Journal of Soil and Water Conservation

ISSN: 0022-4561 (Print) 1941-3300 (Online) Journal homepage: www.tandfonline.com/journals/uswc20

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To cite this article: R. Irvine, L. Yoder, E. Carman-Sweeney, S.C. Harden & C. Wardropper (2024) Risk mitigation or risky business? Agricultural stakeholders' perspectives on crop insurance discount programs, cover crops, and risk management, Journal of Soil and Water Conservation, 79:6, 289-302, DOI: 10.2489/jswc.2024.00105

To link to this article: https://doi.org/10.2489/jswc.2024.00105

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Risk mitigation or risky business? Agricultural stakeholders' perspectives on crop insurance discount programs, cover crops, and risk management

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Abstract: Crop insurance is a common risk management tool used by farmers worldwide, but its efficacy may be strained under climate change. Consequently, there is growing interest in climate-smart agriculture practices like cover crops, which can increase farm resiliency. We studied a novel conservation incentive program in three US Midwest states that gave farmers a US$5 discount per acre (US$5 discount per 0.4 hectares) on their crop insurance premiums. Through six focus groups with farmers, program administrators, and crop insurance agents (n = 39), we sought to understand how they perceived the discount program to impact cover crop adoption or persistence and to better understand their perspectives on cover crops as a risk-mitigation strategy. Our participants' experiences indicated that the crop insurance discount incentive is unlikely to drive cover crop adoption or persistence. While the discount significantly reduces crop insurance premiums on the acres to which it is applied, farmers tended to focus on the US$5 ac^{-1} dollar amount, which is smaller than financial assistance offered in more traditional incentive programs. Furthermore, some crop insurance agents and farmers perceived cover crops to increase risk. Participants broadly supported the need for more data to quantify the impacts of cover crops to better inform farm management. While using crop insurance to promote cover crops has the potential to reduce farmers' reliance on taxpayer subsidies and reduce farmers' risks to extreme weather, program administrators need to tailor messages to make the link between cover crops and risk mitigation more evident.

Key words: agricultural conservation practices—environmental policy—focus group—qualitative methods—risk perception—social science

Cover crops have garnered increased policy support and investment in the United States (Hamilton et al. 2017; USDA NRCS 2022) and internationally (European Commission 2021; Fan et al. 2021; Kathage et al. 2022). When managed properly, cover crops may mitigate harmful environmental impacts of agricultural production while also promoting resilience to climate change (Kaye and Quemada 2017; Thompson et al. 2022; Van Eerd et al. 2023). However, a variety of social, economic, policy, and system-level challenges present barriers to farmers' adoption of cover crops (Roesch-McNally et al. 2017; Plastina et al. 2018; Lee and McCann 2019; Thompson et al. 2021; Duke et al. 2022; Nowatzke and Arbuckle 2023). Worldwide, a variety of incentives are used to support farmers in adopting conservation practices. These range from publicly funded voluntary programs (Garret and Neves 2016) to market interventions, regulations, and cross-compliance measures (Piñeiro et al. 2020). In the United States, practice-based cost-share assistance is one of the most common approaches to incentivizing cover crop use (Myers et al. 2019; Wallander et al. 2021). Administered by the USDA Natural Resources Conservation Service (USDA NRCS), cost-share assistance programs such as the Environmental Quality Incentives Program (EQIP) provide farmers with financial, technical, and informational support during the early years of adopting a conservation practice, such as planting cover crops (Bowman and Lynch 2019; Park et al. 2022). In Europe, direct payments to farmers who implement "greening practices" such as cover crops are available through the Common Agriculture Policy (Shackelford et al. 2019; Schnepf 2021). At a global level, adoption of climate-resilient agriculture practices like cover crops are supported by the Global Environment Facility and the United Nation's International Fund for Agricultural Development (IFAD 2023).

USDA cost-share incentives promote additionality, meaning that cost-share plays a significant role in increasing the number of cover crop acres planted compared to the number that would be planted without the program (Mezzatesta et al. 2013; Gonzalez-Ramirez et al. 2015; Dunn et al. 2016; Fleming 2017; Sawadgo and Plastina 2021; Park et al. 2022). However, the number of cover crop acres planted nationwide remains low relative to the total number of row crop acres planted annually (Wallander et al. 2021). This is particularly true in key US Midwest agricultural states such as Iowa, Illinois, and Indiana, where cover crop use is 4%, 3%, and 8% of row crop acres, respectively (USDA NASS 2017), and where more than half of cover crop users plant less than 50 ac (20.2 ha) of cover crops (Thompson et al. 2021). In recent decades, the USDA has significantly increased investment in cost-share programs to address rising demand and to drive cover crop adoption among new users. Since 2005, EQIP dollars dedicated to cover crop cost-share have increased 20-fold (Wallander et al. 2021). Over the next decade, USDA NRCS will invest millions more toward cover crop initiatives nationwide (USDA NRCS 2022).

Received November 7, 2023; Revised July 15, 2024; Accepted July 21, 2024.

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While it is expected that cost-share will play an important role in furthering the adoption of cover crops across the US Midwest, the degree to which cost-share programs will entice current nonadopters is uncertain (Ranjan et al. 2020; Sawadgo and Plastina 2021). Additionally, it is uncertain to what degree cost-share is likely to support the broader aim of securing practice persistence at scale (Swann and Richards 2016; Dayer et al. 2017; Bowman and Lynch 2019; Chami et al. 2023).

Seeking new avenues to encourage cover crop adoption, the agricultural conservation community has assessed other programmatic options. One new approach is integrating cover crops into risk-reduction programs (USDA RMA 2022). Emerging research suggests that cover crops can reduce farmers' risks from negative climate change impacts, particularly from excess moisture (Aglasan et al. 2023; Sherrick and Myers 2023; Won et al. 2023) and drought and extreme heat (Aglasan et al. 2023). More research is needed on specific biophysical and management factors that can contribute to risk reduction associated with cover crops, such as associations with tillage type, irrigation, and the number of growing days for cover crops (Griscom et al. 2017; Shackelford et al. 2019; Gutknecht et al. 2022; Schlesinger 2022; Francaviglia et al. 2023). More social science research into how farmers' climate risk perceptions impact cover crop use is also needed. Prior studies suggest that the degree to which farmers perceive climate change as a threat to their operation plays a critical role in adoption of climate mitigation practices (Arbuckle et al. 2015; Houser et al. 2017; Mase et al. 2017). However, the connection between farmers' perceptions of climate risk and their decision-making around cover crop use is understudied.

This study seeks to advance theoretical and practical understandings of farmers' and other agricultural stakeholders' perceptions of cover crops, risk management, and programmatic approaches to support cover crop use. We do so through focus group conversations centered on a novel conservation incentive program offered in three US Midwest agricultural states (Iowa, Illinois, and Indiana). To promote cover crop use through a new channel, state policymakers and conservation partners collaborated with the USDA Risk Management Agency (RMA) to pilot crop insurance premium discount programs that link cover crop use with climate risk mitigation (Bryant and O'Connor 2017). Iowa's Crop Insurance Discount Program was piloted in 2017, followed by the Illinois Fall Covers for Spring Savings program in 2018, and Indiana's Cover Crop Premium Discount Program in 2022. The federal government also offered a temporary, nationwide crop insurance discount program known as the Pandemic Cover Crop Program from 2020 to 2022. These crop insurance discount programs offer a US$5 ac^{-1} discount for every farm acre (US$5 discount for every 0.4 hectares) planted in cover crops and enrolled in the program. Through focus group discussions with farmers, conservation program administrators, USDA RMA representatives, and crop insurance agents, our study explores two key questions:

1. To what extent is the crop insurance discount approach perceived to encourage new adoption or persistence of cover cropping?
2. How do different agricultural stakeholders perceive cover crops to influence farm risks in the short and long term?

By identifying how stakeholders perceive the role of cover crops in risk management and their perspectives on the crop insurance discount approach to incentivize cover crop use, we provide preliminary insights to inform policymaking and program delivery regarding public payments for on-farm best management practices and climate risk mitigation.

Background. The climate crisis presents a growing risk to both individual agricultural producers' livelihoods and global food security. Government-subsidized crop insurance has been one of the most widely employed approaches to agricultural risk management in the Global North and is also increasingly relied upon in the Global South (Mase et al. 2017; Tack et al. 2017; Fleckenstein et al. 2020; Perry et al. 2020; Fan et al. 2021). In the United States, the USDA RMA administers the Federal Crop Insurance Program (FCIP) and insures the vast majority (>85%) of row crop acres in the country (Fleckenstein et al. 2020; Rosch 2021). The FCIP began during the Great Depression as one of many institutions helping farmers deal with the uncertainties of agricultural production (Hamilton 2020). It has grown in popularity and scope to insure 444 million crop acres (179.7 million ha) as of 2021 (USDA ERS 2023). Before 1980, the US federal government primarily provided assistance for weather-related crop damages after a disaster. In 1981, with the aim of expanding insurance participation, the US FCIP was altered to allow private insurance companies to service policies with significant federal subsidization of the program (Coble and Barnett 2012; Annan and Schlenker 2015), often upwards of 60% (Bryant and O'Connor 2017; Rosch 2021; ERS 2023).

Despite the history and popularity of the FCIP among US farmers, it is often critiqued and may face challenges under accelerating climate change (Tack et al. 2017; Crane-Droesch et al. 2019). Crop insurance has been criticized for multiple reasons, including for the moral hazard it presents (Wu et al. 2019; Connor et al. 2022) by sometimes working against adoption of some conservation best management practices (Fleckenstein et al. 2020; Sellars et al. 2022), the heavy reliance on actual production history in actuarial ratemaking (Bryant and O'Connor 2017; Zhu et al. 2019), lack of income limits on subsidy recipients (GAO 2023), and its contributions to changes in land use and crop selection (Classen et al. 2016). Stakeholders across the agricultural sector increasingly call for data-driven crop insurance policy that advances farmer profitability and positive environmental outcomes (Woodard 2016; Bryant and O'Connor 2017; Adusumilli et al. 2020; AGree 2021). As one example of this interest, USDA RMA commissioned a study in 2010 to update its actuarial ratemaking in the context of climate change to better align farmers' premiums with their level of risk (USDA RMA 2010) and will continue to do so in accordance with the USDA RMA Climate Adaptation Plan (USDA RMA 2022).

Accurately capturing the impact of climate change on crop insurance is much needed. Research finds that agricultural risk to climate change impacts is increasing. Commodity crop losses associated with climate change (Gowda et al. 2018; Raza et al. 2019; Dhaliwal and Williams 2022) and corresponding crop insurance indemnities have significantly risen since the 1990s as global temperatures have increased (Diffenbaugh et al. 2021). Concerningly, crop insurance indemnities are estimated to increase by a further 22% to 61% in the coming decades (Tack et al. 2017). With these rising costs, both farmers and the public suffer economically—the former through significant increases to their crop insurance premiums,

and the latter through taxpayers' subsidization of federal crop insurance programs (Tack et al. 2017; Crane-Droesch et al. 2019; Perry et al. 2020). Consequently, both producers and the public have a vested interest in increasing agricultural producers' resilience to climate change.

Toward addressing this challenge, the USDA and international groups increasingly promote policy and investment in "climate-smart agriculture" (CSA). Climate-smart agriculture is variably defined (Lipper and Zilberman 2018) but encompasses a suite of on-farm management approaches intended to build producers' resilience to climate change, reduce agricultural greenhouse gas emissions, or sequester carbon (C) (Steenwerth et al. 2014; Lipper and Zilberman 2018). Cover crops are among the CSA practices that have garnered increased global attention (Shackelford et al. 2019; Thompson et al. 2022). Proponents perceive cover crops as an environmentally and economically efficient investment because they can provide co-benefits across spatial scales (Kaye and Quemada 2017; Kathage et al. 2022).

At the individual producers' level, long-term use of cover crops can improve soil properties such as water infiltration and water holding capacity (Basche et al. 2016; Haruna et al. 2022; Koudahe et al. 2022). Much research finds that cover crops can increase soil organic C (SOC) (Poeplau and Don 2015; Chahal et al. 2020; Qin et al. 2023), especially when combined with other conservation practices such as no-till (Porwollik et al. 2022). Because higher SOC is found to protect against crop loss in drought and extreme heat (Kane et al. 2021), it is possible that cover crop use can reduce production risks in these conditions as well. Notably, research finds that cover crops reduce row crop farmers' interannual yield variability (Bergtold et al. 2017; Leuthold et al. 2021) and lower production risks in excessive moisture conditions (Sherrick and Myers 2023; Won et al. 2023; Aglasan et al. 2023).

Beyond production benefits, cover crops can also deliver benefits to the broader public. Crop insurance claims are most often caused by drought, extreme heat, or extreme precipitation events (Diffenbaugh et al. 2021). Since extreme weather events are anticipated to occur with greater frequency and severity as climate change progresses (Gowda et al. 2018), the potential for cover crops to moderate soil moisture and temperature offer an appealing opportunity to reduce risks associated with climate change. Since crop insurance is so heavily subsidized (Bryant and O'Connor 2017; Rosch 2021; USDA ERS 2023), taxpayers could benefit if farmers reduce their risks to climate change impacts. Additionally, because cover crops sequester C from the atmosphere, they offer an appealing climate mitigation opportunity for society. This potential benefit of cover crop use has contributed to a burgeoning agricultural C marketplace (Thompson et al. 2022).

Despite the wealth of benefits that cover crops may deliver, quantifying their benefits and integrating them into conventional agriculture systems, which characterize much of the US Midwest (i.e., a corn [*Zea mays* L.]–soybean [*Glycine max* {L.} Merr.] two-year rotation), can be challenging. The degree to which cover crop benefits accrue varies widely with climate, soil type, species selection, and management choices and expertise (Snapp et al. 2005; Myers et al. 2019; Romdhane et al. 2019). Ample research has identified a variety of barriers to the adoption of conservation practices broadly and cover crops specifically. General barriers include upfront costs, the complexity of the practices, limited markets to diversify away from grain crops, and reputational risks for trying conservation practices (Prokopy et al. 2019; Delaroche 2020; Fleckenstein et al. 2020; Reimer et al. 2021). For cover crops, barriers are tied more specifically to the additional time constraints, the potential consequences to subsequent cash crop yields, and additional input costs (Roesch-McNally et al. 2017; Plastina et al. 2018; Lee and McCann 2019; Thompson et al. 2021; Duke et al. 2022; Nowatzke and Arbuckle 2023). A few studies suggest that farmers may begin to observe production benefits from using cover crops after three years (Myers et al. 2019), with the likelihood of reporting benefits increasing further after a decade of use (Wang et al. 2020). However, the degree to which different management approaches and differing levels of management expertise mediate benefit accrual requires further study. This is especially the case regarding the economic implications of cover crop use. While farmer decision-making about cover crops is not solely driven by economic factors (Roesch-McNally et al. 2017; CTIC 2023), it is an important consideration. Some research suggests that a positive return on investment from using cover crops is not guaranteed (Plastina et al. 2018; Deines et al. 2022; Qin et al. 2023). Difficulties in quantifying the economic return on cover crops remain a key sticking point to advancing cover crop adoption (Bergtold et al. 2017), particularly among the diffusion of innovation theory's so-called "middle- and late-adopters" (Rogers 2010). The underdeveloped business case for cover crops presents challenges to securing long-term practice persistence (Swann and Richards 2016; Dayer et al. 2017).

Research finds that trusted advisors (Stuart et al. 2018; Reimer et al. 2021; Houser et al. 2023) and climate risk perceptions play a critical role in farmers' management decision-making (Arbuckle et al. 2015; Mase et al. 2017). Existing research indicates that farmers may perceive increased risks associated with initial cover crop adoption, such as delayed cash crop planting, instead of basing risk perceptions on long-term climate impacts (Yoder et al. 2021). We define risk following Aven and Renn (2009), where risk comes from uncertainties regarding an event that might affect an outcome and the magnitude of the outcome. Uncertainties come from the risk assessor's point of view—they may be quantifiable or not. Whereas farmers and other agricultural stakeholders increasingly perceive climate change to be occurring (Houser et al. 2023), many do not perceive it to be a significant risk to their operation unless they have directly experienced negative impacts (Mase et al. 2017). A survey of US Midwest farmers found that among those who perceived climate change as a risk, farmers reported adapting farm management by incorporating in-field conservation practices (64%), purchasing additional crop insurance coverage (59%), and/or utilizing new technology (43%) (Mase et al. 2017). These valuable preliminary insights into how farmers perceive and respond to climate risk highlight the need for more research into why farmers and other agricultural stakeholders do or do not perceive climate change as a risk, why they do or do not engage with different adaptation strategies, and which of those management adaptations are most effective at mitigating climate risk. Our research begins to address this gap in knowledge by studying farmers' and other key agricultural stakeholders' perceptions of cover crops, risk management, and the crop insurance discount approach.

Materials and Methods

To address our research questions, we organized a series of six focus group discussions from February to May of 2023 with a total of 39 participants, including farmers (n = 20), program administrators and USDA RMA representatives (n = 15), and crop insurance agents (n = 4), who have direct experience with the federal and/or state cover crop insurance premium discount programs offered in Iowa, Illinois, and Indiana (table 1). This study received Indiana University's Institutional Review Board approval (#17886). We present the results using anonymous identification numbers to provide privacy to study participants and have removed any identifiable information, such as associations with local, state, or federal programs.

We chose focus groups as our mode of data collection because they allow for a more comprehensive and detailed understanding of participants' perspectives than quantitative surveys alone (Prokopy 2011) and because of their cost-effectiveness compared to individual interviews (Warr 2005). However, while focus groups offer these advantages, they are not without limitations. Sample bias and limited generalizability of results are potential challenges, as participants who opt to join might not fully represent the broader population. Furthermore, the group dynamics within focus groups can sometimes allow extroverted or more vocal participants to dominate the conversation, which may not fully capture the diversity of views present in the wider community (Parker and Tritter 2006). Despite these limitations, the benefits of using focus groups, particularly their ability to elicit complex responses and interactions between participants, justified their use in our study.

To foster a representative sample, focus group participants were recruited from a variety of agricultural networks across the case study region (Iowa, Illinois, and Indiana). We utilized a recruitment strategy that targeted row crop corn/soybean farmers from across each of the I-states and offered a US$100 gift card as a participation incentive. Farmers were recruited by sending email invitations through our established agricultural networks, supplemented by outreach from partner organizations and each state's department of agriculture. The sole criterion for participation was involvement in their state's cover crop insurance discount program. In total, 20 farmers participated across three focus groups: 6 from Indiana, 6 from Iowa, and 8 from Illinois (table 1). Farm characteristics and demographic data (table 2) were primarily gleaned through information shared during focus group discussions. Farmers were given the additional opportunity to share further demographic and farm details via a Qualtrics survey post discussion. This survey also provided an avenue for farmer participants to share feedback on the focus group discussion or express opinions they may not have felt comfortable sharing in the group setting. While we do not claim generalizability from our sample of farmers, their experience with the learning curve of adopting cover crops and cover crop incentive programs provided valuable insights on the strengths and weakness of the crop insurance discount program and how it might influence their and other farmers' use of cover crops.

Program administrators and crop insurance agents were likewise recruited with attention toward representation of perspectives and experience. We sought both mid- and senior-level program administrators from within each state's department of agriculture, conservation organizations, and regional and federal levels at USDA RMA. Program administrators were drawn from those with direct experience with traditional USDA cost-share programs as well as those who work with the crop insurance discount programs to elicit insight on the range of incentive programs available for cover crop users. Crop insurance agents were primarily selected through outreach efforts facilitated

Table 1
Overview of focus groups.

Group	Focus group audience	Meeting location	Participants (n)	County/agency represented
1	Farmers (IN)	Indianapolis, IN	6	Delaware, Hamilton, Tipton, and Wayne counties (IN)
2	Farmers (IL)	Bloomington, IL	8	Cass, Champaign, Crawford, McLean, Montgomery, Peoria, and Tazewell counties (IL)
3	Farmers (IA)	Toledo, IA	6	Benton, Bremer, Hardin, Marshall, and Poweshiek counties (IA)
4	Program administrators: federal and state crop insurance premium discount programs	Online (Zoom)	8	State Department of Agriculture and USDA RMA representatives (IA, IL, and IN)
5	Program administrators: USDA cost-share programs	Online (Zoom)	7	State NRCS and State Department of Agriculture representatives (IA, IL, and IN)
6	Crop insurance agents	Online (Zoom)	4	IA, IL, and IN

Notes: IN = Indiana. IL = Illinois. IA = Iowa. NRCS = USDA Natural Resources Conservation Service. RMA = Risk Management Agency.

Table 2
Farm and demographic characteristics of farmer participants.

Category	Min.	Max.	Average	Median	n
Farm size (ac)	294	4,000	1,292	875	11
Cover crop area (ac)	294	2,500	783	560	11
Cove crop intensity (% of farm)	13	100	84	100	13
Years of experience with cover crops (y)	5	35	15	12	13
Age (y)	43	78	61	64	9

by partner organizations' personal networks. These efforts focused on agents known to work in areas with enrollment in crop insurance discount programs, ensuring that the agents had direct experience with cover crop farmers and the relevant crop insurance discount programs.

Each of the six focus groups lasted approximately 90 minutes. Three in-person focus groups were conducted with farmers who use cover crops and who have participated in their respective state's crop insurance discount programs. Two online focus groups brought together administrators from across the three I-states and USDA RMA who work with the crop insurance discount programs and/or traditional USDA NRCS cost-share programs. One online focus group convened crop insurance agents from across the three I-states who have worked with farmers participating in their respective state's crop insurance discount programs. The administrator and crop insurance agent focus groups were held online via Zoom (Zoom Video Communications, San Jose, California) to account for participants' widespread geographies. Members of the research team moderated each of the six focus groups; partner organization representatives who helped secure farmer participants assisted with notetaking and question follow-up at each of the farmer focus groups.

The focus group discussions were semi-structured and followed a question guide that was tailored to the specific stakeholders present but which covered the same thematic concepts at all focus groups (see supplementary materials for the focus group questions used at each discussion). Each focus group discussion explored participants' perceptions and experiences regarding (1) drivers and barriers of cover crop use, (2) risk perceptions of cover crop use, and (3) the influence of programmatic factors on cover crop use. Focus group discussions were audio-recorded with permission of the participants and then transcribed verbatim. Transcripts were analyzed using a qualitative coding approach using NVivo 14 software (Lumivero, Denver, Colorado).

The authors collectively developed a codebook (see supplementary materials) based on thematic concepts and focus group questions (Deterding and Waters 2021). Codes pertaining to the first thematic concept (drivers and barriers to cover crop use) were used to code participants' dialogue on what factors motivate, discourage, or prevent farmers' adoption, expansion, or long-term use of cover crops, and what factors lead to the abandonment of cover crops. Codes pertaining to the second thematic concept (risk perceptions of cover crops) were used to code for participants' discussion of the management benefits and challenges of using cover crops and perceptions of how cover crops impact risk or are used to manage risk. Codes pertaining to the third thematic concept (programmatic factors) were used to record participants' perspectives on different program attributes of the design and delivery of programs (e.g., cost-share programs, the discount approach, and C markets) related to cover crop use. In addition to the expected codes that correspond with the thematic concepts we set out to explore, an emergent thematic concept on the topic of "data uncertainties" appeared across all six focus group discussions. Codes for this emergent concept were applied to participants' discussion of the need for more quantitative data on how cover crops impact risk and risk management, the need for more data to inform program design and delivery, and the need for more data to inform farmer decision-making around cover crop adoption, abandonment, and persistence.

Transcripts were coded independently by two of the authors who then compared their coding decisions, discussed any coding differences and their interpretations, and resolved discrepancies through discussion to reach a coding consensus. We used this approach instead of relying on an intercoder reliability score to ensure that the coders discussed all differences in how codes were applied to achieve 100% agreement. We chose discussion as our approach because coders may still disagree on their reasons for applying a code for a given section of text even when achieving high intercoder reliability scores (Clarke et al. 2023). Given the exploratory nature of this study, we were primarily concerned that each instance of disagreement be resolved so that coders could generate a shared understanding through discussion (Chinh et al. 2019), which is consistent with a growing number of researchers who call for discussion to be a core part of one's approach to achieve high intercoder reliability (O'Connor and Joffe 2020).

Results and Discussion

Perceptions of the Crop Insurance Discount Approach. Across focus groups (farmers, program administrators, and crop insurance agents), participants expressed varying degrees of value for the crop insurance discount approach, particularly in comparison to the generally positive views expressed toward traditional cost-share approaches. In general, participants seemed to view the two approaches to cover crop incentives as serving different but complementary roles in supporting farmers' use of cover crops. Many participants expressed that the discount approach is less likely to drive new cover crop adoption than traditional cost-share programs, but that it may somewhat support practice persistence.

Adoption. Nearly every participant across all six focus groups agreed that the crop insurance premium discount approach is not likely to be a strong driver of cover crop adoption. This was largely attributed to the perception that the US$5 ac^{-1} rate is too low to entice conventional farmers to invest in using cover crops for the first time. Farmers seemed to express the strongest perspectives on the perceived inadequacy of the discount approach to drive cover crop adoption. Farmers largely saw the discount as "an added bonus" (ID19). Many farmers expressed displeasure that the discount amount was much lower than their costs per acre of using cover crops. As one participant commented,

> Economics [are] the major problem … quit embarrassing farmers with [US$5] an acre. If you want [farmers to use] cover crops … I've got US$50 or US$55 an acre [invested] in [using] cover crops.… Don't get me wrong, I appreciate the [US$5] an acre, it's supplemented … But … I can't afford to change my way of farming for [US$5] an acre. You know, are you kidding me? It's kind of embarrassing. (ID16)

Farmers also expressed that the discount approach is unlikely to drive adoption as its per acre value (US$5) is so much lower than the per acre incentives available through cost-share. Farmers discussed how new cover crop users need a greater financial buffer in the early years of cover crop use than what the discount incentive offers. Multiple farmers described how the higher financial support offered through cost-share programs was essential in their adoption process, illustrated by one farmer's reflections:

> The EQIP [incentive] was US$40 to US$50 an acre [and it] really helped boost our operation, because it was a significant amount of money that we could [use].... I [could] make some management decisions because I got a little pot of money here, [and I could decide] how do I best allocate that to see if [cover crops] work, and to make it work … it's like, US$40 an acre is a lot more significant [than US$5 an acre], I mean, it's like what can I do [with US$5 an acre]? (ID16)

Echoing this sentiment, other farmers noted that the discount program is particularly unlikely to incentivize cover crop adoption among presumed middle and late adopters. Farmers implied that existing cover crop users are part of the so-called "early adopter" segment of the population, as defined by the theory of innovation diffusion, and share some level of intrinsic motivation to use cover crops. In contrast to themselves, farmer participants expressed the perspective that a strong financial case is needed to get the remaining population of conventional farmers to make the switch to using cover crops. As one farmer explained, "It's going to take a much larger incentive [than US$5] to change that individual that's been in traditional farming all the years and to get them to make the change" (ID12). Other farmers voiced similar sentiments, sharing that

> [for] US$5 an acre discount on your crop insurance to a tillage farmer—no [the discount won't change their mind on cover crops].… I've sat in meetings where the room [expressed that] US$100 an acre is what it's gonna take [for them to try cover crops]. (ID15)

Like farmers, crop insurance agents also did not think that the crop insurance discount would drive cover crop adoption at scale. Most crop insurance agents seemed ambivalent about the program's influence on cover crop adoption, illustrated by one agent's comment that "the US$5 has not had a negative impact on participation [with] cover crops, but it probably hasn't been the silver bullet to get people to participate in a cover crop program [either]" (ID37).

In contrast to farmers and crop insurance agents, program administrators were tentatively optimistic but uncertain about the role the discount approach plays in cover crop adoption. Administrators echoed the sentiments expressed by farmers that traditional cost-share may be more likely to drive adoption than the discount approach. As one administrator noted,

> Data kind of remains to be seen [about the discount program]. So, US$5 may or may not be enough to spur somebody when they're looking at the cost of putting out a cover crop as relative to other potential programs [like cost-share]. (ID21)

Despite the perceived lack of influence the discount approach plays in cover crop adoption, participants did identify two indirect adoption-related benefits it might add to the existing landscape of conservation assistance programs: the potential to drive the reporting of cover crop acres, and the potential to promote greater intensity of cover crop use. Both farmers and administrators presented the idea that a crop insurance discount indirectly provides an incentive for reporting the number of cover crop acres planted each year. Participants discussed how the lack of a USDA reporting requirement contributes to potentially significant undercounting of cover crop acres: "In Illinois, we hear [that there are] about one million acres of cover crops. But what's being reported is only half a million" (ID12). Participants suggested that the discount approach may improve the accounting on cover crop use as it gives farmers "a reason to [report cover crop acres.] If nothing else, I know from a data standpoint that's been an interesting side bonus I believe we didn't anticipate [from the discount program] … but that's another benefit that came out of it for sure" (ID23).

Some participants from across all focus groups also suggested the possibility that the discount approach may support cover crop expansion and drive higher cover crop intensity over the long term. Participants attributed this to two factors: (1) that the discount approach, unlike cost-share, has no acreage caps for enrollment, and (2) that the savings from the discount might free up funds to offset the management costs of additional cover crop acres. Describing how no acreage caps might impact practice expansion and contribute to planting cover crops at higher intensities, an administrator explained that

> for those folks that have more experience and are more comfortable with [cover crops], or maybe they max out the acre limits in some of our [cost-share] programs, and they want to do more acres,… [participating in the discount program] is a way to help them further down and longer term. (ID33)

Similarly, some agents and farmers described how the discount incentive might encourage farmers to plant more cover crop acres. One agent shared that "at least one of … [my clients] put more acres under cover crop because of the program" (ID38). Likewise, a farmer described how "instead of maybe running 200 acres of cover crop, I ran 600 acres of cover crop because the cash flow was there to make it make sense through CSP (Conservation Stewardship Partnership) and stacking [payments] and all that stuff" (ID10).

Practice Persistence. Most focus group participants did not see the crop insurance premium discount approach as a key driver of practice persistence, but many expressed that it may play a neutral to slightly beneficial role in supporting long-term cover crop users who don't qualify for cost-share programs.

Across focus groups, farmers were the least likely to perceive the discount approach as a key factor in practice persistence. Akin to farmers' perspectives on what drives cover crop adoption, many expressed that long-term cover crop use requires some degree of intrinsic motivation beyond receipt of incentive payments or solely economic considerations. As one farmer noted, "Most of the people that are in cover crops right now, without any US$5 here and US$5 there, would stay in it" (ID12). In general, farmers tended to downplay the role the discount, or even larger cost-share incentives, play in farmers' persistence decisions. One farmer shared the following perspective:

> Most operations I've seen that start dabbling in cover crops.… they're gonna do it because they want it to work, but they're not sure. Those are the ones that may actually keep doing it. The ones who only do it for the incentives—as soon as they can't qualify for something or it becomes slightly more difficult, they're never doing it again. (ID4)

Agents likewise tended not to view the discount as a strong driver of farmers' long-term decision-making around cover crop use.

One agent felt that the discount was too low to drive practice persistence in part because the perceived transaction costs of participating in the program are greater than the US$5 ac^{-1} farmers receive in return. Recalling an experience with a client who already uses cover crops, an agent shared that

> I actually had a guy this year, I said, "Hey, you put in cover crops," and he's like, "Yeah, I don't wanna waste all that time for a US$5 discount." I'm like, "Okay.…" So, some of them even know about it and they choose not to [participate in the discount program]. (ID38)

Administrators tended to express more positive views of the discount program's role in supporting practice persistence. For example, one administrator described how the discount plays a valuable role in the transition from adoption to persistence in the following terms:

> I think our approach has been [to] try to get some new people in [with cost-share] … to get some people established using cover crops. And then, at some point in time … to transition them once they make it part of their day to day … into something that's going to be this crop insurance discount. I think that's the ultimate goal. (ID24)

Administrators also highlighted the novelty of the discount program's eligibility requirements as a reason why the discount program may promote practice persistence. As one administrator explained,

> One of the strengths of [the discount] program is [that it] caters to those longtime, existing cover croppers, because as you look across the landscape of incentives and motivations for [cover cropping], there are just not a lot of things they can participate in.… The cost-shares, the climate programs, the carbon programs, all of those are looking for additionality, and there's a lot of guys … that feel left out because they can't participate in those. (ID22)

Related to this observation, administrators also voiced the sentiment that while the US$5 discount may seem nominal to some, it signals appreciation of long-term cover crop users' value to the agricultural community and might thereby encourage other farmers to follow suit. One administrator saw the possible social implications of the discount in promoting practice persistence as

> an opportunity for those who … have been doing this for a long time and don't have those opportunities to get some of the other money that's out there—to reward them for their hard work over the years and setting the path forward. (ID24)

Some farmers and administrators also suggested that the discount could play a greater role in practice persistence if it is framed in terms of the percentage by which it reduces crop insurance premiums rather than as a flat amount per acre. Proponents of doing so suggested that it makes the discount more psychologically appealing and therefore more likely that farmers will want to engage with it in the long term. As one farmer explained, if you consider the crop insurance discount "percentage wise, it's a pretty decent amount" (ID12). This sentiment was echoed by other farmers and administrators, who shared that the discount could offset sometimes upwards from 25% to nearly 100% of farmers' premium costs depending on the crop insured and the level of coverage elected.

Perceptions of Cover Crops and Risk Management. Participants across focus groups expressed a range of perspectives on the timeline and degree to which they perceive cover crops to increase or decrease the risk to individual- (e.g., production) and global-scale (e.g., climate change) hazards. When discussing cover crops and short-term risk management, participants generally agreed that cover crops create additional management considerations. Many voiced that farmers' management expertise or lack thereof was an important factor in production impacts associated with cover crop use. When discussing cover crop use over the long term, participants also discussed how cover crops impact risk management to off-farm hazards such as climate change. Regardless of participants' perspectives, across focus groups, participants voiced the desire for improved data on the short- and long-term impacts of cover crops.

Cover Crops and Short-Term Risk Management. Across focus groups, most participants discussed the short-term impact of cover crops on risk management in terms of how cover crops impact on-farm rather than off-farm risks. Farmers, administrators, and crop insurance agents all described how using cover crops can increase production risks in the short term if managed improperly. Farmers and administrators generally held more favorable views of cover crops than crop insurance agents; the latter also farmed but did not use cover crops in their operations. Similar to what existing studies report, all focus groups identified how factors such as timing, weather, labor availability, appropriate species selection, technical knowledge, and financial considerations present annual recurring challenges with cover crop use. Key management challenges associated with cover crop use that were perceived to increase production risks in the short term were noted in situations where the cover crop interferes with timely planting or even-aged stand establishment of the cash crop, or instances where nutrient or moisture conditions are negatively affected by cover crop use.

Farmers and administrators generally agreed that cover crops most dramatically increase production risks during the initial period of cover crop use (within the first five years) when farmers' learning curve is the steepest. Participants also expressed the perception that, as management expertise increases and cover crop-derived soil health benefits accrue, the annual on-farm risks presented by cover crop use gradually decreases. Given that short-term risks derived from cover crop use are experienced so differently by the novice versus experienced cover crop user, one administrator suggested that the topic of cover crops and risk should be viewed as "a conversation around balance of risk and not just risk mitigation" (ID21). Speaking to the potential management pitfalls of the first years of cover crop adoption, a crop insurance agent described how a supplementary insurance product that is designed to help cover the short-term increase in farmers' production risks might increase farmers' interest in adopting cover crops.

> As far as people who are close to adoption, if there was an initial transition period, let's say a three-year transition period to utilizing cover crops that would allow you to have higher replants, payments, or some fringe benefit to do it that would help offset some of that risk, yeah, it would probably help with

> adoption of the programs or make people more comfortable with utilizing [cover crops]. (ID37)

Although focus group participants primarily described potential increases in short-term risks associated with cover crop use, soil retention and weed suppression were identified as two short-term risk-reducing benefits of cover crops that positively impact production. As one farmer noted, reducing soil erosion is invaluable because "if you don't have any topsoil left, or less topsoil left [you can't farm], I just don't understand why that's never an argument or brought into the formulation of [using cover crops]" (ID9). Regarding weed suppression, another farmer described how

> in one year, you can see weed suppression benefits.… If you wanna talk about the one-year reward on cover crops, I think—if you can establish … a stand that takes up available nutrients and pushes out weeds you can see a reduction … especially in like water hemp and jack ragweed pressure. (ID18)

Cover Crops and Long-Term Risk Management. When discussing the impact of cover crops on long-term risk management, most farmers and administrators expressed positive, if uncertain, views of cover crops' risk mitigation potential, while crop insurance agents tended to express a more negative outlook.

Farmers often discussed the long-term risk management value of cover crops in terms of the on-farm production benefits that can accrue over time—namely, yield increases and interannual yield stabilization. Farmers noted that yield benefits are impacted by many variables, including baseline soil characteristics, and are not guaranteed. However, multiple farmers shared that they experienced yield increases after four to six years of cover crop use, such as one farmer who described that his "yields have increased a little bit each year … but it takes … four or five years to be realistic" (ID20). Similarly, another farmer found that cover crops help him achieve "more consistent yields year to year. So, [if] you have a drought … you … [have] almost the same yield as you did in a wet year" (ID3).

As this latter point illustrates, some farmers connected on-farm production benefits of cover crop use with climate resilience benefits. However, farmers did not consider cover crops to uniformly impact risk management of all long-term risks associated with climate change. Farmers were more uncertain about the impact cover crops have on the global C budget. While they agreed that cover crops sequester C and increase soil organic matter, they expressed skepticism regarding cover crops' ability to do so to a degree that dramatically reduces global greenhouse gas concentrations of carbon dioxide (CO_2). As one farmer described,

> We all wanna sequester carbon and build organic matter. And we want to do it on thousands upon thousands of acres and save the planet, and I get that … [but] … tell me if you can track the carbon being sequestered. Maybe we can, maybe we can't. (ID10)

Farmers' uncertainty about the impact cover crops have on C sequestration seemed to be heightened by general mistrust of the burgeoning C market. Farmers tended to express negative views of C programs' role in long-term risk management, with one farmer calling them "snake oil" (ID1) while another depicted it as "a paper shuffle" (ID9) that shifts climate responsibilities onto the farming community. Furthermore, farmers noted the inconsistency between the purported intention of C payments as compensation for climate risk mitigation and which farmers are eligible to receive those payments. As one long-term cover crop user shared,

> It's kind of funny, because the company says we … wanna sequester carbon and make this earth better. Well, if you've been [growing cover crops] for years, aren't you sequestering carbon? If you've been doing it a lot of years and doing it [on] a lot [of acres], wouldn't you really be helping the environment? Because those [farmers] should get paid the most, but they're the ones that can't get in. (ID11)

In contrast to farmers' uncertainty about the role cover crops play in managing the public's risk to global greenhouse gas levels, some farmers did perceive their use of cover crops to reduce the public's risk in other ways. Some farmers discussed the health and economic benefits they provide the public through long-term use of cover crops, both in terms of improved water quality and fewer insurance claims in extreme weather scenarios. Discussing the value farmers deliver in terms of improved water quality, one farmer expressed the following perspective:

> As farmers, when you say you're keeping nutrients out of the waterways, you're doing all these things that are great for everyone who pays taxes; that's why [they should pay] you to do cover crops; that's a different perspective than just handing out welfare to farmers. (ID18)

Similarly, another farmer explained how cover crops reduce the public's risk to climate change impacts by ultimately saving taxpayers money via fewer indemnity payments.

> I'm not a big fan of welfare, and you know … there's obviously tax dollars involved in giving us … the US$5 [per acre discount] … but I also don't feel guilty about [taking the discount] … because I look at three years ago [in 2019] when everybody [without cover crops] was running around trying to replant and buy replant seed, [and] our crops came up just fine. We didn't need that advantage because I think we've got our soil in a place that … it's not totally foolproof or weatherproof, that's something [you] can't [fully achieve, but cover crops] really [do] a lot towards weatherproofing our soils to adverse weather conditions. (ID17)

Similar sentiments were shared by administrators, who as a group tended to support the framework that cover crops reduce long-term agricultural risk to climate change. Like farmer ID17, quoted above, an administrator voiced support for cover crops in managing long-term risk by arguing that it

> actually makes financial sense for the government to give [farmers a crop insurance discount]—any insurance company [operates on the principle that] if you do something that's going to reduce risk, it's going to reduce your premium.… So, if you've got a safer farm field [from using cover crops], then you can pay less on your crop insurance. (ID28)

Another administrator pointed out that the current emphasis that actuarial assessment places on annual production history

may be a disservice to quantifying the risk-mitigating potential of long-term cover crop use, explaining that changes in yield are not a direct indicator of risk. "Some of these farmers that are early adopters that are doing cover crops … are maybe looking more at their bottom line [than yields]. They may have reduced yields but may be more profitable" (ID25).

Despite mostly positive views toward cover crops and long-term risk management, administrators acknowledged that data uncertainties remain. Like farmers, administrators tended to agree that "we need to see more data … to show that cover crops actually do reduce risk" (ID25). Speaking directly to the premise that the crop insurance discount approach reflects the risk reduction of using cover crops, another administrator expressed that "the ability to get … [the risk reduction value of cover crops] actuarily demonstrated and reflected is, to me, the Holy Grail of where [the crop insurance discount approach is going]" (ID21).

In addition to the need for improved data on how cover crops impact risk, administrators also identified stakeholder communications as a factor that affects long-term risk management. Administrators identified a communications challenge in the perceived gap between the existing science and agricultural stakeholders' risk perceptions of cover crops.

> The science might be there … [but the] people that I talk to don't see it … they don't see reductions in nutrient loading. They don't see their yield increases. So, if there is that [data] out there, how do you present that data? And it should be more undisputed than how it is currently. (ID34)

In contrast to this communications challenge, administrators perceived the crop insurance premium discount program to play a positive role in stakeholder communications around cover crops and crop insurance eligibility. Although the FCIC clarified its policy on cover crop use in 2019, administrators expressed that some within the agricultural community may still hold lingering misconceptions or misunderstandings about cover crops and crop insurance eligibility, and that the existence of the discount program helps to correct this.

While all crop insurance agents were aware that cover crop users are eligible for crop insurance, and all agents had in fact worked with some farmers who used cover crops, agents primarily expressed negative perspectives on the impact of cover crops on farmers' long-term risk management. Agents expressed skepticism of cover crops in general, illustrated by one agent's comment that cover crops "present a new set of challenges. It's another crop to manage and another practice to manage as you go in" (ID37). Furthermore, crop insurance agents did not seem to link cover crop use with long-term climate risk mitigation as some farmers and administrators did. Agents even expressed the sentiment that cover crops are more likely to increase farmers' long-term risk. Citing the frequency of crop insurance claims as a proxy for farmers' long-term risk, one agent shared the following:

> If anything … [I think using cover crops is] probably gonna cause a little more variability in the point of you're probably gonna have a few more claims. I don't foresee [using cover crops] negating claims … personally—my gut feeling is that's the opposite way I'd look at it. It's probably gonna cause more claims than it causes us to not have claims. (ID37)

Discussion and Implications. Climate change increasingly harms stakeholders across the agricultural sector (Raza et al. 2019), from farmers to taxpayers. Consequently, there is growing interest in CSA practices, like cover crops, that offer both mitigation and climate risk management benefits (Kaye and Quemada 2017). However, there are many unknowns regarding the connection between climate risk perceptions, risk reduction choices, and cover crop use. Our focus group discussions with farmers, program administrators, and crop insurance agents revealed varied perceptions of whether cover crops reduce or increase risk. Combining insurance programs with funding for climate mitigation and adaptation has the potential to better prepare farmers for the future and benefit taxpayers (Crane-Droesch et al. 2019). However, our results suggest that the design of the pilot crop insurance discount programs needs to be refined to improve stakeholder buy-in toward increasing use of cover crops. Administrators' suggestions to frame the discount as a percentage of the total premium, rather than a flat US$5 ac^{-1} rate, could be an avenue by which to increase its appeal to farmers. Doing so might also more clearly highlight the connection between cover crops and risk management. However, it also suggests that using a crop insurance discount to motivate cover crop use may require stronger beliefs that cover crops reduce risk.

Using the Crop Insurance Discount to Motivate Adoption Requires Stronger Beliefs that Cover Crops Reduce Risk. The farmers in our focus groups expressed nearly uniform views that crop insurance premium discounts, at current levels, are unlikely to drive cover crop adoption, motivate practice persistence, or increase cover crop intensity among existing users. Consistent with prior research, farmers did not single out climate change risks as a major driver for using cover crops. This is unsurprising given the widespread use of crop insurance for managing agricultural risks (Rosch 2021). Considering that our sample includes farmers with an above-average level of experience with cover crops, this suggests that the general population of farmers may be even less concerned with climate-driven risks and may also be more attentive to the short-term risks of cover crop use created by new management challenges. Research by Arbuckle et al. (2015) has found that "perceived risk … [is] among the strongest positive predictors of support for climate change policy and behavior." More research needs to look at whether and how farmers draw a connection to cover crops and mitigating extreme weather or climate risks.

Ultimately, better messaging around climate risks and cover crops could help generate a stronger case for how farmers can benefit from cover crops. Notably, crop insurance agents largely viewed cover crops as a source of increased risk due to their farmer clients' varied experiences with using cover crops and the potential impact of cover crops on actual production history—a key factor in setting farmers' premium rates (Coble et al. 2010). Research points to the influence that trusted advisors have on farmer decision-making (Stuart et al. 2018; Reimer et al. 2021; Houser et al. 2023). More research is needed to determine if crop insurance agents' perceptions of cover crops and risk influence farmers' cover crop use, given our very small sample size of agents. While some modeling research finds that crop insurance

agents have a minimal impact on farmers' insurance coverage choices (DeLay 2020), no research has examined if crop insurance agents influence farmers' risk perceptions of in-field management decisions like cover crops. Additionally, crop insurance agents' skepticism toward cover crops as a risk mitigation practice points to a potential lack of information transmission from USDA RMA to agricultural service providers. Providing education on the risk mitigation value of cover crops to crop insurance agents and others who regularly advise farmers on aspects of farm management (e.g., retailors of fertilizer and seed) could be valuable in dispelling any misconceptions about cover crops and reduce barriers to cover crop adoption.

The Discount Serves as a Weak Incentive Because Farmers Do Not Bear Full Liability for Their Management Under the FCIP and Because the Financial Amount Is Smaller Than Better-known Cost-share Assistance. We consider two possible explanations for why the connection between cover crops and crop insurance is not consistently identified. First and foremost is the challenge presented by the existing structure of the FCIP. At present, the heavy subsidization of crop insurance premiums effectively masks farmers' actual liability and the full cost of insurance premiums (Tack et al. 2017; Crane-Droesch et al. 2019). The current insurance structure relies heavily on historical yield data and generally excludes in-field management practices from its actuarial ratemaking process (Coble et al. 2010). While it is not clear whether including in-field management in ratemaking would favor conservation practices or be administratively feasible, the ratemaking process in its current form offers no clear incentives for farmers to evaluate how their in-field management decisions affect their risk and the associated insurance costs. It is therefore unsurprising that across focus group conversations, only administrators and a handful of farmers seemed to justify connecting cover crop use and insurance premiums. Insurance premiums are rising as climate change impacts accelerate (Tack et al. 2017; Crane-Droesch et al. 2019). Crop insurance discount programs are therefore well positioned to better educate farmers about climate risks, the full cost of insurance, and what risk-reducing management actions they can take. While assessing in-field management is not an easy task, it would be a valuable outcome. Starting with voluntary efforts could provide an opportunity to explore how best to design a more formalized approach that advances farmers' understanding of why adopting CSA practices like cover crops is valuable.

Second, rather than thinking of the discount approach as a reward for risk mitigation, farmer participants tended to describe the crop insurance discount approach as if it were a failed cost-share program. To some degree, their comparison of the discount approach to cost-share programs is unsurprising as cost-share programs are the primary way in which cover crops have been promoted to date in the United States. While some farmers described the amount as insulting, they also pointed to the desire to be able to use financial assistance to make meaningful decisions. A nominal amount fails to provide much usefulness in this regard. However, that our farmer participants regularly used the financial amounts offered in cost-share programs as a reference point to contextualize their displeasure about the US$5 ac^{-1} amount offered by the discount approach is worth noting for several reasons. For one, farmers' offense at the dollar amount offered is surprising because without the program, farmer participants would have been largely ineligible for other incentive payments. Furthermore, most farmer participants expressed the belief that long-term cover crop use is attributable to reasons beyond receipt of financial incentives; this perspective aligns with prior research on cover crop use (Roesch-McNally et al. 2017) and conservation practice adoption more broadly (Reimer et al. 2021). This apparent inconsistency may be attributable in part because farmers tended to describe the value they provide the public by using cover crops to be worth more than US$5 ac^{-1}. This points to challenges presented by the current structure of cover crop incentive programs, which are limited in funding capacity and primarily compensate beginners over established practitioners. Farmers and administrators expressed interest in the concept of stacking the discount with other payments, which permits farmers to receive multiple financial incentives for the same field from public, nonprofit, and/or private sources. This approach could potentially increase the appeal of the crop insurance discount approach among farmers and expand the pool of funding available to support farmers' use of cover crops. However, policymakers should also consider the question of additionality. There is a concern that those who already use cover crops would benefit from stacking payments without actually increasing their use of cover crops. A discussion of how financial incentives across the array of cover crop programs might be restructured is beyond the scope of this research. Ultimately, our findings suggest that it may be more effective to build a market or management case for long-term cover crop use, rather than relying on financial incentives. Risk-mitigation benefits would seem to align with a business case for using cover crops.

The Discount Program Creates an Opportunity for Better Data Collection and Could Help to Assess Business and Actuarial Cases for Conservation and Crop Insurance, Respectively. Communication challenges may be ameliorated by exploring a common theme that emerged across focus group conversations: a unanimous call for better data to accurately quantify the risk mitigation value that cover crops deliver. In this case, more data may be one of the greatest benefits that the crop insurance discount approach delivers and one of the best opportunities to build the business and actuarial case for cover crop use. Tying receipt of the crop insurance discount to cover crop acre reporting is already generating greater understanding of how many acres of cover crops exist. Improving this datapoint has critical implications for informing the business and actuarial case for cover crops (see Sherrick and Myers [2023] for similar recommendations) by increasing the accuracy with which scientists can measure the relationship between cover crop use, crop insurance claims, and a host of other soil health and production-related impacts. Notably, the acreage data collected from the discount approach are particularly useful for quantifying risk mitigation value as participants tend to be experienced cover crop users rather than novices. Because soil health improvements tend to increase and management-associated production risks tend to decrease with more years of cover crop use (Basche et al. 2016; CTIC 2023), the data collected from participants of the crop insurance discount approach have the potential to best showcase the long-term, risk-reducing value of cover crops. Furthermore, it is crucial that these valuable data be made accessible to researchers. The willingness of the USDA RMA to share these data can significantly enhance the potential for

future research to establish a more robust, evidence-based link between cover crop practices and risk mitigation. In addition to acreage reporting, expanded data collection of simple cover crop management aspects such as the planting date and variety of cover crop planted might further improve the baseline understanding of cover crop use, the impact of management decisions, and subsequent implications for risk management. In time, the data collected could be incorporated by USDA RMA into setting insurance premium rates and calibrating the per acre amount offered by crop insurance discount programs so that the incentive accurately reflects the quantified risk mitigation value that cover crops can deliver.

Limitations. While our study points to a number of valuable factors that can inform future research and practice on incentivizing climate mitigation and adaptation in farm management and policy, our approach is limited in several ways. As a nonrandom sample of farmers, the views reported in the focus group discussions may not generalize to the larger population of farmers using crop insurance and cultivating corn–soybean rotations. Our study overrepresents farmers with experience using cover crop. Thus, this paper does not provide much insight on how farmers who have not used cover crops would feel about the usefulness of a crop insurance discount. Lastly, our sample of crop insurance agents was very small. While exploratory, future research should examine the perspectives and roles of crop insurance agents to gain a more representative and comprehensive picture of this group of stakeholders.

Summary and Conclusions

We studied the role of three state-level pilot projects incentivizing the use of cover crops in the US Midwest. We found that the current incentive structure of the crop insurance discount approach is unlikely to drive cover crop adoption or persistence beyond existing levels. However, we see strong potential for it to provide a win-win for farmers and taxpayers by improving data collection that can in turn better align actuarial ratemaking with farmers' risk. Research shows that the current approach to crop insurance is unsustainable for US taxpayers in the face of accelerating agricultural impacts from climate change (Tack et al. 2017; Crane-Droesch et al. 2019). The increasing risks to the food supply chain and the economic livelihoods of farmers mean that further research on the risk-mitigation potential of cover crops is a timely and pressing issue. The crop insurance discount approach has the potential to contribute to more accurate risk assessment and improved actuarial ratemaking such that crop insurance better reflects farmers' risk, incentivizes risk-reducing on-farm management practices, and reduces taxpayers' subsidization of risky farming practices. From an applied policy perspective, crop insurance discount programs could better engage stakeholders by improving communication of the link between in-field management practices and risk management. Improved messaging of this concept could advance farmers' and key agricultural stakeholders' understanding of why adopting CSA practices like cover crops are valuable for producers and society at large. Additionally, more research into how trusted advisors' perceptions of cover crops and risk may impact farmers' land-use decisions is needed, as is a better understanding of how cover crop incentives can be designed to encourage adoption and practice persistence among farmers who choose not to engage with existing conservation incentive options.

Supplemental Material

The supplementary material for this article is available in the online journal at https://doi.org/10.2489/jswc.2024.00105.

Acknowledgements

We would like to thank the farmers, administrators, and crop insurance agents who participated in our focus groups in 2023. We would also like to thank the organizations who supported participant outreach on the research team's behalf, including American Farmland Trust, Iowa Farmers Union, Practical Farmers of Iowa, The Nature Conservancy, and State Departments of Agriculture.

Funding

This research was supported by the National Science Foundation [2206086] and The Nina Mason Pulliam Charitable Trust [F106507-NMPCT072020WhiteRiver].

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