



Social Science Research Informing Promotion of Soil Health Practices

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Goals for today's presentation

- Present survey data on Iowa farmers' perspectives on soil health
- Summarize findings from recent reviews of social science research on soil and water conservation practice adoption (and non-adoption)
- Discuss ways agricultural stakeholders can help facilitate more widespread adoption of soil health practices

Structureless

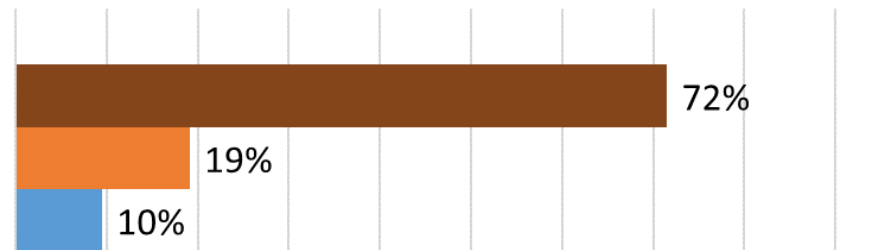
Good Structure

Research on farmer soil health perspectives?

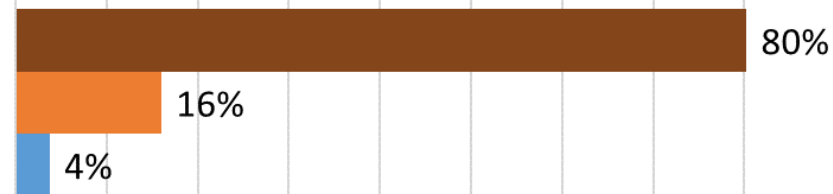
- Given the interest in soil health in conservation circles, farm press, private sector firms, surprisingly little research on farmer perspectives
- Iowa Farm and Rural Life Poll only survey research (?) to ask farmers questions specific to soil health
- Worked with Ron Nichols, USDA NRCS Communication Specialist behind “Unlock the Secrets of Soil” campaign and NRCS soil scientists to develop questions for 2015 and 2017 surveys
- Questions on 1) knowledge of soil health, 2) perceived benefits of healthy soils, 3) actions taken to improve soil health

Soil health awareness

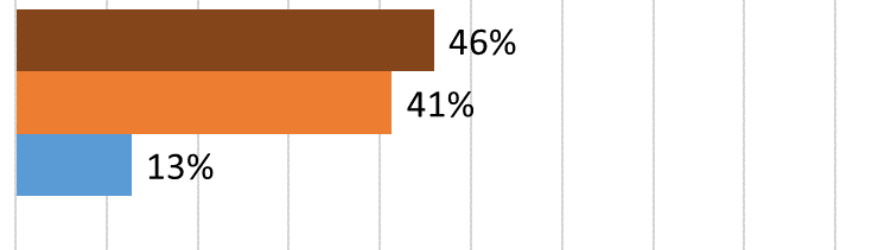
I have paid more attention to soil health in the last couple of years



I have noticed more discussion of soil health in the farm press in the last couple of years

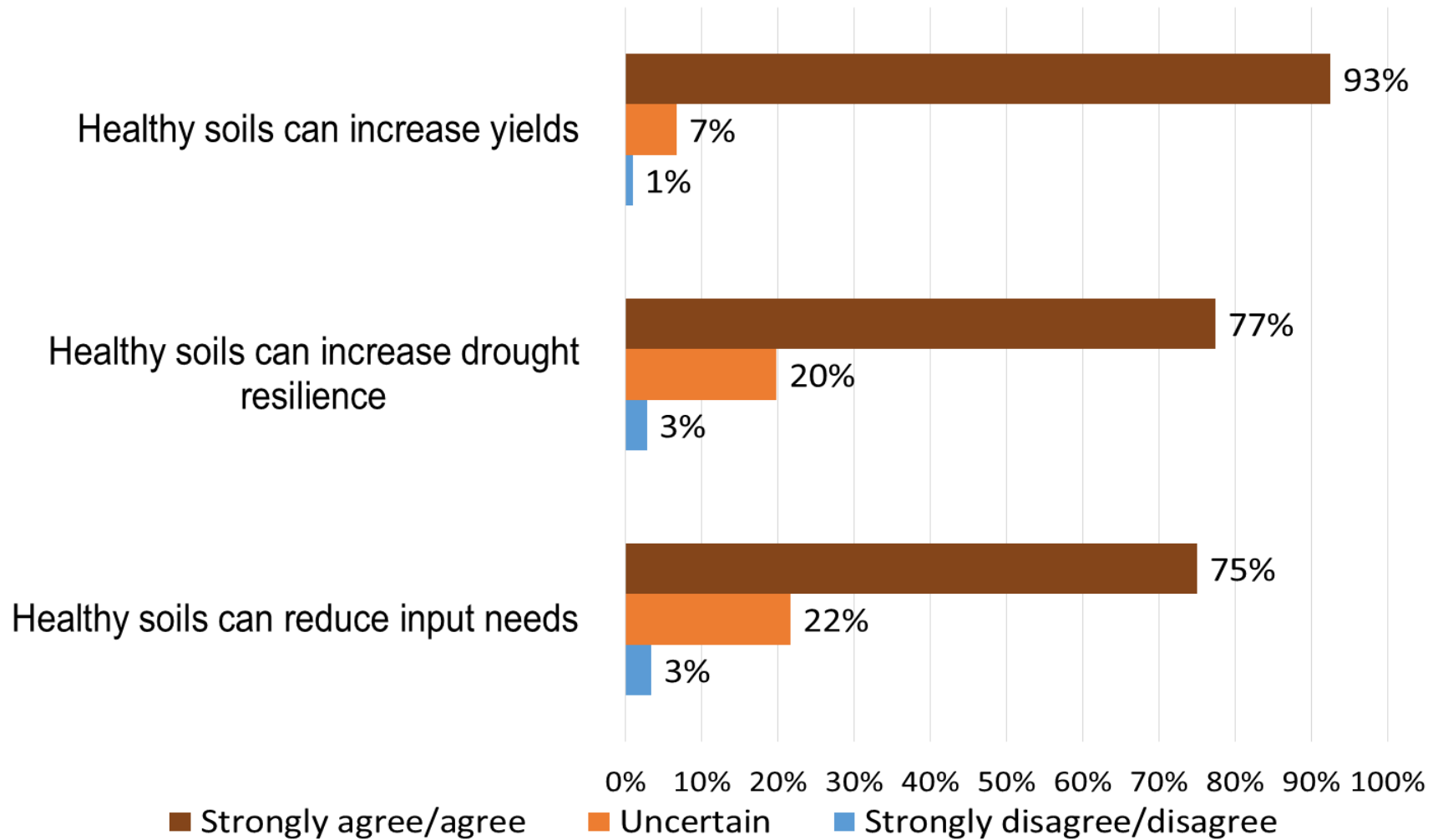


I have noticed more discussion of soil health among fellow farmers in the last couple of years



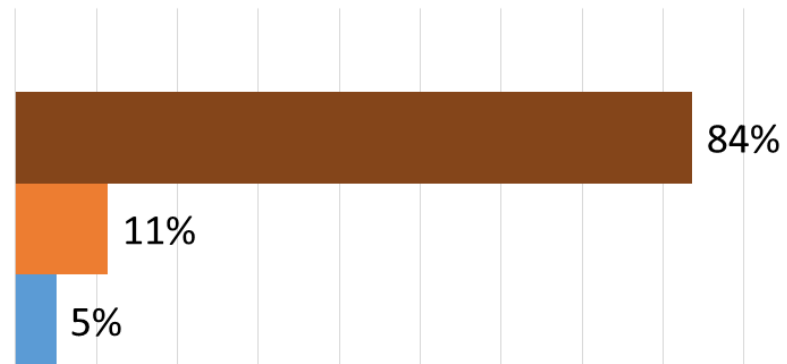
Strongly agree/agree Uncertain Strongly disagree/disagree

Soil health potential benefits

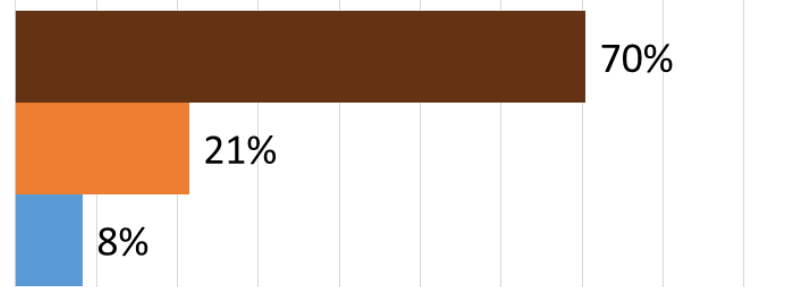


Soil health concerns

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



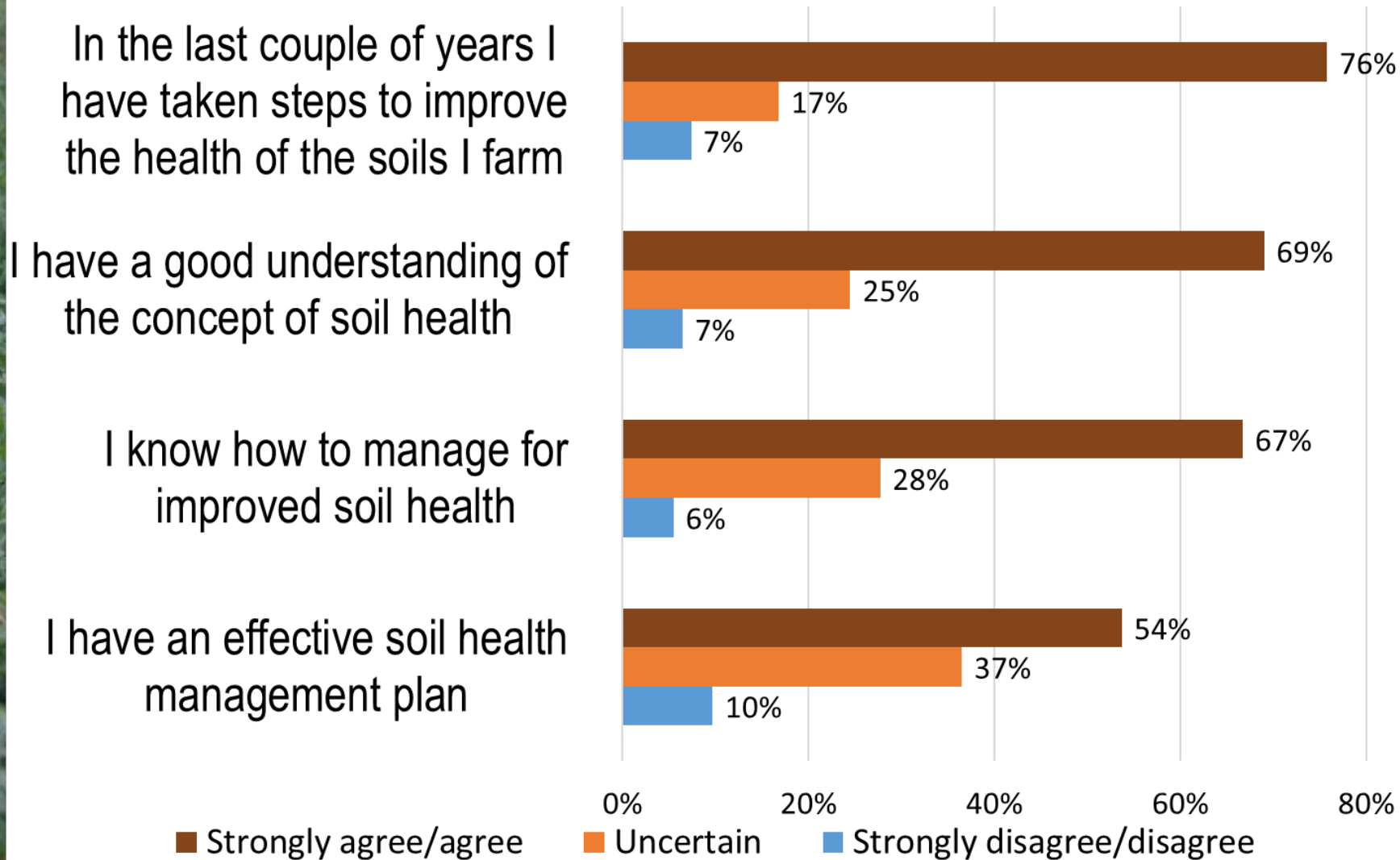
I am concerned about the impact of pesticides (herbicides, insecticides, fungicides) on soil health



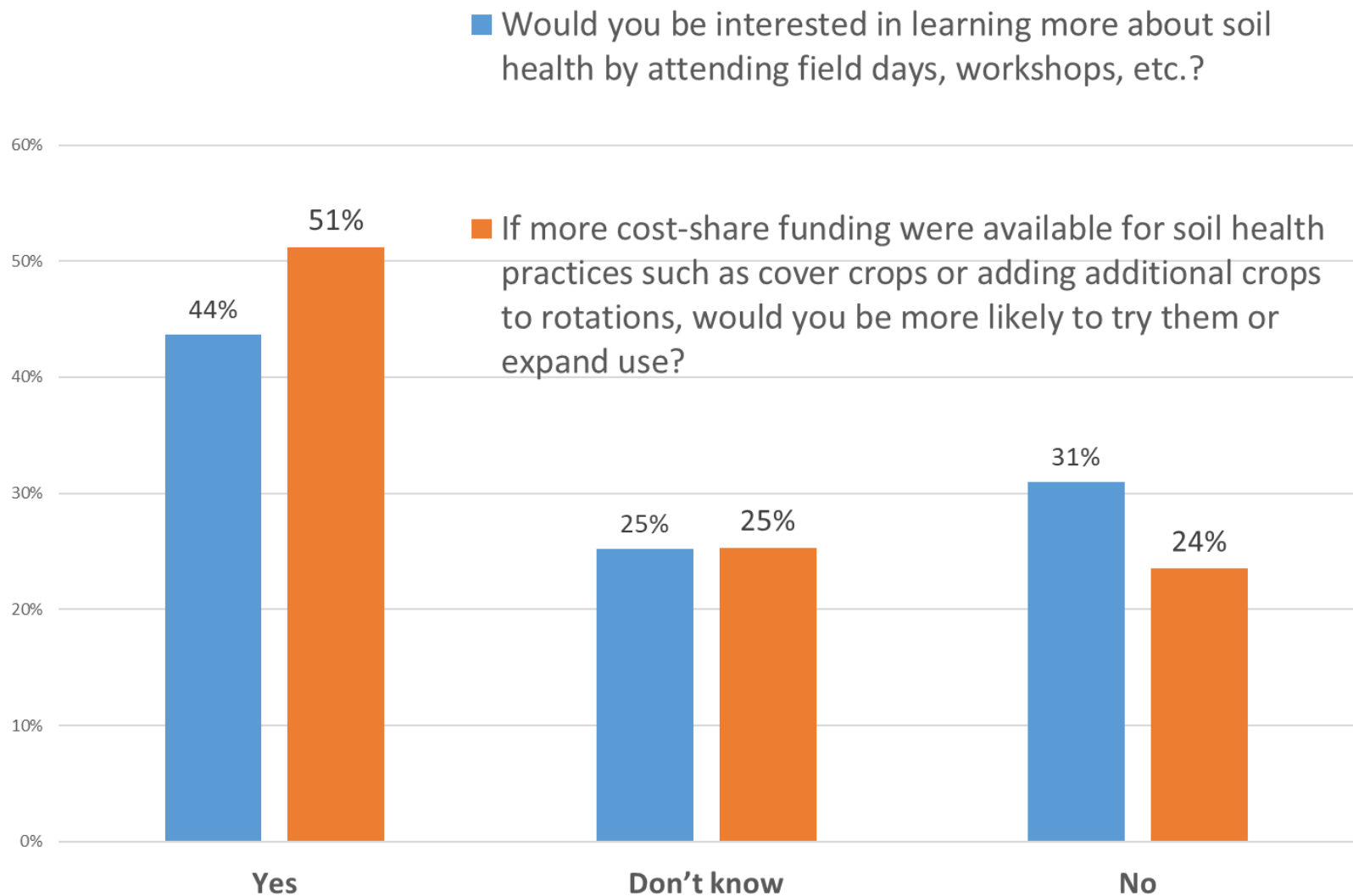
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■ Strongly agree/agree ■ Uncertain ■ Strongly disagree/disagree

Soil health knowledge and action



Interest in soil health



Summary: Soil health awareness, attitudes, action

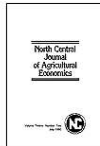
- Most Iowa farmers believe that healthy soils have productivity benefits, can reduce input needs, and can lead to drought resilience
- They are also concerned about the potential negative impacts of pesticides, heavy equipment, on soil health
- Most Iowa farmers have heard more about soil health in last few years, many want to learn more

A lot of social science research on soil health-related practices: Cover crops, no-till, extended rotations, etc.

Are cover crops being used in the US corn belt?

J.W. Singer, S.M. Nusser, and C.J. Alf

Abstract: The benefits of using cover crops are well established, but adoption in agronomic farming systems is unknown. The objectives of this study were to quantify cover crop use



JOURNAL ARTICLE

Farm Family Resources and the Adoption of No-Plow Tillage in Southwestern Wisconsin

John Belknap and William E. Saupe

North Central Journal of Agricultural Economics
Vol. 10, No. 1 (Jan., 1988), pp. 13-23 (11 pages)
Published By: Oxford University Press

<https://doi.org/10.2307/1349232>

doi:10.2489/jswc.73.2.143

Farmer adoption of cover crops in the western Lake Erie basin

E. Burnett, R.S. Wilson, A. Heeren, and J. Martin

Abstract: Runoff from agricultural nutrient applications is the most significant human factor leading to phosphorus (P) loading and water quality issues in western Lake Erie. Recent

doi:10.2489/jswc.71.1.29

Perceptions and use of cover crops among early adopters: Findings from a national survey

M. Dunn, J.D. Ulrich-Schad, L.S. Prokopy, R.L. Myers, C.R. Watts, and K. Scanlon

Journal of Agricultural and Applied Economics (2019), 1-18
doi:10.1017/aae.2019.20

CAMBRIDGE
UNIVERSITY PRESS

RESEARCH ARTICLE

Adoption of Cover Crops by U.S. Soybean Producers

Seungyub Lee* and Laura McCann

Department of Agriculture
*Corresponding author.

doi:10.2489/jswc.70.6.418

Abstract
Using cover crops

Cover crop adoption in Iowa: The role of perceived practice characteristics

J.G. Arbuckle Jr. and G. Roesch-McNally

Abstract: Cover crops are widely viewed by the soil and water conservation community to be an effective means for reducing soil erosion and nutrient loss and increasing soil health, yet relatively few farmers have adopted the practice. Despite the widespread recognition of

Water Resources Research

RESEARCH ARTICLE
10.1029/2017WR022385

Key Points:
• Agriculture's negative water quality impacts can be mitigated by cover crops

Conditional Causal Mediation Analysis of Factors With Cover Crop Adoption in Iowa, USA

Danhyang Lee¹, J. Gordon Arbuckle², Zhengyuan Zhu¹, and Laurie Norton³

¹Department of Statistics, Iowa State University of Science and Technology, Ames, IA, USA, ²

Cover crops use in Midwestern US agriculture: perceived benefits and net returns

Alejandro Plastina¹, Fangge Liu¹, Fernando Miguez² and Sarah Carlson³

¹Department of Economics, Iowa State University, 478 Heady Hall, Ames, IA 50011, USA; ²Department of Agronomy, Iowa State University, 1206 Agronomy Hall, Ames, IA 50011, USA and ³Practical Farmers of Iowa, 600 Fifth Street, Suite 100, Ames, IA 50010, USA

Renewable Agriculture and Food Systems: Page 1 of 12

doi:10.1017/S17421705170

The trouble with cover crops: Farmers' experiences with overcoming barriers to adoption

Gabrielle E. Roesch-McNally^{1*}, Andrea D. Basche², J.G. Arbuckle³, John C. Tyndall⁴, Fernando E. Miguez⁵, Troy Bowman⁶ and Rebecca Clay⁵

Midwestern US Farmers Perceive Crop Advisers as Conduits of Information on Agricultural Conservation Practices

Francis R. Eanes, Ajay S. Singh, Brian R. Bulla, Pranay Ranjan, Linda S. Prokopy, Mary Fales, Benjamin Wickerham & Patrick J. Doran

Environmental Management 60, 974-988(2017) | Cite this article

644 Accesses | 8 Citations | 15 Altmetric | Metrics

Social science research on soil health-related practices: Two recent reviews of adoption research, 1982 - 2017

Paper #1: Prokopy et al. 2019

doi:10.2489/jswc.74.5.520

Adoption of agricultural conservation practices in the United States: Evidence from 35 years of quantitative literature

L.S. Prokopy, K. Floress, J.G. Arbuckle, S.P. Church, F.R. Eanes, Y. Gao, B.M. Gramig, P. Ranjan, and A.S. Singh

Abstract: This is a comprehensive review of all published, quantitative studies focused on adoption of agricultural conservation practices in the United States between 1982 and 2017. This review finds that, taken as a whole, few independent variables have a consistent statistically significant relationship with adoption. Analyses showed that variables positively associated with adoption include the farmer self-identifying primarily as stewardship motivated or otherwise nonfinancially motivated, environmental attitudes, a positive attitude toward the particular program or practice, previous adoption of other conservation practices, seeking and using information, awareness of programs or practices, vulnerable land, greater farm size, higher levels of income and formal education, engaging in marketing arrangements, and positive yield impact expected. Some variables often thought to be important, such as land tenure, did not emerge as consistently important in this cross-study review. Other variables, such as farmers' sense of place, training, presence of institutional conditions supporting adoption, and the role of collective decision making are not measured in enough studies to draw conclusions but potentially have a relationship with adoption decisions. Implications for how to promote conservation adoption and directions for future research are discussed. Because positive attitudes and awareness of conservation programs or practices are positive

associated with conservation included education, capital, income, farm size, access to information, positive environmental attitudes, and social networks (Prokopy et al. 2008).

Since these papers were published, the literature exploring the determinants of conservation practice adoption has grown substantially. During the last decade, we know of five attempts to synthesize this burgeoning literature. Tey et al. (2017) focused their efforts on synthesizing 31 studies conducted in what they categorize as developing countries, identifying several socioeconomic and agroenvironmental factors that were relatively consistent predictors of conservation adoption in that context. Liu et al. (2018) took a more global view and look at conservation adoption studies from a diversity of countries; however, their review does not follow a systematic approach and includes review articles, summary fact sheets, and a mix of qualitative and quantitative studies. It is unclear how Liu et al. (2018) categorized and analyzed the studies, which makes it challenging to draw conclusions. Carlisle (2016) performed a narrative review of 43 studies in the soil health literature in the United States (both quantitative and qualitative) and found that farms and farmers are too heterogeneous for decisions and behaviors to be explained by rational actor models. Boussey et al. (2017)

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Paper #2: Ranjan et al. 2019



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Synthesizing Conservation Motivations and Barriers: What Have We Learned from Qualitative Studies of Farmers' Behaviors in the United States?

Pranay Ranjan, Sarah P. Church, Kristin Floress & Linda S. Prokopy

To cite this article: Pranay Ranjan, Sarah P. Church, Kristin Floress & Linda S. Prokopy (2019) Synthesizing Conservation Motivations and Barriers: What Have We Learned from Qualitative Studies of Farmers' Behaviors in the United States?, *Society & Natural Resources*, 32:11, 1171-1199, DOI: [10.1080/08941920.2019.1648710](https://doi.org/10.1080/08941920.2019.1648710)

To link to this article: <https://doi.org/10.1080/08941920.2019.1648710>

Study Identification Strategy

- US farmer adoption of soil and water conservation practices
- Team Ag BMP collectively identified 100 articles
- 175 additional articles from 1982 - 2017
 - Google Scholar: reverse searches from 2008 and 2012 studies
 - SCOPUS and Web of Science: Boolean searches with multiple criteria, needed to include implement, adopt, willing, or participate
- 107 quantitative adoption studies: Paper #1
- 49 qualitative adoption studies: Paper #2



Major Themes from the Research

- Reviews identified the most consistent predictors of soil and water conservation practice adoption, both negative and positive
- I have pulled key quotes from selected quantitative and qualitative studies to exemplify findings, primary focus on cover crops, no-till, extended rotations
- Guiding question: What are the major barriers to and facilitators of practice adoption?

Negative predictors: Barriers to adoption

- **Perceived risks: Potential yield loss**

- “I've never [done] cover crop. I can see some benefits of it. But when you get looking at the financial end of it and then in the interim who's paying for that for the producer and reduction in yields or whatever?” (Ranjan et al. 2020, 8)
- That’s the only downfall I see in cover crops...it’s going to suck some moisture out. They say it don’t, but it does something...and once you get that off in there and it turns out dry, you’re hurting (Arbuckle and Roesch 2015, 426)

Negative predictors: Barriers to adoption

- **Perceived risks: Timing**

- “We’ve all identified that, when you need to put cover crop on, if it’s after harvest, it’s ... not everybody has that time (Roesch-McNally et al. 2017, 5)
- “I've talked to a lot of the cover-crop guys...and if you're going to try and do it after tillage, our growing season is so short that I don't know what around here is probably going to work...So now I've got to not only address cover crops...but then I also have to address my management because if I'm going to rip or do any fall tillage, then cover crops doesn't fit in that.” (Ranjan et al. 2020, 12)
- “If you're talking [about] cover crops...It’s a timing thing...you get such small windows of time where you can do something that's a positive thing rather than a negative thing. I don't know how you throw that [cover crops] into the mix when you're trying to just take care of business.” (Ranjan et al. 2020, 12)

Negative predictors: Barriers to adoption

• Cost

- “Just take [cover crops] as one example. I work for NRCS. I see all the data. I've listened to all that stuff. But then, I also look at, ‘Okay, it's \$30 an acre.’ That's a big cost. I mean, in my budget right now, it's a big cost.” (Ranjan et al. 2020, 8)
- “It's getting cheaper now but what does it cost to establish that [cover crop]? Well I got a deal here. We can fly it on for US\$45 an acre. Well then and what does it cost me to kill it? They've done the math before and without the incentives, the CSP program, last year's EQIP, last year's state of Iowa incentive programs, it's hard to put the math to cover crop unless you can put a number, a dollar value on that nitrate saved” (Roesch-McNally et al 2017, 6)

Negative predictors: Barriers to adoption

- **Lack of self-efficacy, perceived effectiveness of practice**

- “A second finding was that lower levels of perceived agronomic capacity to implement conservation practices was associated with lower likelihood of cover crops adoption. In other words, farmers who tended to view nutrient loss reduction as a difficult challenge were less likely to use cover crops.” (Lee et al. 2018, 15)
- “Results also revealed that farmers were more likely to already use cover crops if they were more willing to take risks, had more education, greater response efficacy, had more owned acreage, and had a higher sense of control over nutrient loss” (Burnett et al. 2018, 151)

Negative predictors: Barriers to adoption

- **Structural factors: Lack of infrastructure**

- “At a structural level, a major factor that may influence adoption of cover crops is the historic and normative trend toward industrial, commodity-oriented monoculture systems” (Roesch-McNally et al. 2017, 3)
- “Many Iowa farmers believe that if more facilitating infrastructure—educational, institutional, and technical—were available to them, they would be more likely to use cover crops” (Arbuckle and Roesch 2015, 426)

Negative predictors: Barriers to adoption

• Structural factors: Rented land

- “...short-term lease arrangement is the biggest barrier in my mind. If you're going to keep the land 10 years, and you have the organic matter higher and less erosion, it [adopting conservation practices] was worth it, I am convinced...I think year-to-year leases are a big barrier...” (Ranjan et al 2019a, 216)
- “Right. I think that's where the biggest rub's going to be, is if your landlord is on this. And a lot of them-- my mother, I rent some ground from her...the first three years I put cover crops...She says, ‘Well, you got some weeds [on] your own field...How'd your weeds get so bad? Nobody else's looks like that.’ And this is my own mother.” (Ranjan et al. 2020, 15)

Positive predictors: Facilitators of adoption

- **Perceived benefits of practices**

- “Farmers with higher scores on the perceived benefits scale were more likely to have planted cover crops in 2013. Conversely, farmers with higher scores on the perceived risk scale were less likely to have planted cover crops” (Arbuckle and Roesch 2015, 424).
- “I think the cover crops really served as the kicker to get me thinking differently about, really, farming in general and to start thinking about something other than yield. If your [soil] medium is gone there's no point in farming... even if you're...I mean, [maybe] you're giving up five bushels 1 year, but you could be giving up your entire way of living in short order, 40 years maybe.” (Roesch-McNally et al. 2017, 7)

Positive predictors: Facilitators of adoption

- **Perceived compatibility**

- “Cover crops’ compatibility with a producer’s current farming system was important for every producer who had adopted it. They were using annual ryegrass specifically because they were practicing no-till. Annual ryegrass was seen as beneficial for no-till because of its deep root system” (Reimer, Weinkauf, and Prokopy 2012, 126).
- “...our findings show that conservation practices should be compatible (or perceived to be compatible) with farmers’ farm management needs; especially in-field practices (e.g., cover crops) that would change farmers’ current management strategies” (Ranjan et al 2019b, 1188)

Positive predictors: Facilitators of adoption

- **Systems thinking**

- “Our results indicate that farmers who had implemented cover crops were thinking about their farms as an interconnected system....These results reflect what has emerged in other research – conservation adopters have a systems thinking approach to farm management and decision-making” (Church et al 2020, 4).
- “I look at it as a system. You got to do the whole system. You can’t nitpick. You got to manage your nitrogen. You got to get good soil/seed contact cause you’re planting into a mass of roots sometimes and you need to do everything. Just to do one piece? One piece...it doesn’t work, they get discouraged and say that’s no good and they’re not going to do it anymore. You need to do everything” (Roesch-McNally et al. 2017, 6)

Positive predictors: Facilitators of adoption

- **Supportive landlords**

- “The presence of a supportive landowner or not renting also emerged as a significant factor. Those who consider their landowner supportive of cover crops or who don’t rent land are more likely to have larger proportions of their land dedicated to the practice.” (Dunn et al. 2016, 36)
- “[Some landlords] are supportive of their renters taking conservation-oriented action on the land, and very willing to provide this support through such action as extending the length of their operator’s lease to facilitate implementation of conservation practices on their land.” (Petrzelka et al. 2020, 14)

Positive predictors: Facilitators of adoption

- Seeking and using information, especially from trusted actors

- “...I tend to look towards university sources and research that you tend to interpret them as being unbiased...you don't necessarily put as much faith in commercially-funded research that is promoting their products. It's a little harder to trust even if it is maybe fine research...I tend to think a lot of times I'll look to the university research, University of Illinois, Purdue, sources that you feel are trusted and unbiased.” (Ranjan et al. 2020, 23)
- “Trust, or lack thereof, in sources of information in general, or in specific sources of information such as farmers, watershed groups, conservation agencies, and university extension, emerged as an important theme that motivated or hindered adoption of conservation practices.” (Ranjan et al. 2019b, 1183)
- [Crop advisors] indicated that they were most likely to recommend practices associated with soil health, specifically in-field practices such as soil testing, nutrient management, and cover crops, which CAs perceive as highly effective, and which fit squarely within CAs' functional role of providing operational and tactical advice related to crop production” (Eanes et al 2019, 368)

Positive predictors: Facilitators of adoption

- **Diversified systems, Livestock**

- “Farmers with more diverse cropping systems were substantially more likely to have planted cover crops in 2013. Likewise, farmers who reported having livestock were more likely to have adopted cover crop.” (Arbuckle and Roesch 2015, 425)
- But you need livestock to make that work. I mean, they're using a Kura clover [cover crop] and, when you get clover established...And then third year, you've got to let it recoup so you don't kill the clover out and they're doing it, but you need livestock.





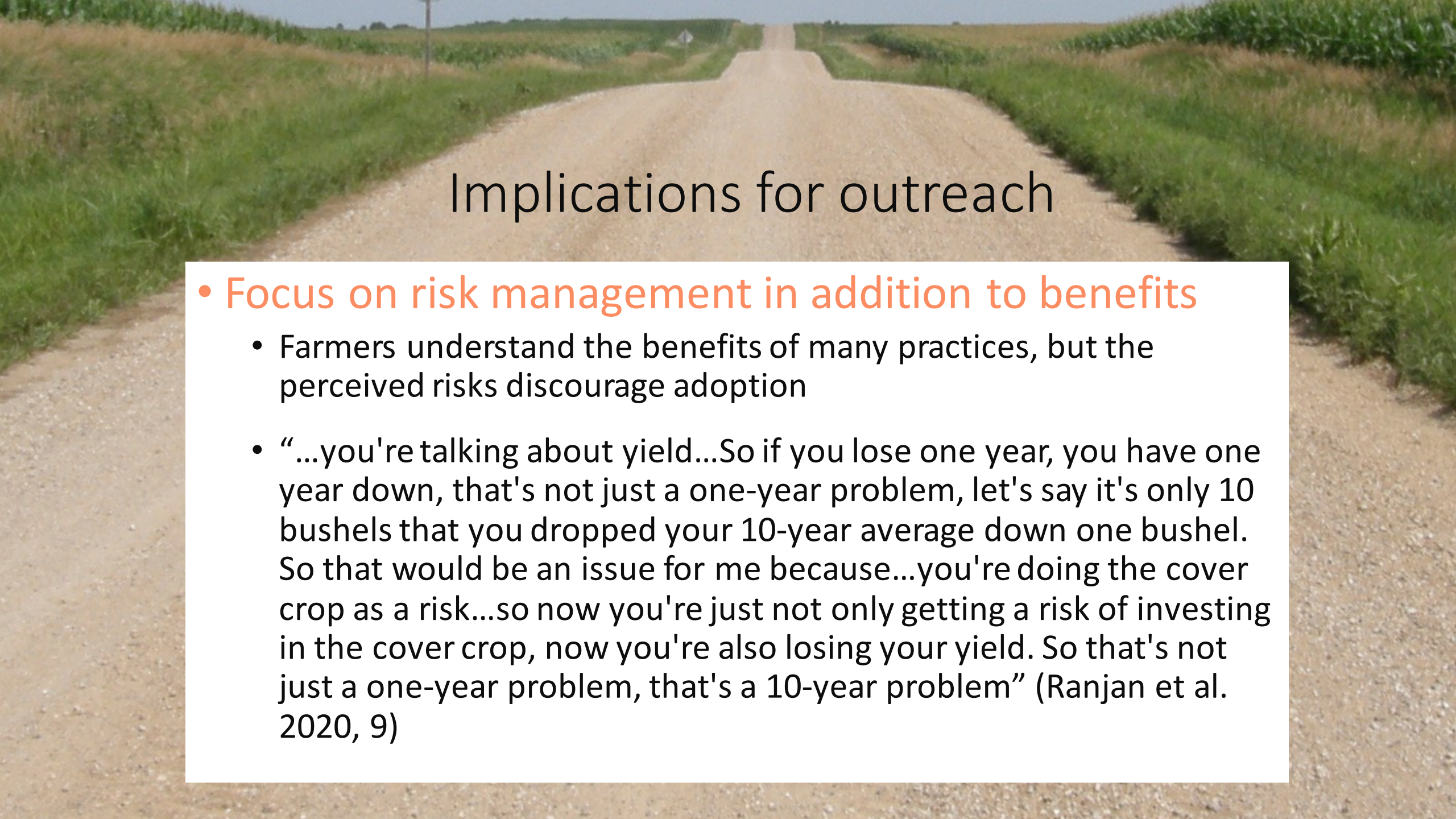
Positive predictors: Facilitators of adoption

- **Awareness, concern about soil and water issues, soil health**
 - “You’re trying to think ahead and say, how can I make that soil more resilient or able to handle the stresses . . . , whether it’s a dry stress or too much rain or something like that, you know? By having that structure and those roots there [from using cover crops] and holding on to that soil and maybe, hold on to more nutrients through [the winter].” (Roesch et al. 2018, 156)
 - “Building tilth in the soil...that’s going to be the main thing that a farmer’s going to say, or, where’s the payback on this...how can I make that soil more resilient or able to handle the stresses...By having that structure and those roots there and...holding on to that soil and maybe, hold on to more nutrients...if we can keep those loose nutrients out of our water and use them to build organic matter...then that’ll be a plus. (Arbuckle and Roesch 2015, 425)

Positive predictors: Facilitators of adoption

Other important factors:

- Attitudes toward programs and practices
- Program participation
- Use of complementary practices, e.g., no-till->cover crops
- Stewardship identity, ethics
- Farm size and income: Larger scale operations more likely to use cover crops



Implications for outreach

- **Focus on risk management in addition to benefits**

- Farmers understand the benefits of many practices, but the perceived risks discourage adoption
- “...you're talking about yield...So if you lose one year, you have one year down, that's not just a one-year problem, let's say it's only 10 bushels that you dropped your 10-year average down one bushel. So that would be an issue for me because...you're doing the cover crop as a risk...so now you're just not only getting a risk of investing in the cover crop, now you're also losing your yield. So that's not just a one-year problem, that's a 10-year problem” (Ranjan et al. 2020, 9)

Implications for outreach

- Farmers prefer incremental change
- Start small, help farmers trial
 - “I think you have to do it [adopt cover crops] in moderation because we had a farmer that did all of these...corn acres the following fall with ryegrass and he had a local fertilizer plant spread to kill it in the spring. But the day they wanted to do it and the day they had to do it was not the day he wanted it done. And that's where his mistake came. And the weather changed, and they couldn't get back to it. And when he put the planter in there, everything wrapped around the chain, so that's why I say you have to do things in moderation.” (Ranjan et al. 2020, 24)

Implications for outreach

- Farmers interested in longer term, flexible funding support
- Think about innovative support to help farmers through learning phase
 - “I think the cost-share has to be available year after year. It can't just be as, ‘We'll start you out with 25 acres for one year, and then you're on your own’” (Ranjan et al. 2020, 25)
 - “...a hassle [associated with conservation adoption] for a 2-year program versus a hassle for a 10-year program, okay, it's worth the hassle [for a 10-year program], but at 2 years, maybe it's not worth the hassle” (Ranjan et al. 2020, 26)

Implications for outreach

- Local demonstration is important to farmers
- Develop more, larger-scale demonstration projects
 - “...one of the comments I hear [from farmers] is they don't trust test plots. It's not a big enough data sample... It's like, ‘...[that] probably is true for that little speck. But what about the whole farm...?’ So, having a bigger sample” (Ranjan et al. 2020, 26)
 - “It's got to be from a farmer in our area...It doesn't matter to me if it comes from Purdue or Illinois or anywhere. It's got to come from someone in this area on these soil types...What matters is the people in this area that have grown it on 80 acres and averaged that yield. Then we'll go for it.” (Ranjan et al. 2020, 27)

Implications for outreach

- **Improve outreach to non-operator landowners, farm managers**
 - “They [landowners] would have to at least understand, same as the farmer, that there's a value in conservation. Same message that you got to convince me that the cover crop has a value, and it affects my bottom line...This has a value...if you convince them that they're protecting their long-term investment, there's maybe even more of a value to them than even I have on a year-to-year [lease] where I'm just struggling to make my tractor payment or combine or whatever.” (Ranjan et al. 2020, 29)
 - “...farm managers, they have to encourage it [conservation] with the landowners. And then, of course, then they can pick and choose who they want to farm on the ground because of that...farm managers manage a lot of this rented ground. Not all, but a lot of it...their bottom line is affected by 12% or 10% or whatever the gross, and if they aren't getting very much gross, they don't get very much return. So again, they have to educate the landowner.” (Ranjan et al. 2020, 29)



Implications for outreach

- **Other important considerations**

- Research-based information on fertility, soil health, yield impacts
- Diversifying partners: Watershed groups, municipalities, NGOs, commodity groups, ag retailers, etc.
- Segmentation: What's the right message for this particular person, group?

Final note on soil health

- Concept of soil health resonates with farmers
- Soil health can be an “integrative concept” that helps farmers think holistically, systems thinking
- It can help bridge short-term and long-term thinking because farmers perceive that the primary benefits *accrue to **them** and the next generations*
- And, the practices that lead to healthy soils-no-till, cover crops- can also result in major on- and off-farm societal benefits: soil building, water quality, carbon sequestration, etc.

Acknowledgments

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A wide-angle photograph of a lush green field filled with numerous yellow and white wildflowers. The field stretches towards a gentle rise in the distance under a clear sky. A white rectangular box is overlaid in the upper left corner.

Thank you!

A wide-angle photograph of a lush green field filled with numerous yellow and white wildflowers. The field stretches towards a gentle rise in the distance under a clear sky. A white rectangular box is overlaid in the center of the image.

Questions?