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)
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]

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**

**Tillage**

- Chemical cost
- Fuel cost
- Labor cost

**Cover Crops**

- Total operating costs
- Labor cost

**Nutrient Mgt Plan (NMP)**

- Custom operations cost
- Seed cost
- Fertilizer cost
- Chemical cost

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)
Does land ownership matter for SH practice adoption?

- **Soy**: Cover crops used on land with lower opportunity cost

- **Soy**: 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)

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≤0.05)
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