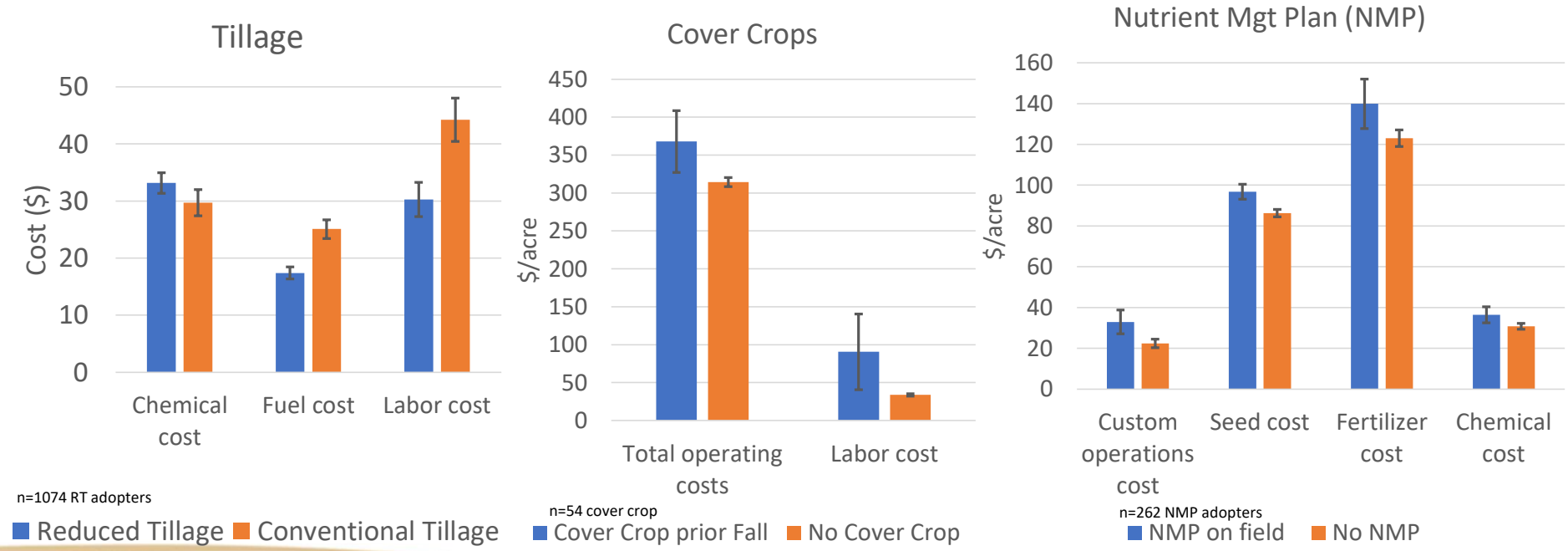


n=283 NMP adopters

Note: Difference in means statistically significant (p≤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]

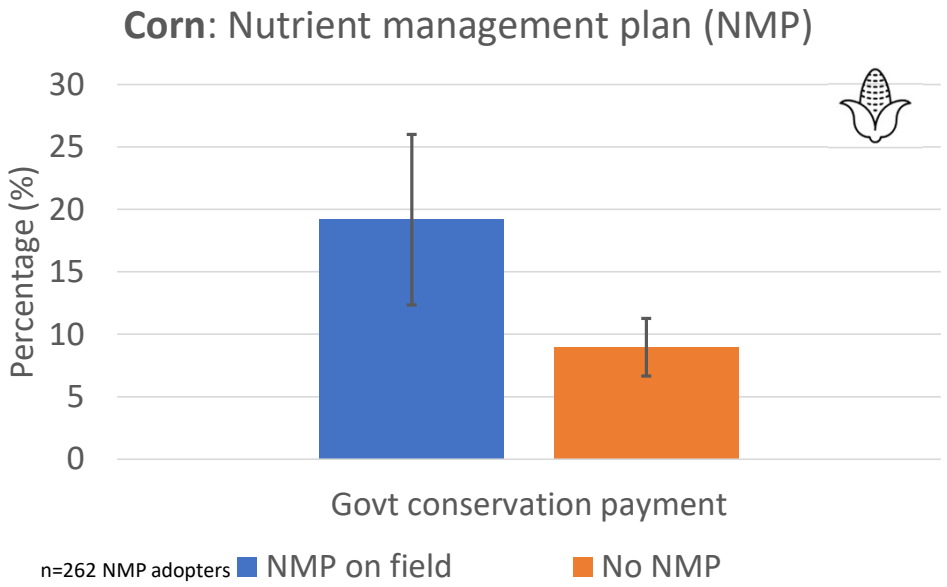
Corn Fields



Note: Difference in means statistically significant (p≤0.05)

Source: ARMS Phase 2 (2010, 2016)

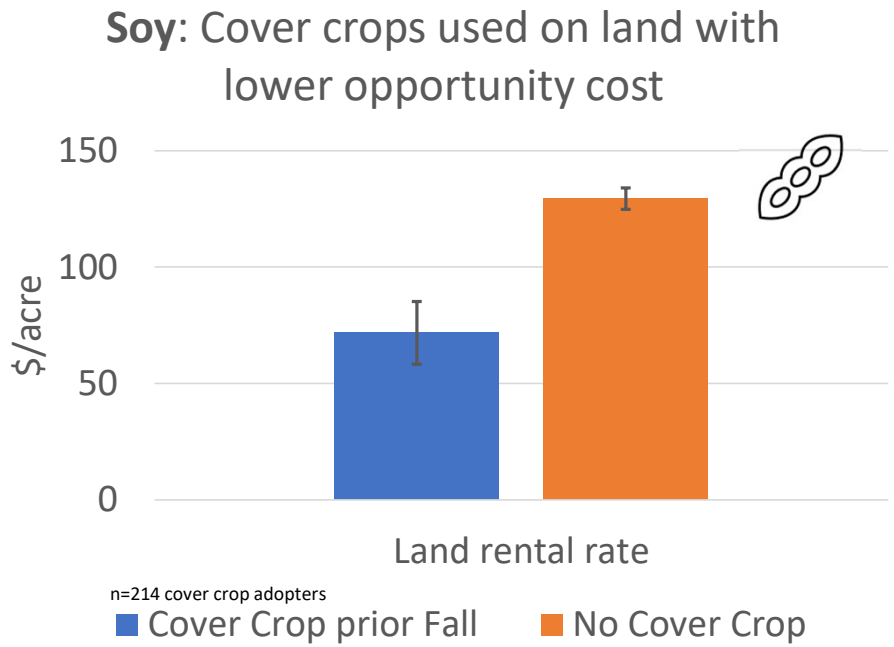
How many fields that adopt SH practices receive government conservation program payments?



- 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≤0.05)
Source: ARMS Phase 2 (2010,2012,2016, 2018)

Does land ownership matter for SH practice adoption?



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

Note: Difference in means statistically significant (p≤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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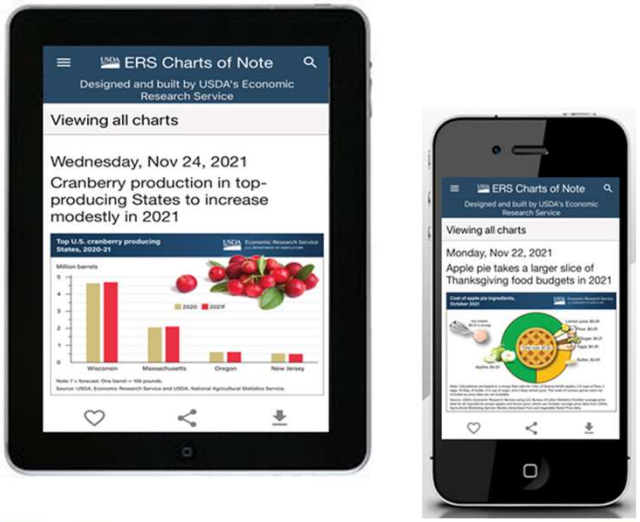

Questions?

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