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The Social Factors Influencing Cover Crop Adoption in the Midwest: A Controlled Comparison

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Abstract

Increased funding and resources have become available in recent years for agricultural producers to plant cover crops to improve soil health and prevent nutrient loss and erosion; however, cover crop adoption remains relatively low and has been uneven across different Midwestern counties. This study employed a controlled comparison method to investigate the social factors affecting cover crop adoption in Iowa, Illinois, and Indiana. In each state, the authors compared pairs of neighboring counties, where one county was a relatively higher adopter and the other was a lower adopter of cover crops, while controlling for variations in climate conditions. Results show that there were multiple factors explaining the difference in cover crop adoption among county pairs. Social factors included attitudes toward cover crops; conservation agency influence; presence of cover crop experts, advocates, and/or entrepreneurs; and collaboration between agencies and the private sector. Other important factors included topography, cattle raising, organic production, and local incentive-based programs. Among these, collaborations between agencies and the private sector played the most important role in explaining why some counties had higher rates of cover crop adoption compared to their neighbors.

Keywords Social indicators · Agricultural best management practice (BMPs) · County-level comparison · Soil health · Qualitative

Introduction

In recent years, cover crops (CCs) have become an increasingly popular practice for addressing soil health issues such as nutrient loss and erosion (Leslie et al. 2017). Around the year 2016, the Midwest saw increased participation in cost-share programs for CCs, including the Environmental Quality Incentives Program (EQIP) and the Conservation Stewardship Program (CSP). Such programs aim to encourage and mainstream CC adoption among producers by providing funds and technical expertise to help them conserve the environment while increasing productivity (NRCS 2020).

In spite of increased funding and resources available for planting CCs, their adoption across different counties in the Midwest has been uneven. One reason for the variation in CC adoption is differences in climate conditions. In more arid areas, it is believed that CCs compete with cash crops for soil moisture and nutrients, which reduces their likelihood of adoption (Unger and Vigil 1998; Alonso-Ayuso et al. 2018; Majka 2020). While climate conditions are important in determining CC adoption, social factors could also help explain why we see different levels of adoption. Earlier studies have pointed to several social factors that could be important; these include environmental stewardship values (Ahnström et al. 2009; Reimer and Prokopy 2014; Roesch-McNally et al. 2018; Prokopy et al., 2019), local leadership (Arbuckle and Roesch-McNally 2015; Moore et al. 2016; Bowman and Lynch 2019; Ranjan et al. 2019), institutions that provide appropriate information and guidance (Baumgart-Getz et al. 2012; Liu et al. 2018), and access to financial resources (Karali et al. 2014; Carlisle 2016).

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Our study seeks to better understand factors that contribute to CC adoption in the states of Iowa, Illinois, and Indiana. To do so, we leverage Operational Tillage Information System (OpTIS) data on CC adoption trends in the Midwest (Hagen et al. 2020). An analysis conducted by Majka (2020) shows that the Southern counties in each state have more CCs than their Northern counterparts, due to higher temperature and precipitation. Nevertheless, even in counties that are located within the same climatic region, i.e., have similar temperature and precipitation, the data show that some counties have higher (and lower) levels of CC adoption than others.

This study builds on Majka's 2020 study to better understand the social drivers of CC adoption in the Midwest. We employed a controlled-comparison approach: we compared pairs of neighboring counties within the same climatic region, where one county had a higher level of CC adoption and the other had a lower level of CC adoption. By minimizing variations in climate, landscape, soil type, population, and proximity to a large city, we were able to better understand the social factors responsible for the difference in CC adoption levels between each county pair. Unlike most studies that focus on assessing individual producer's perspectives on CC adoption, our unit of analysis is the county, and understanding drivers of CC adoption at the county-level.

Methods

Controlled Comparison: Selection of Counties

We used a controlled comparison strategy to select the county pairs in the three I-states. The OpTIS data showed a positive and statistically significant correlation between average precipitation and temperature between January and April and CC adoption over a range of years (2005 – 2018) (Majka 2020). Thus, we selected counties that were similar in population and that were in the same January-April precipitation and temperature ranges but that had different levels of CC adoption.

To determine how the counties in each pair differ in their adoption of CCs, we compared their average CC percentage adoption for 2016, 2017, and 2018. We only considered those three years (as opposed to calculating average CC percentage adoption from 2005- 2018) because in 2016 we observed a noteworthy increase in CC adoption for some counties, and it is in 2016 that strong differences in CC adoption started to appear between different counties in the same climate area. Before 2016, their CC adoption percentage levels were similar.

In Iowa, Illinois, and Indiana, we cross-referenced the applicable precipitation and temperature ranges from January to April that were outlined in Majka (2020) (see Figs. 1 and 2 below), to see which counties were in the same Jan-April climate range.

We selected counties that were similar in terms of proximity to a large city and topography but that had the largest difference in CC percentage adoption from 2016–2018. We included counties in at least two different climate ranges. The neighboring counties with the largest difference in CC adoption but that were in closest proximity to each other (to reduce variation in soil type) were included in our study.

We narrowed down the list to three county pairs per state. In two of the states, some high-adopter counties were counted twice because there were not sufficient high/low CC adopter pairs within the same climate range. Before finalizing our paired counties used for comparison, we contacted key informants in each state (local crop advisors and personnel working at local The Nature Conservancy offices) to confirm with them that the counties were indeed similar and comparable in terms of climate, landscape, soil type, population, and proximity to a large city. Our final list of counties is summarized in Table 1 below. Throughout the remainder of this paper, the term "higher adopter" refers to the county in our controlled comparison pair that had higher levels of CC adoption compared to its neighbor, while the term "lower adopter" indicates the opposite situation.

Data Collection and Analysis

In each county, we conducted focus groups and semi-structured interviews with personnel the Natural Resources Conservation Service (NRCS), the Soil and Water Conservation District (SWCD), the Farm Bureau, the Farm Service Agency, and university extension. We also invited local producers, crop advisors, and members of other relevant organizations such as Practical Farmers of Iowa to discuss drivers of CC adoption in their respective counties. Each focus group had between two and five participants. In addition, we conducted one-on-one interviews with participants that could not attend focus groups due to scheduling conflicts, as well as with crop advisors and agency personnel that operated in two or more counties.

In total, we had 23 interviewees and 31 focus group participants (split across 11 focus groups, which had between two and five participants), for a total of 54 unique participants. Focus groups were conducted over Zoom, while interviews were conducted either on Zoom or by phone. Focus groups lasted between one and 2.5 h, whereas interviews lasted between 30 min and one hour. We collected data during October and November 2020. Interviews were transcribed and coded using NVivo, a software used for qualitative analysis. The codebook was developed jointly by the first author and a coauthor, using the thematic coding strategy (Saldaña 2009). The two

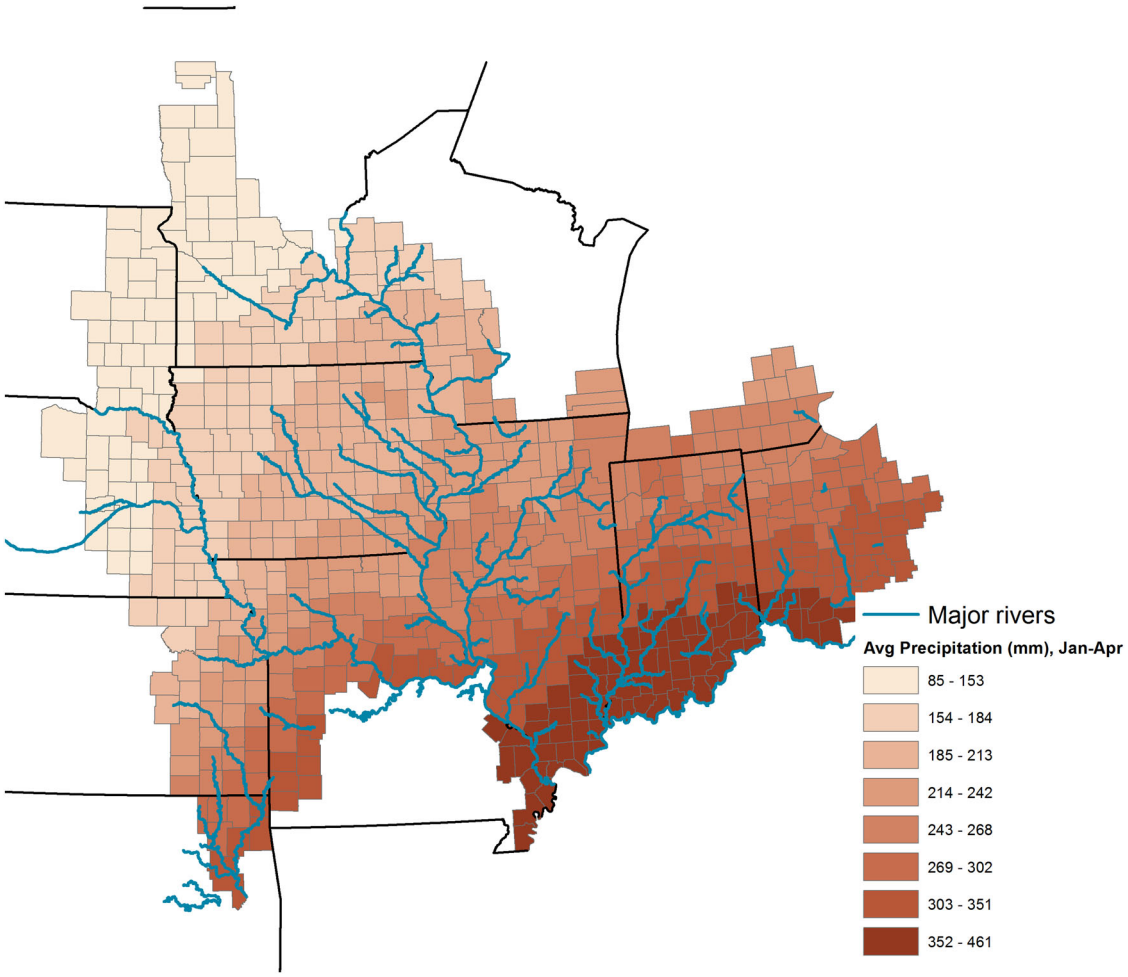

Fig. 1 Average January-April Precipitation. Source: Reproduced from Majka (2020, p. 41)

authors each coded over 10% of the transcripts and achieved an intercoder reliability value (Cohen's kappa) of 0.74, indicating adequate coding consistency between the coders (Viera and Garrett 2005). Additionally, results were summarized in a draft report and sent by email to all 54 research participants for feedback, also known as respondent validation or member check (Torrance 2012). Three participants replied with comments, indicating that they agreed with our research conclusions.

Results

Our results indicate that several social factors contributed to the difference in CC adoption between counties. We found that counties with higher CC adoption presented a "cluster" of social factors that together increased adoption over time. These factors are summarized in Table 2 and are described in narrative form below. County-specific results are found in the Appendix.

The sections below present a narrative description of factors contributing to CC adoption. In the following paragraphs, the names of people remain confidential. Where possible, we provided specific examples and county names. In some cases, when discussing some obstacles to CCs or other more sensitive issues we remained deliberately vague in order to maintain confidentiality, and did not provide county names.

Agency Employees (NRCS, SWCD, Farm Bureau, Extension, etc.) Promote CCs beyond Their Regular Duties

A factor that helped increase CC adoption at the county level was the presence of agency employees (NRCS, SWCD, Farm Bureau, Extension, etc.) that felt they were promoting CCs beyond their regular duties. Some counties had staff that found additional or creative ways to promote CCs. These counties included the following counties: Clarke (IA, higher adopter), Union (IA, lower adopter), and Sioux (IA, higher

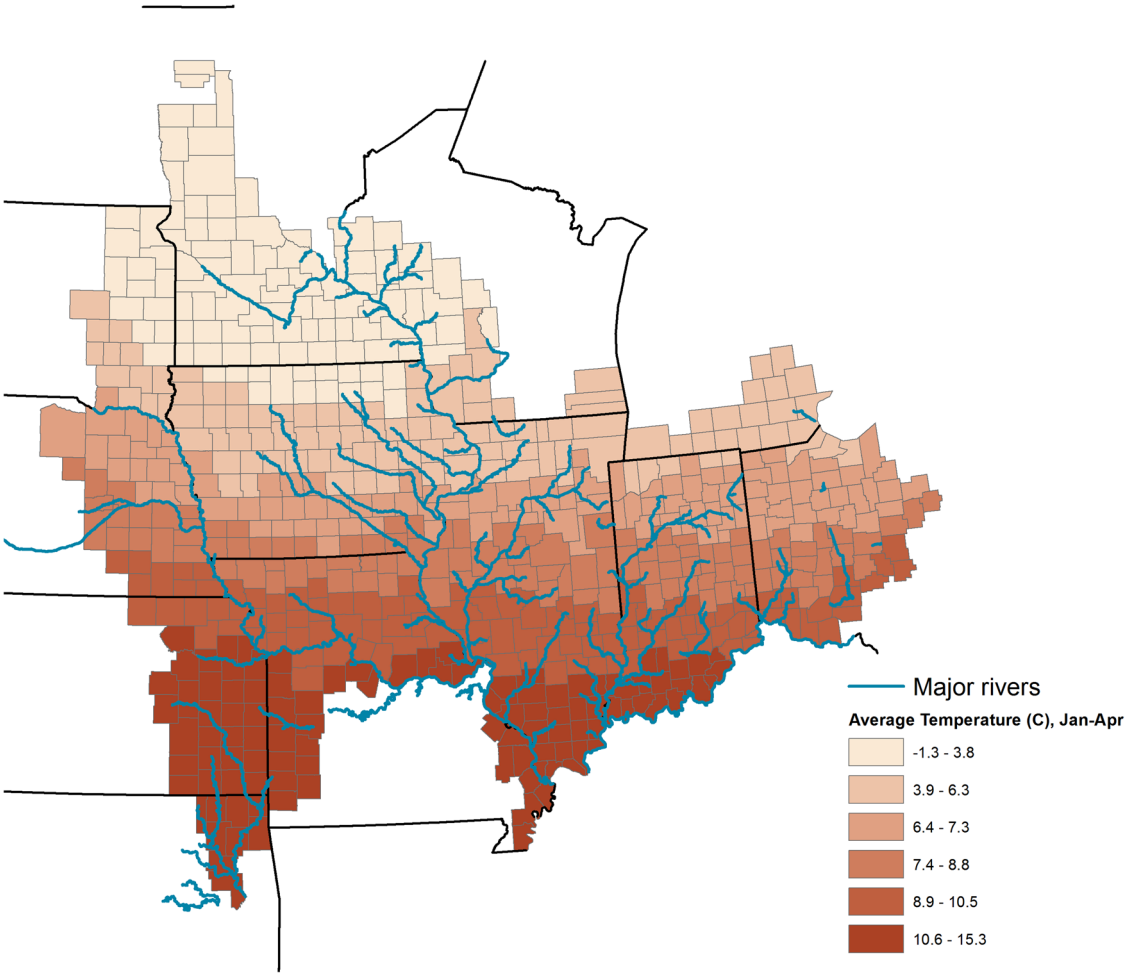

Fig. 2 Average January-April Temperature. Source: Reproduced from Majka (2020, p. 41)

adopter), White (IL, higher adopter), Edwards (IL, higher adopter), Lawrence (IN, higher adopter), Jackson (IN, higher adopter), Bartholomew (IN, lower adopter), and Steuben (IN, lower adopter).

Examples of these additional activities included the following: helping secure grants that could be used for CCs; coordination between different agencies to plan events and allocate funds toward CCs; reaching out to farmers with specific CC-related guidance or promotion; participation in external groups related to soil health; and following up with farmers to see if CCs worked.

For example, agency personnel in Sioux County told us they followed up with producers and gave them specific CC instructions:

> "And we just constantly are in touch with them […] I make sure when they sign up, they get all the technical notes that we have access to, that give them information on our recommended rates, and seeding dates. And if they have any kind of technical questions that I don't feel comfortable answering, we always recommend that they speak to their agronomist."

Similarly, agency personnel in Clarke County (IA, higher adopter) found themselves following up with producers who had planted CCs for the first time. If the producers faced any issues, agency personnel helped connect them to networks of other, more experienced producers:

> "I always try to pick at them a little bit and just say, 'Hey, you know what? How did it go? How did it go this year?' You kind of just ask some of those questions like that. And sometimes the answers I get back from guys are what I can use to help spark a conversation with another cover crop producer. 'Hey, so and so has been doing this and this in this work.' Or, 'So and so had this issue. It sounds pretty similar to yours.' I think those are pretty good, sometimes better than just some of the general cover crop guidance that's out there. More specific to their county and their operation."

Table 1 County pairs for controlled comparison

State	January-April precipitation (mm) and temperature (°C)	County	Population (2018)	% Agriculture	Avg CC % adoption 2016–2018	Difference in CC % adoption 2016–2018
Iowa	Prec: 185–213 mm Temp: 6.4–7.3 °C	Adair	7074	0.87	3	8.2
		Clarke	9502	0.34	11.2	
		Union	12298	0.65	4.3	6.9
		Clarke	9502	0.34	11.2	
	Prec: 154–184 mm Temp: 3.9–6.3 °C	O'Brien	13753	0.85	0.7	4.4
		Sioux	34855	0.82	5.1	
Illinois	Prec: 352–461 mm Temp: 10.6–15.3 °C	Wayne	16215	0.59	8.9	10.6
		White	13537	0.65	19.5	
		Hamilton	8116	0.6	11.3	8.2
		White	13537	0.65	19.5	
	Prec: 352–461 mm Temp: 8.9–10.5 °C	Wabash	11520	0.7	7.6	11.5
		Edwards	6395	0.6	19.1	
Indiana	Prec: 243–268 mm Temp: T3.9–6.3 °C	Steuben	34487	0.33	3.5	9.8
		LaGrange	39375	0.38	13.3	
	Prec: 352–461 mm Temp: 8.9–10.5 °C	Greene	32059	0.28	14.1	15.6
		Lawrence	45630	0.11	29.7	
		Bartholomew	82722	0.41	12.2	6.7
		Jackson	44068	0.38	18.9	

In terms of CC promotion, agency personnel in Lawrence County (IN, higher adopter) told us the following:

> "I think a lot of it's the way we promote it. We started early promoting cover crops with some field days. When I first came on the board, many moons ago, we put a cover crop plot out near the high school where the vocational kids could go and see it. Then we opened it up to the farmers and had a couple of days-- a day there they could all come see it and then we took them out to another farmer's that was on the board. [We] fed them, and we promoted it. And I think promotion has been the big thing."

Presence of CC Experts, Advocates, and/or Entrepreneurs among Farmers and Crop Advisors

On the producer side, higher CC adoption was linked with the presence of CC experts, advocates, and/or entrepreneurs in certain counties. CC experts were well-known producers that used CCs, as well as crop advisors or seed retailers with expertise in CCs. *CC experts* were not necessarily promoting CCs, but they felt comfortable talking about them and providing their expertise to producers who specifically asked them for advice. Agency staff from Adair County (IA, lower adopter), a lower adopter, told us the following regarding local producers with expertise in CCs:

> "Yeah, I would say there is definitely quite a few farmers who have figured out cover crops in that sense and they do talk to other farmers. I would say other farmers go to those people for advice and what works for them and what doesn't."

Likewise, agency personnel from Wabash County (IL, lower adopter), another county with lower levels of CC adoption, told us that while there are some producers that adopt CCs and talk about their benefits, they are not explicitly promoting them:

> "I know farmers that you can guarantee they're going to have cover crops on the ground. I don't know that they vocally go out and let everybody know. […] As far as one guy that goes around and tries to push, or other farmers to try to push other people to do it, probably not."

Table 2 Overview of factors contributing to increased cover crop adoption

Factors	Iowa					Illinois					Indiana				
	1st comparison			2nd comparison		1st comparison			2nd comparison		1st comparison		2nd comparison		3rd comparison
	Clarke	Adair	Union	**Sioux**	O'Brien	**White**	Wayne	Hamilton	**Edwards**	Wabash	**Lawrence**	Greene	**Jackson**	Bartholomew	**LaGrange**	Steuben
Agency employees (NRCS, SWCD, Farm Bureau, Extension, etc.) promoting CCs beyond their regular duties	x		x	x		x			x		x	x	x	x		x
Presence of CC experts, advocates, and/or entrepreneurs	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
Favorable attitudes toward CCs	x			x		x	x	x	x		x				x	
Collaboration between organizations (NRCS, SWCD, Extension, Farm Bureau, etc.) and CC experts, advocates, and/or entrepreneurs	x			x		x			x		x		x		x	
Topography (rolling hills and more erodible soil led to early adoption of CCs)				x		x			x		x				x	
Farm characteristics (more cattle, organic produce, pastured livestock and/or smaller-scale farms)	x			x					x		x				x	

• The counties that are highlighted in bold are the high CC adopters in their respective pairs

• In some areas, there were insufficient counties that fit our selection criteria. Instead of having three distinct pairs, some high adopter counties were compared to two lower adopter counties (Clarke vs. Adair & Union; White vs. Wayne & Hamilton)

• By high adopters and low adopters, we are referring to CC adoption levels relative to their neighboring county or counties, and not to absolute overall adoption

Similarly, most counties had crop advisors and seed dealers who were able to advise producers who specifically inquired about CCs. Agency personnel from LaGrange County (IN, lower adopter) explained:

> "I'm not sure exactly how many, but we do have forage companies here that sell forage seeds, so they've got some expertise in cover crop selection and blends and stuff like that, so they're using those guys."

CC advocates were producers and crop advisors that actively promoted CCs and encouraged producers to adopt them. An agency employee from Wabash County (IN, lower adopter) gave us an example from Edwards County (IL, higher adopter):

> "There is a gentleman from Edwards County […] I mean, he's been one of our speakers at, well, both of our events. And he is pushing cover crops."

CC advocates were very involved in field days and promotional events organized by agencies, educational farms, and corporations. They also promoted the benefits of CCs among producers when interacting with them. CC advocates were skilled at networking, and they regularly interacted with other CC users in order to share experiences. As a crop advisor in Clarke County (IA, higher adopter) explained:

> "That young man came to me because he'd talked to another guy about 60-inch rows. So his buddy was actually an influencer to him. He'd researched YouTube and all that. He's just reached out. Well, I get that from three or four young guys around, but those are the guys that are going to do it anyway. It's more of a network because I reach out to them too […] "Hey, what are you doing? What do you see?" I guess it's more of a network on that."

CC entrepreneurs were people who owned a CC-specific business, and these people were only present in Sioux County (IA, higher adopter) and LaGrange County (IN, higher adopter), two of the higher adopters in the sample. The CC entrepreneur in Sioux County sold wholesale CC seed and retail. His company owned a drill and custom applied CC, as well as doing aerial applications. At the same time, he advised producers on CC use, as he explains below:

> "We don't want it to be a failure the first year because if they fail the first year, it's never going to happen again. So we try and educate our customers basically wholeheartedly just so that they understand what it

takes to grow cover crops and what their goals are with that cover crop that we work with."

In LaGrange, agency employees mentioned the presence of a person that helped producers apply to CC programs in exchange for a fee:

"We have a really unique situation up here. There is a former FSA employee, and she has went out on her own. And she's from this community, and she is going around selling the program. And that's kind of a new concept. […] So having - what? - 25, 30 years of experience with FSA, she's well-acquainted with Farm Bill procedures, which, to the average farmer, they're fairly incomprehensible and complicated. So she acts as a liaison between agency and farmer and I guess simplifies it to the extent that she talks her clients into participating in a program that maybe otherwise or ordinarily would not."

Attitudes toward Cover Crops

An important factor mentioned by focus group participants that contributed to the high levels of CC adoption in some counties was the presence of favorable attitudes towards CCs. In Iowa, interviewees said that producers in high-adopter counties such as Clarke (IA, higher adopter) and Sioux (IA, higher adopter) were entrepreneurs. They said that producers in entrepreneurial counties were more willing to take risks and experiment with CCs. As an agency (university extension) personnel explained,

"This is weird, but if you go to Sioux County, they're entrepreneurs. […] There's creative enterprises there, so it's not just in the industry that we see entrepreneurship and creativity in Sioux County. We see it in the rural sector too, of different things that they'll do on the side. […] They got time, they try to fill it with something, and they're willing to take risk and new ideas. They're risk takers."

Similarly, interviewees in Clarke County (IA, higher adopter) placed great emphasis on the economic benefit of CCs. Crop advisors, retailers, and agency personnel promoted and focused primarily on the potential of CCs to increase revenue, as opposed to the environmental benefit. One CC entrepreneur from Clarke County explained his strategy to us:

"So what I'm focusing on are those people that recognize that they've got livestock already. And that they recognize if they don't lose yield, they still keep the banker happy. But then they turn around and really make him happy because now they can turn around and graze that and save a lot on their hay bill. So that's the side that I'm more working on is those with-- I've kind of stopped talking soil health, and I've talked revenue more."

In contrast, interviewees in neighboring Iowa counties that were lower CC adopters (Union, Adair, and O'Brien Counties, IA, lower adopters) said that most of their producers held a less optimistic attitude when it came to CCs, and most did not believe that CCs would work in their area.

Interviewees in Indiana and Illinois also generally considered individuals that adopted CCs to be more innovative or to tolerate risk better than the average farmers. In Iowa, however, CC adoption was explicitly associated with entrepreneurship, which was believed to have shaped the attitudes of producers. In contrast, interviewees in Indiana and Illinois recognized entrepreneurship in individuals but mainly attributed CC adoption to environmental stewardship in certain counties. In White (IL, higher adopter), Edwards (IL, higher adopter), and Lawrence (IN, higher adopter), the positive attitudes toward CCs were attributed to the fact that these counties are hillier. To prevent soil erosion, more producers adopted CCs out of necessity, and the practice became a mainstream practice. Some interviewees said that many producers were embarrassed to have "naked" fields and that CCs are increasingly becoming mainstreamed.

In Lawrence (IN, higher adopter), focus group participants also mentioned that CC adoption, along with other conservation practices, is seen as a way for producers to maintain autonomy over their own farming practices. Specifically, some producers attempted to implement their own conservation activities in order to avoid future environmental regulations that might be imposed by the federal government. As an agency personnel from Lawrence County explained:

"I don't know if you've heard of the 4R Stewardship initiative for Indiana, but we're actually one of the members trying to start that. And that's the whole idea behind that as well, the nutrient stewardship, to make sure we all know there's going to be regulations, but we don't want it to be mandated from somebody in Washington, DC or some environmental group. We want it to be science-based, practical information and cover crops are just a big part of that as well. […] As farmers, agriculture people, anybody invested in this,

we need to do a better job of kind of leading that charge and setting the tone or somebody else will."

In sum, we found diversity in attitudes around CCs. In Iowa, CCs were associated with entrepreneurship, while in Indiana and Illinois they were more explicitly associated with environmental stewardship and a desire to maintain autonomy. Nevertheless, one thing all high-adopter counties had in common was that CC adoption was not seen to be at odds with economic profit. On the contrary, CC were seen as helping the bottom line and helping the farmer become more competitive. As one Lawrence County producer explained:

"I'd like to say that I put cover crops down for two reasons basically. One, to improve my profits, hold my soil, make it better soil. And the second thing, I do not want to see our nutrients go down the Mississippi River, and then one of these days they come along and say, "Hey, you farmers, you can only use only so much nitrogen, only so much phosphate." I don't want control. I want the farmers to control it now, so we are in control of what we can do on our farms."

We also found that successful efforts at promoting CCs focused primarily on the economic aspect. Interviewees in all counties told us that farmers (even the ones that do not adopt CCs) deeply care about their environment, their land, and soil health. They know that CCs are good for their soil. They also said that most farmers that did not adopt CCs would like to adopt them, but the reason they did not is because they did not believe that CCs would work for them.

In some counties (names are omitted to keep confidentiality), agency personnel tried to promote CCs by focusing on their environmental benefits. However, they told us they experienced a negative reaction from farmers, who did not seem to appreciate agency personnel's attempts at environmental education. In general, interviewees and focus group participants told us that farmers are already aware of the environmental benefits of CCs, and that the reason they are not adopting them is not because they are against environmental conservation, but that they do not have enough information on how to integrate them into their farm management system and make them economically profitable.

Collaboration between Agencies and Farmers or Crop Advisors that are CC Experts/Advocates/Entrepreneurs

This factor was only present in all high adopter counties and not in their lower adopter neighbors. These higher adopter counties included Clarke (IA), Sioux (IA), White (IL), Edwards (IL), Lawrence (IN), Jackson (IN), and LaGrange (IN). What distinguished these high adopting counties was a much higher level of collaboration between agencies (NRCS, SWCD, Extension, Farm Bureau) and individual CC experts, advocates, or entrepreneurs. Higher collaboration was apparent in the focus groups, where participants from different agencies and producers knew and talked among each other. When answering questions, they also asked each other to fill in some of the gaps by saying things like "s/he can tell you more about this." Participants with high levels of collaboration also mentioned regular and frequent interactions between agencies and CC experts/advocates/entrepreneurs. As a Lawrence County crop advisor that was a CC advocate stated:

"In my mind, it's the open communication just like he was talking about where I mean, we'll talk about different blends for customers or different product availability. I mean, I just think it's all that open communication."

Agency staff and CC experts/advocates/entrepreneurs consulted with each other when giving advice to other producers about specific CC issues, to make sure they were aware of the most up-to-date practices. For example, if producers visited the NRCS or SWCD for advice on planting CCs, their staff often called other crop advisors and/or farmers for additional input. That way, they provided targeted advice and technical assistance that corresponded to each producer's specific need. The same crop advisor from Lawrence County told us the following:

"We've been on two other meetings today with our Extension agent, so yeah. […] [crop advisor] is calling from the White River CO-OP here - and he kind of reflected that, too - but he'll just pick up the phone or send us an email wanting to know, "Hey, does this cover crop mix [work]? We're going to adjust this. Maybe this species is more economical right now. We've got bulk of this. Will this work?" It's a really good partnership in this county. I mean, we hear from each other quite often."

Agency staff and CC experts/advocates/entrepreneurs also coordinated when organizing field days. In some cases, crop advisors, who were discouraged from providing advice on CCs by their company, collaborated with the SWDC to push for cost-share programs for CC adoption. In addition, agency personnel and CC experts/advocates/entrepreneurs in high adopter counties continually brainstormed and discussed ways of integrating

CCs into farm management systems. Both parties were particularly concerned about demonstrating the economic value to producers through field days and empirical studies. In Edwards County (IL, higher adopter), agencies such as the Farm Bureau helped link producers to CC experts through various talks and workshops, as explained by a Farm Bureau employee:

> "[Cover crops are] on this year's [agenda] because it's just a hot topic and more people are planting them, and more people want to know more about them. I know some of the things that we want to cover this year, that they've asked me to provide workshops and speakers on, are which cover crop is best and why. And so I think that's more where we're at in this state on cover crops, is, "Should I plant wheat on here," or, "Should I plant this mixture this?" And why? What does this leave left in the soil, or what does this take out of the soil? So I think that's where we're focusing this year."

Topography

Although we sought to minimize topographical and soil differences between county pairs, it was impossible to find neighboring counties with the exact same landscape, and we found that even relatively small differences in topography affected CC adoption. In five of the seven county comparisons – Sioux (IA, higher adopter), White (IL, higher adopter), Edwards (IL, higher adopter), Lawrence (IN, higher adopter), and LaGrange (IN, higher adopter) – topography was stated as an important factor influencing CC adoption. Specifically, interviewees shared that producers with farms on rolling hills and more erodible soil had a greater incentive to adopt CCs because they helped stabilize the soil and prevent erosion. In such counties, planting CCs had a clear and immediate economic benefit. Moreover, some counties have floodplains and river bottoms (Wayne and Hamilton; IL, lower adopters), where it is not as effective to plant CCs because the seeds do not grow in areas prone to frequent flooding.

County topography also influenced the emergence of early CC adopters, who were producers who started planting CCs before 2000 and continue doing so presently, regardless of whether they participate in incentive programs. Early adopters were present in most counties in this study, but they were more numerous and considered by focus group participants as being responsible for the high CC adoption we observed in the following counties: Sioux (IA, higher adopter), White (IL, higher adopter), Edwards (IL, higher adopter), Lawrence (IN, higher adopter), and LaGrange (IN, higher adopter).

Farm Characteristics

Research participants mentioned that producers who owned more cattle, especially dairy cows, were more likely to adopt CCs because they served as an additional source of feed. Moreover, cattle farmers had a larger window for planting CCs compared to crop farmers, which gave them additional flexibility to adopt them. Counties that had a larger proportion of cattle compared to their neighbors were Clarke (IA), Sioux (IA), and LaGrange (IN). In LaGrange County particularly, rotational grazing has been practiced for decades among the large Amish community living in the county and was associated with the use of CC among its farmers. An interviewee also mentioned prior cattle activity for Edwards County (IL). According to them, until about 15 years ago, Edwards County had more cattle compared to its neighbor, Wabash County. Cattle farmers were using CCs to maintain soil health and this practice has been continued to the present day.

Research participants also reported that producers who operated smaller plots, raised pastured livestock, and grew organic produce were more likely to adopt CCs. According to participants, producers in Sioux (IA), Lawrence (IN), and LaGrange (IN) owned and operated smaller fields. We were told that smaller fields were more manageable because owners are familiar with every inch of their land, thus making it easier to coordinate the timing of CC planting and termination. We were also told that smaller-scale producers were more likely to grow organic crops, raise pastured livestock, and adopt CCs as an alternative to conventional fertilizers.

Discussion

Our results indicate that the counties with higher levels of CC adoption had a diverse set of contributing factors. This supports previous studies indicating that some conservation practices become adopted as a result of multiple social factors rather than one specific policy (Muhumuza and Balkwill 2013).

We found that CC adoption can be attributed to a cluster of factors, which can be divided into three groups: 1) Planting CCs out of necessity and/or convenience, 2) Agencies and individuals promoting CCs, and 3) Attitudes and collaborations. These groups are shown in Table 3, which indicate that CC adoption is due to several factors. Moreover, our findings suggest that factors in the third group – CC attitudes and collaborations between agencies and CC experts, advocates, and/or entrepreneurs – might be additive in some cases, i.e., they might be the end-result of an accumulation of factors that are favorable

Table 3 Categories of factors contributing to county-level CC adoption

Planting CCs out of necessity and/or convenience	Agencies and individuals promoting CCs	Attitudes and collaborations
• Topography • Farm characteristics • Favorable climate	• Agency employees promoting CCs • Presence of CC experts, advocates, and/or entrepreneurs	• Attitudes toward CCs • Collaboration between agencies and CC experts, advocates, and/or entrepreneurs

to CC adoption. For example, it is easier to develop positive attitudes toward CCs in a county that has more rolling hills and where CCs are planted out of necessity. Likewise, it is easier to form collaborations in a county that has positive attitudes toward CCs or where agency employees promote CCs beyond their regular duties.

However, it is important to note that such collaborations seem to be exceptions to the rule, as they were also present in counties where other important social factors were missing. Examples include LaGrange County (IN, higher adopter), where agency employees did not promote CCs beyond their regular duties, and Jackson County (IN, higher adopter), which did not have favorable attitudes toward CCs nor favorable baseline conditions for planting CCs (topography, farm characteristics).

The first group of factors, planting CCs out of necessity and/or convenience, includes topography (rolling hills and more erodible soil), farm characteristics (more cattle, organic produce, pastured livestock and/or smaller-scale farms), as well as a favorable climate (higher temperature and precipitation) as found by Majka (2020). As our interviewees mentioned, counties with rolling hills and erodible soil had "early adopters," which are producers that started planting CCs as early as the 1970 s, before the emergence of incentive programs. These early adopters were not reported in counties with a flatter topography. In addition to topography, counties that had more cattle or that practiced organic agriculture and rotational grazing had producers that planted CCs even without incentive programs. For counties in this group, the benefits of using CCs were more immediate, greater, and more obvious than in their neighboring counties. Interestingly, all counties in our study that planted CCs out of necessity and/or convenience were the higher adopters in their respective controlled comparisons. However, not all counties that were higher adopters planted CCs out of necessity. This suggests that baseline conditions such as topography, farm characteristics, and favorable climate are important but do not alone explain the different levels of CC adoption between county pairs.

The second group of factors, agencies and individuals promoting CCs, includes agency employees promoting CCs and the presence of CC experts, advocates, and/or entrepreneurs. Agency employees who felt they were promoting CCs beyond their regular duties were present in some of the higher and the lower adopter counties, which suggests that this factor does not play a big role in county-level differences in CC adoption. Similarly, CC experts, advocates, and/or entrepreneurs were present in almost every county (even the low-adopter ones), also indicating that this factor is not very important in explaining county-level differences. While individuals promoting CCs do play a role in increasing overall CC adoption (Reimer et al. 2012; Moore et al. 2016), our results show that these factors are not helpful in explaining county-level variation in adoption.

The third group of factors, attitudes and collaborations, includes CC attitudes and collaboration between organizations and CC experts, advocates, and/or entrepreneurs. Favorable attitudes toward CCs were present in all higher adopter counties except for Jackson County (IN), as well as in two lower adopter counties (Wayne and Hamilton Counties, IL). Our results show there was diversity in attitudes around CCs, the most prominent being entrepreneurship, environmental stewardship, and self-sufficiency. However, even counties with a strong sense of environmental stewardship planted CCs because they considered them to be economically beneficial. While interviewees mentioned that producers who did not adopt CCs believed they could not afford to do so, the producers who did plant CCs did not do so as a form of self-sacrifice and environmental stewardship alone. Rather, successful CC adopters had found a way to incorporate CCs into their farm management system (Church et al. 2020) that increased their revenue in the medium and long terms. Overall, our findings are corroborated by other studies documenting the importance of cultural beliefs, such as environmental values, in enhancing CC adoption (Raedeke and Rikoon 1997; Maloney and Paolisso 2006; Maloney 2009). We found this factor to be very helpful, though not essential, in explaining county-level variation in CC adoption.

Collaboration between organizations and CC experts, advocates, and/or entrepreneurs, however, was only present in the higher adopter counties, and it was not found in lower adopter ones. This is the single factor that distinguished higher adopters from lower adopter counties, suggesting that these collaborations are the most important in explaining county-level variation in CC

adoption. A study conducted by Eanes et al. (2019) found a similar result, that relationships between crop advisors and government agencies helped increase adoption of conservation practices among producers. Campbell et al. (2011) also found that collaborations contributed to the adoption of best management practices among farmers. Interestingly, we found that collaboration between organizations and CC experts, advocates, and/or entrepreneurs can make a difference even in counties where important factors such as topography and positive beliefs about CCs are missing. We saw this happening in Jackson County (IN), where a crop advisor who was a CC expert and advocate joined the SWCD board and worked with them to prioritize CCs in a county that would otherwise be a lower adopter. Unlike developing positive attitudes toward CCs, which are not very easy to foster or replicate in places that do not value CCs already, our example from Jackson County (IL, higher adopter) shows that a collaboration was created by a relatively low number of people and with few resources. However, understanding how to foster lasting collaborations between agencies and CC experts/advocates/entrepreneurs requires more careful study.

Recommendations for Policymakers and Practitioners

In this section, we provide suggestions for enhancing factors in the third group – attitudes and collaborations, which comprises attitudes toward CCs and collaborations between organizations and CC experts, advocates, and/or entrepreneurs – as these factors were found to be the most influential in explaining differences in county-level CC adoption.

In our study, CCs were in many cases associated not only with environmental stewardship but also with innovation and entrepreneurship. To be effective, educational efforts and promotional material should emphasize both the soil health and economic benefit of CCs. As outlined in our results, interviewees mentioned there is currently a scarcity of information on the economic benefits of CCs. CC experts, advocates, and entrepreneurs were looking for ways to quantify this benefit in and presenting it to farmers in a digestible format. Here, there is an opportunity to involve universities and extension offices in this effort.

Regarding collaborations between organizations and CC experts, advocates, and/or entrepreneurs, our study suggests that these could be nurtured even in counties where baseline factors (topography, farm characteristics, favorable climate) or where there is an absence of positive attitudes toward CCs. In particular, agencies such as the NRCS and SWCD could focus on strengthening their relationships with specific crop advisors or local producers that use CCs and build a network where information and expertise can be exchanged. A simple mechanism for fostering this type of network would be for NRCS, SWCD, and Extension staff to have regular phone calls with producers and crop advisors that have experience with CCs. In successful counties, agency staff called these local entrepreneurs on the phone when a producer walked into their office to ask for assistance regarding CCs. Agencies helped connect producers with CC experts, advocates, and entrepreneurs, which ensured that the producer received complementary and personalized advice from different sources.

Agency personnel could also ask CC experts, advocates, and entrepreneurs how the agencies can best assist them with their experimentation with and diffusion of CC practices. In high adopter counties, these individuals paved the way by experimenting with cover crops and incurring most of the risk. For example, they experimented with different types of CCs and different planting timeframes. They then turned to agencies to diffuse the information they acquired through their experimentation, and also contacted Extension for help in quantifying the benefits obtained from CCs. Thus, agencies could position themselves as intermediaries between CC experts, advocates, and entrepreneurs and the wider community. They can play an important role in facilitating communication channels and providing specialized information that is otherwise difficult to access.

In the field of agriculture, there is a scarcity of research on collaborations between agencies and individuals or businesses (such as the one conducted by Eanes et al. 2019). While our study found such collaborations to be the most important factor in explaining county-level CC adoption in the Midwest, it is difficult to generalize to other regions or other types of practices. Moreover, our study is qualitative in nature, which provided us with rich data on the mechanisms through which collaborations and other factors lead to CC adoption. As collaborations between agencies and individuals is currently an understudied topic in the field of agriculture, future studies documenting their creation, functioning, and sustainability over time would be beneficial to both scholars and practitioners.

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Appendix: Detailed County Comparisons

Iowa

Clarke County Vs. Adair & Union Counties

Factors	Clarke (higher adopter)	Adair (lower adopter)	Union (lower adopter)
Agency employees (NRCS, SWCD, Farm Bureau, Extension, etc.) feel they are promoting CCs beyond their regular duties	- Coordination between agencies to allocate additional funds toward CCs - Agency staff follows up with farmers that participate in CC programs to see if CCs worked. They ask them what worked, what didn't, and offer to connect them to another producer that had success with CCs. - Some agency staff is part of a soil health team in Southwest Iowa.		- Agency staff speaks about soil health to local college
Presence of CC experts, advocates, and/or entrepreneurs	- There is a local seed dealer that promotes and provides advice for CCs.	- A local crop advisor promotes CCs. - There are local producers who use CCs and they are the go-to persons for questions. - At least one local producer actively encourages others to adopt CCs.	- A local producer holds field days on his farm. - This producer is the go-to person and answers questions about CCs.
Favorable attitude toward CCs	- CC adoption is part of a culture of entrepreneurship. There are some local CC entrepreneurs (producers and/or crop advisors) that experiment with CCs to see how they can be profitable and increase revenue. This information is communicated with other producers and to agency personnel (SWCD, NRCS). - Producers interested in CCs seek information on YouTube and share videos with each other. There is a small network of producers trying new practices and experimenting with CCs that regularly consult with each other and exchange experiences.		
Collaboration between organizations (NRCS, SWCD, Extension, Farm Bureau, etc.) and CC experts, advocates, and/or entrepreneurs	- Agency staff and CC entrepreneurs coordinate field days together. - A local CC entrepreneur shares videos of his work with NRCS staff. - CC entrepreneurs and NRCS staff have discussions and brainstorming sessions. - NRCS staff networks with CC entrepreneurs in order to reach more producers.		
Topography (rolling hills and more erodible soil led to early adoption of CCs)	Topography was reported to be flat across all three counties. Differences in CC adoption were not attributed to strong topographical differences.		
Farm characteristics (organic produce, pastured livestock, smaller-scale farms, and/or more cattle)	- There are smaller-scale producers in Clarke County compared to Adair and Union Counties There is more livestock in Clarke County than in Adair and Union Counties		

Sioux County vs. O'Brien County

Factors	Sioux (higher adopter)	O'Brien (lower adopter)
Agency employees (NRCS, SWCD, Farm Bureau, Extension, etc.) feel they are promoting CCs beyond their regular duties (entrepreneurial staff)	- Agency employees keep track of new CC adopters and follow up with them regularly to increase their likelihood of success. - New CC adopters receive technical notes with information about CCs from agency staff, including recommended rates and seeding dates.	
Presence of CC experts, advocates, and/or entrepreneurs	- A local producer has set up a CC side business. He sells CC seeds and provides services (drill, aerial application, advice). His priority is to make sure that first-time CC adopters have success with it.	- Local crop advisor is promoting CCs among farmers
Favorable attitude toward CCs	Interviewees mentioned Sioux producers have an entrepreneurial mindset. In the rural sector, producers are more willing to take risks and experiment with CCs.	
Collaboration between organizations (NRCS, SWCD, Extension, Farm Bureau, etc.) and CC experts, advocates, and/or entrepreneurs	- The local producer with the CC business and the agency staff have developed a shared goal of making sure new adopters have a first good year. Both parties communicate regularly and exchange notes and lessons learned. - There is collaboration between producers and crop advisors promoting CCs and agency personnel for field day coordination. Both parties actively help organize the event.	(There is the beginning of a collaboration between IA Soybean Association and NRCS, but it is very new as it only started in 2020. So it has not had a chance to develop fully.)
Topography (rolling hills and more erodible soil led to early adoption of CCs)	Sioux County has more rolling hills than O'Brien County, resulting in more highly erodible areas	
Farm characteristics (organic produce, pastured livestock, smaller-scale farms, and/or more cattle)	- Interviewees mentioned that Sioux has more small-scale family farms compared to O'Brien. Sioux has more cattle than O'Brien, and more silage acres.	

Illinois

White County vs. Wayne & Hamilton Counties

Factors	White (higher adopter)	Wayne (lower adopter)	Hamilton (lower adopter)
Agency employees (NRCS, SWCD, Farm Bureau, Extension, etc.) feel they are promoting CCs beyond their regular duties (entrepreneurial staff)	- SWCD in White County has two longstanding employees promoting CCs. They are very skilled at writing grants and have obtained funding for 2 salaries. - Agency staff engage in early promotion of CC programs. They advertise in the newspaper and on the radio.	- SWCD staff have obtained TNC funding to host CC coffee shops. Staff host a breakfast and they invite a mix of producers, some of which grow CCs and others that do not. This is a joint effort led by Edwards and Wayne Counties that started around 2017.	

Table (continued)

Factors	White (higher adopter)	Wayne (lower adopter)	Hamilton (lower adopter)
Presence of CC experts, advocates, and/or entrepreneurs	- A local producer is a CC champion, actively promoting them with other farmers. - In addition, there are other local well-known producers that grow CCs, but do not necessarily actively promote them. These producers consistently experiment with different CC blends and they are go-to people for CC-related advice.	- Interviewees mentioned the presence of one local producer that is a CC specialist.	- There are local well-known producers that grow CCs, but do not necessarily actively promote them. These producers consistently experiment with different CC blends and they are go-to people for CC-related advice.
Favorable attitude toward CCs	Interviewees mentioned that producers in White County generally have a favorable attitude toward CCs.	Interviewees mentioned that producers in Wayne County generally have a favorable attitude toward CCs.	Interviewees mentioned that producers in Hamilton County generally have a favorable attitude toward CCs.
Collaboration between organizations (NRCS, SWCD, Extension, Farm Bureau, etc.) and CC experts, advocates, and/or entrepreneurs	- The CC champion mentioned above is often invited by agencies to be a speaker at various field days and events. - Other well-known CC adopters have also been invited as speakers during field days. - Agency personnel connect producers to the well-known farmers that use CCs when producers have questions that agency staff cannot answer.		- A well-known CC adopter participates in field days organized by agencies.
Topography (rolling hills and more erodible soil led to early adoption of CCs)	White County has more rolling hills than Wayne and Hamilton.	(In contrast, Wayne County has more floodplains and wider floodplains too.)	(Likewise, Hamilton County is flatter, with several skillet-fork river bottoms.)
Farm characteristics (organic produce, pastured livestock, smaller-scale farms, and/or more cattle)	Interviewees did not report a significant difference in soil type between the two counties.		

Edwards County vs. Wabash County

Factors	Edwards (higher adopter)	Wabash (lower adopter)
Agency employees (NRCS, SWCD, Farm Bureau, Extension, etc.) feel they are promoting CCs beyond their regular duties (entrepreneurial staff)	- SWCD staff have obtained TNC funding to host CC coffee shops. Staff host a breakfast and they invite a mix of producers, some of which grow CCs and others that do not. This is a joint effort led by Edwards and Wayne Counties that started around 2017.	
Presence of CC experts, advocates, and/or entrepreneurs	- A local, well-respected producer promotes CCs in Edwards County. He plays a huge leadership role as a CC champion. He pushes producers to adopt CCs and provides advice and input to help them. - There are also other well-known farmers that plant CCs on their own, but they don't necessarily promote them. - There are some crop advisors that feel comfortable advising producers about CCs. Producer interviewees mentioned getting much of their CC-related information from their crop advisor. Soil testing is also heavily promoted.	- Wabash County also has some well-known local producers that grow CCs but they do not necessarily promote them. - Likewise, there are some crop advisors that feel comfortable advising producers about CCs. Producer interviewees mentioned getting much of their CC-related information from their crop advisor.
Favorable attitude toward CCs	Interviewees mentioned that producers in Edwards are more likely to have a favorable attitude toward CCs and they are more open to growing them.	
Collaboration between organizations (NRCS, SWCD, Extension, Farm Bureau, etc.) and CC experts, advocates, and/or entrepreneurs	- The CC champion mentioned above is often invited by agencies to be a speaker at various field days and events. - Producers that are on the board of the Farm Bureau ask agencies to provide specialized information on CCs. They make requests for CC-related speakers, workshops, information on which CC to plant, impacts on soil health, etc.	
Topography (rolling hills and more erodible soil led to early adoption of CCs)	- Edwards County has more rolling hills and poorer soils quality than Wabash. CCs help keep the topsoil in place.	(In contrast, Wabash has a more diverse landscape, including river bottoms that are not conducive to CC growth.)
Farm characteristics (organic produce, pastured livestock, smaller-scale farms, and/or more cattle)	- Edwards County has smaller-scale farms than Wabash County. - Historically, up until about 15 years ago, Edwards County had more cattle. Cattle farmers were using CCs to maintain soil health and use CCs, and this practice has lived on.	

Indiana

Lawrence County vs. Greene County

Factors	Lawrence (higher adopter)	Greene (lower adopter)
Agency employees (NRCS, SWCD, Farm Bureau, Extension, etc.) feel they are promoting CCs beyond their regular duties (entrepreneurial staff)	- Agency personnel engage in early promotion of CCs. - They maintain a demonstrational plot where CCs are planted for producers to see. - Staff also systematically reach out to new producers that have not used CCs previously. These new producers are targeted first through early promotion. Then, they are offered based on a first come, first served basis. - CCs are not only promoted among crop farmers but also with other landowners: those that graze cattle (CC serve as extra forage over the summer and fall months); deer hunters, and landowners interested in providing pollinator habitat. - Staff also reach out to female and non-operating landowners to promote CCs. Staff said this is in response to data showing that over 51% of land in Indiana is owned by women, and the increasing occurrence of absentee landowners. In particular, absentee landowners are invited to meetings, where the benefits of CCs are discussed.	- Agency personnel see their role as that of a salesperson when it comes to CCs and are constantly coming up with new ways of promoting them. - They engage in early promotion: when CC grants start they advertise on many platforms (radio, papers, field days).

Table (continued)

Factors	Lawrence (higher adopter)	Greene (lower adopter)
Presence of CC experts, advocates, and/or entrepreneurs	- There are local crop advisors that provide CC-related advice to farmers on a regular basis. CCs are part of the local business practice. - There are local well-known local producers that adopt CCs and they are go-to people that provide advice to other farmers.	
Favorable attitude toward CCs	- Local producers seem to be highly concerned about environmental sustainability and minimizing the negative effects of farming (nutrient runoff, chemicals, manure biosolids, etc.). - There are close-knit families in Lawrence County, who had switched to no-till farming in the 70s. This no-till culture has been passed down to younger producers, who have remained in the county instead of moving away. Interviewees mentioned being ashamed to plow their land and facing social pressure to be environmentally sustainable. They said that these producers are also more likely to use CCs. Interviewees mentioned the desire to self-regulate when it comes to environmental sustainability as opposed to having regulations imposed from outside. Specifically, there is a desire to engage in sustainable farming practices (such as using CCs) that are locally driven, in order to avoid central government control. In other words, there is a desire to manage the negative effects of farming locally to avoid future environmental regulations imposed from the outside. Interviewees said they want to rely on science and their local knowledge to set the tone for what environmental sustainability should look like in Lawrence.	(There seems to be a general distrust of CCs and CC programs among producers)
Collaboration between organizations (NRCS, SWCD, Extension, Farm Bureau, etc.) and CC experts, advocates, and/or entrepreneurs	- The well-known producers that plant CCs and the agency personnel share a similar vision regarding environmental self-regulation. - There is collaboration and a good working relationship between crop advisors and agency staff (NRCS and SWCD). Their CC-related advice and promotion is supported by agencies, though the form of guideline and informational provided to farmers. According to crop advisors, this sets the stage and makes their work easier. - In addition, there is collaboration between CCA and extension personnel, which is not as common in other counties, where collaborations are usually limited to NRCS and SWCD. Specifically, the extension agent regularly phones crop advisors to ask their input on particular CC mixes and prices. Both parties communicate often and they reported having an excellent partnership. - Interviewees said there is open communication between agencies (NRCS, SWCD, Extension), crop advisors, and well-known CC adopting farmers. They regularly pick up the phone and discuss CC-related issues. For example, they consult with each other regarding spec sheets for different CCs and different rates, to see what will work best with growers. - A local CC adopting farmer is on the SWCD board all allows part of his field to be used for CC testing. - A crop advisor from a local coop actively participates in field days and his company co-sponsors events.	
Topography (rolling hills and more erodible soil led to early adoption of CCs)	Soils in Lawrence County are more prone to erosion than in Greene. For this reason, it is easier for farmers in Lawrence to see a clear benefit from CCs due to their soil type.	
Farm characteristics (organic produce, pastured livestock, smaller-scale farms, and/or more cattle)	- Interviewees said there are more small-scale family farms in Lawrence County than in Greene County. In addition, there are more operating landowners in Lawrence. Compared to other counties, Lawrence is known for being a tight-knit community with old families that work the land themselves.	

Jackson County vs. Bartholomew County

Factors	Jackson (higher adopter)	Bartholomew (lower adopter)
Agency employees (NRCS, SWCD, Farm Bureau, Extension, etc.) feel they are promoting CCs beyond their regular duties (entrepreneurial staff)	- NRCS and SWCD employees collaborate to organize field days, where they promote CCs.	- University extension personnel helps farmers apply to SARE grants.
Presence of CC experts, advocates, and/or entrepreneurs	- A local crop advisor is an advocate of CCs because they contribute to improved soil health, water quality, and return on investment on fertilizer.	- There are two or three well-respected local farmers that grow CCs.
Favorable attitude toward CCs	Interviewees did not report a significant difference in between the two counties.	
Collaboration between organizations (NRCS, SWCD, Extension, Farm Bureau, etc.) and CC experts, advocates, and/or entrepreneurs	- Local crop advisor explained the benefits of CCs to SWCD board members. They got more funding for CCs as a result because they chose to allocate cost-share funds toward them. - This crop advisor is also available to advise other producers who would like to grow CCs.	
Topography (rolling hills and more erodible soil led to early adoption of CCs)	Interviewees did not report a significant difference in soil type between the two counties.	
Farm characteristics (organic produce, pastured livestock, smaller-scale farms, and/or more cattle)	Interviewees did not report a significant difference in between the two counties.	

LaGrange County vs. Steuben County

Factors	LaGrange (higher adopter)	Steuben (lower adopter)
Agency employees (NRCS, SWCD, Farm Bureau, Extension, etc.) feel they are promoting CCs beyond their regular duties (entrepreneurial staff)		- There is an experienced administrative coordinator in charge of grant writing, who secures grants that can be used for CCs.
Presence of CC experts, advocates, and/or entrepreneurs	- One local entrepreneur has a full-time business selling CC programs to non-Amish producers. She helps them with the paperwork required for participating in CC programs offered by agencies such as NRCS. - There are also several local seed dealers sell CC seeds to producers (both Amish and non-Amish) and provide advice on CC selection and blends.	
Favorable attitude toward CCs	- Planting CCs is a traditional practice for the Amish, a continuation of their farming style. In LaGrange County, CCs have become a mainstream practice. Including them in land management is associated with being a "good farmer."	(In contrast, interviewees in Steuben mentioned that social and knowledge components of CCs are lacking. There is not a network of farmers that regularly exchange knowledge and discuss CC challenges and solutions.)
Collaboration between organizations (NRCS, SWCD, Extension, Farm Bureau, etc.) and CC experts, advocates, and/or entrepreneurs	- The entrepreneurs that sells CC programs to producers serves as an intermediary between farmers and agencies such as NRCS. Close to half of NRCS contracts were facilitated by her. - According to interviewees, she sells the programs to producers that NRCS would ordinarily not reach.	
Topography (rolling hills and more erodible soil led to early adoption of CCs)	- LaGrange has sandier soil than Steuben.	
Farm characteristics (organic produce, pastured livestock, smaller-scale farms, and/or more cattle)	X - There are over 300 certified organic farms owned by the. They use CCs to help stabilize nutrient sources and combat weeds. There is a larger Amish community in LaGrange, whose members practice rotational grazing. They are more likely to grow CCs in the fall as a feed source for some of their animals.	

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