Iowa Farmers’ Perspectives on Soil Health: Predictors of knowledge and action
Research context:

• The concept of soil health is now central to NRCS conservation programming

• Increasing resources dedicated to soil health programs in university extension programs

• Increasing discussion in farm press, ag community

• Important to know what farmers think about soil health: Does the concept resonate?

• Survey research: Iowa Farm and Rural Life Poll

• In-depth interview research with recipients of the Iowa Farm Environmental Leader Award
Methods: Survey

**Survey data** from the 2015 and 2016 Iowa Farm and Rural Life Poll, an annual survey of Iowa farmers

- Focus on issues of importance to agriculture in the Midwest
- Since 1982, longest-running survey of its kind
- In cooperation with Iowa Dept. of Ag and Iowa Ag Stats
- ~1,200 farmers
- Soil health questions (2015) focused on 1) Knowledge of soil health, 2) perceived benefits of healthy soils, 3) landlord understanding of soil health, and 4) actions taken to improve soil health
- Worked with Ron Nichols, other NRCS staff, ISU faculty to develop survey questions for farmers
The concept of “soil health” has been a topic of discussion in the agricultural community in recent years. Soil health has been defined as “the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans.” What are your thoughts about soil health?
Information about Soil Health

I have noticed more discussion of soil health among fellow farmers in the last couple of years

I have paid more attention to soil health in the last couple of years

Strongly agree/agree
Uncertain
Strongly disagree/disagree

0% 10% 20% 30% 40% 50% 60% 70% 80% 90%
Information about Soil Health

USDA NRCS is a good source of information on soil health

- Strongly agree/agree: 63%
- Uncertain: 30%
- Strongly disagree/disagree: 7%

I would like to learn more about how to improve soil health

- Strongly agree/agree: 69%
- Uncertain: 24%
- Strongly disagree/disagree: 7%
Potential Benefits

- Healthy soils can increase yields: 93% strongly agree/agree, 7% uncertain, 1% strongly disagree/disagree.
- Healthy soils can increase drought resilience: 77% strongly agree/agree, 20% uncertain, 3% strongly disagree/disagree.
- Healthy soils can reduce input needs: 75% strongly agree/agree, 22% uncertain, 3% strongly disagree/disagree.
Concerns

I am concerned about the impact of soil compaction on soil health

I am concerned about the impact of pesticides (herbicides, insecticides, fungicides) on soil health

- Strongly agree/agree
- Uncertain
- Strongly disagree/disagree

- 84% strongly agree/agree
- 11% uncertain
- 5% strongly disagree/disagree

- 70% strongly agree/agree
- 21% uncertain
- 8% strongly disagree/disagree
Soil Health and Rented Land

In general, landlords have a good understanding of the concept of soil health

- 22% Strongly agree/agree
- 29% Uncertain
- 49% Strongly disagree/disagree

In general, landlords know what farming practices can improve soil health

- 28% Strongly agree/agree
- 27% Uncertain
- 45% Strongly disagree/disagree
Knowledge and Action

In the last couple of years I have taken steps to improve the health of the soils I farm

Strongly agree/agree: 76%
Uncertain: 17%
Strongly disagree/disagree: 7%

I have a good understanding of the concept of soil health

Strongly agree/agree: 69%
Uncertain: 25%
Strongly disagree/disagree: 7%

I know how to manage for improved soil health

Strongly agree/agree: 67%
Uncertain: 28%
Strongly disagree/disagree: 6%

I have an effective soil health management plan

Strongly agree/agree: 54%
Uncertain: 37%
Strongly disagree/disagree: 10%
Statistical analysis: OLS Regression

Research question: What factors predict ratings of soil health knowledge and action?

Dependent variable: 4-item, 5-point agreement scale measuring knowledge and action

- I know how to manage for improved soil health
- I have a good understanding of the concept of soil health
- I have an effective soil health management plan
- In the last couple of years I have taken steps to improve the health of the soils I farm
Regression analysis: Factors predicting ratings of soil health knowledge and capacity

Independent variables: Soil health awareness, attitudes

- Soil health perceived benefits and concerns (5-item scale)
  - I am concerned about the impact of soil compaction on soil health
  - I am concerned about the impact of pesticides on soil health
  - Healthy soils can reduce input needs
  - Healthy soils can increase yields
  - Healthy soils can increase drought resilience

- Soil health information (3-item scale)
  - I have noticed more discussion of soil health in the farm press in the last couple of years
  - I have paid more attention to soil health in the last couple of years
  - I have noticed more discussion of soil health among fellow farmers in the last couple of years

- Landlord attitudes on soil health (2-item scale)
  - In general, landlords have a good understanding of the concept of soil health
  - In general, landlords know what farming practices can improve soil health
Regression analysis:
Factors predicting ratings of soil health knowledge and capacity

- Stewardship motivations for conservation practice adoption (11-item scale, each item measured on a 5-point importance scale)
  - Protect the land for the next generation
  - Maintain or improve soil health
  - Because it is the right thing to do
  - My stewardship ethics
  - Protect my investment in the land
  - Avoid polluting streams, rivers and lakes
  - Maintain or enhance productivity
  - Reduce the environmental impact of my farming activities
  - Keep chemicals and nutrients on the farm
  - Feeling of responsibility to earlier generations
  - Increase long-term profitability
  - Improve wildlife habitat
Regression analysis:
Factors predicting ratings of soil health knowledge and capacity

• Government policy motivations for conservation practice adoption (7-item scale, each item measured on a 5-point importance scale)
  • Ensure eligibility for Farm Bill programs and payments
  • Comply with Farm Bill requirements
  • Prepare for potential future regulations
  • Prepare for programs that reward conservation behavior
  • Tax benefits of conservation expenses
  • Avoid problems with regulatory agencies
  • Cost-share programs helped make it more affordable
Regression analysis: Factors predicting ratings of soil health knowledge and capacity

• Opinion leadership (6-item scale, each item on a 5-point agreement scale)
  • Other farmers tend to look to me for advice
  • I consider myself to be a role model for other farmers
  • Extension staff, crop advisers, and others involved in agriculture tend to look to me for advice
  • I take a leadership role in local agricultural matters
  • Compared to other farmers, I tend to use more innovative management practices and strategies
  • My opinions matter in the local agricultural community
Regression analysis: Factors predicting ratings of soil health knowledge and capacity

- Age in years
- Education (0=up to some college, 1=College degree, 2=at least some graduate school)
- Gross farm income
- Owned acres of land in corn, soy, small grains, fruit/veg, pasture or hay
- Rented acres of land in corn, soy, small grains, fruit/veg, pasture or hay
- Livestock (0=No, 1=Yes)
Regression results: What factors were associated with higher ratings of soil health knowledge and capacity?

- Higher scores on the soil health *perceived benefits* and concerns scale
- Greater *awareness* of soil health information in the ag community
- Positive assessments of *landlord knowledge* of soil health
- Higher scores on the *stewardship motivations* for conservation practice adoption scale
- Higher scores on the self-rated *opinion leadership* scale
- Higher levels of gross farm income
Regression results:

Factors associated with lower ratings of soil health knowledge and capacity:

- Higher scores on the government policy motivations for conservation practice adoption scale
- Higher level of education

Neutral factors:

- Age
- Owned land
- Rented land
- Livestock
Regression results table:

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<th>Std. Beta</th>
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\[ F=48.514***; \text{Adjusted R Square} = .388 \]
In-depth interview data from qualitative research with Iowa Farm Environmental Leader Award Winners

• Worked with Master’s student Hanna Bates, who conducted in-depth interviews for her thesis project
• Interviews with 28 Iowa Environmental Leader Award recipients conducted over summer and fall of 2014.
• Questions in a standard “protocol” focused on family farm history, current management practices. What motivated these exemplary stewards?
• No specific questions about soil health were asked, but most farmers spoke at length about it…
Quotes from In-Depth Interviews: Tillage and Soil Health

Q. What are the main priorities for your farm from year to year?
A. …to not move that soil horizontally any more than you have to so you don’t kill the worms. See, you talk about earthworms…people look at you screwy, but over the last two years when I dig in that ground looking for the seed to see how deep it is… I used to take my pliers because it was so packed. Now I can just take my hand and it’s firm and you always find earthworms. To not move that ground, to keep the tilth, and let them do the tilling for me….You’ve seen seagulls following behind the anhydrous sprayers in the fall--you know what they’re doing? They’re eating our tillers. We don’t have any seagulls following our planters anymore in our fields. You tell that to some people and they look at you like you’re a fruit loop….We went out there after a rain and you walk in that ground and its firm in the middle and you find these leaves partially – last year’s corn partially pulled down in these holes – it’s worms doing that. You actually stand there when it’s quiet and you step, you can hear the worms going down. You think I’m goofy don’t you?
Quotes from In-Depth Interviews: Tillage and Soil Health

We had a strip till demonstration out here in this field and it was soybeans two years ago. The rain happened the night before and [I thought] ‘Oh man, it’s going to be muddy out here…It was a little muddy. We tilled it just to show people what it was like. Well how deep do you go in the ground? Well, I stuck my hand in you know and it was about that deep you know. I just pulled up some dirt like that. The first thing you know, I say oh look! I got a critter. He’s alive! You know, and a worm comes rolling out of that thing like that. You’d be surprised how many farmers around didn’t never see a critter or an earthworm in their ground. They don’t have them. They use anhydrous, they till up the ground, you know. Every time you move the ground, you wreck their holes you know.
We don’t use anhydrous. People say, why? …there’s several reasons – I might as well go into that now, now that I think of it. Anhydrous. If I give you an anhydrous hose and I take the liquid hose. You hold it above your head and I’ll hold it above my head, you open your valve and I’ll open mine. You’re going to be dead froze. I’m going to be sticky-icky, okay? I’m going to live, okay? The same thing happens, I think, in the soil. When you put liquid cold nitrogen into the ground, which is anhydrous, you kill the bugs and critters and night crawlers in the ground. Where you put the liquid in the ground, they can maybe get sticky, but they’re still going to survive and live. So I use the liquid so I can get more critters and microorganisms in the ground growing, so that’s the process we do there.
Quotes from In-Depth Interviews: Fertilizer and Soil Health

We haven’t used ammonia for over 20 years. We made that decision based on the idea that we…were interested in plant health…soil health. We actually planted earthworms and night crawlers in several of the fields to get a population of those worms that are very beneficial. We were told that the application of anhydrous kills all the microbes in the zone and we understood that. I had a relative come back from the army and…they’d drop him in to blast trees out and set up an airfield, he says they would put on anhydrous ammonia to make the ground hard and like a rock, so they could land planes there. I thought well, that kind of fits because we want the ground loose and…a capacity to hold moisture so that it will carry that crop longer. It just makes more sense. And so all those things contributed to the decision to quit using anhydrous ammonia.
Quotes from In-Depth Interviews: Landlords and Soil Health

I sent pictures – you know in the fall when you’re driving around you look at the dirty ditches, the snow-blowing dirt, you take a picture of a dirty ditch that’s all black from the snow blowing dirt…[then] you drive down the road a little bit farther and you find this corn stalk field that’s standing corn stalks and the snow is white in the ditch you know? I took several pictures of those, and you send them to your landlords and say, which field is yours? They come back – I hope it’s the one with the white snow, you know? So I say, yes it is. This is the reason I do that, because I want to keep your soil where it is….It’s hard for the average farmer to say that.
What factors are associated with soil health knowledge and capacity for action?

- Perceived benefits and concerns
- Awareness of soil health information
- Greater stewardship ethics
- Opinion leadership
- Landlord support?
Overall conclusions

• Concept of soil health resonates with farmers

• It can help bridge short-term and long-term planning and thinking because the primary benefits accrue to farmers themselves and the next generations

• Benefits also accrue to society: The practices that lead to healthy soils-no-till, cover crops-can also result in: soil building, water quality, carbon sequestration, etc.

• Need to continue to raise awareness and capacity among farmers, landlords, other stakeholders
Questions for this panel session

• How do farmers (and landlords, and crop advisers for that matter) learn about soil health, and how to improve it?
• What strategies are best to reach more farmers and other stakeholders with soil health information and know-how?
Farmers’ preferred information pathways:
Soil and water conservation information

- One-on-one Consultation: 36.4%
- Workshops, Trainings, Meetings: 44.5%
- Downloaded Publications: 19.9%
- Online Videos, Webcasts: 12.4%
- Social media like Twitter, Facebook: 1.7%
- “Apps” for a Smartphone or Tablet: 2.2%

Source: 2016 Iowa Farm and Rural Life Poll
Who do farmers trust most for soil and water conservation information?
Percent somewhat or strongly trust

- Iowa State University (e.g., Extension field staff, campus researchers, field...): 71.0%
- Family members who farm: 67.4%
- Other farmers who farm close by: 67.3%
- USDA/NRCS/Soil and Water Conservation District Service Center: 52.7%
- Iowa Department of Agriculture and Land Stewardship: 48.6%
- Local agricultural retailer(s) (e.g., fertilizer, agricultural chemical dealer,...): 48.6%

Source: 2016 Iowa Farm and Rural Life Poll