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The Role of Farmer Heterogeneity in Nutrient Management: A Farm-Level Analysis

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ABSTRACT

Understanding farmer heterogeneity regarding nutrient management decisions is crucial for the success of any nonpoint source pollution prevention programs. Data from a farm-level experiment of cover crops in corn production were used in the Stochastic Efficiency with Respect to a Function framework to examine preference for nitrogen strategies over a range of risk aversion levels. We show the highest net return and certainty equivalent to the consideration of N supplied by cover crops. The results provide insights into policy discussions about the level of conservation incentives and plans that offer solutions to mitigate nonpoint source pollution.

KEYWORDS

conservation, corn, cover crops, nitrogen, risk aversion, net present value, stochastic efficiency

INTRODUCTION

Under the 2018 Farm Bill, the Congressional Budget Office (CBO) provided an estimated US$60 billion in mandatory 2019–2028 funding for the United States Department of Agriculture (USDA) voluntary conservation programs that encourage the adoption of cost-share conservation practices (Stubbs, 2019). Land retirement and working land programs are the two major conservation programs.[1] These programs support the use of various practices in conservation planning and offer financial and technical assistance to help agricultural producers improve their environmental performance with respect to soil health, water quality, air quality, and wildlife habitat. Some cost-share programs are paid for at a flat rate or straight per-acre rate or a percentage basis. The cost-share program practices can reduce farmers' expense to less than 30% of the total cost. Although spending on working land programs accounts for about 53% of the total share of conservation title programs under the 2018 Farm Bill, the overall conservation funding is roughly equal to baseline levels (Stubbs, 2019). Thus, how farmers choose their conservation practice to maximize their profit with the same amount of funding available for the cost-share program in the next 5 to 10 years continues to be an important question. On the other hand, the adoption of cost-share conservation practice is influenced by a number of factors, such as the characteristics of the farmer and the practice (Pannell et al., 2006). Conventional wisdom suggests that farmers are less likely to adopt a conservation practice if the cost to implement a conservation practice exceeds the benefits on a short-term basis. In contrast, a farmer is more likely to adopt a conservation practice if the financial incentive, together with the expected economic return, will be greater than the cost. Within this assumption, farmers' adoption decision is affected mainly by risk-related issues (Greiner et al., 2009; Sattler & Nagel, 2010). For a given scenario, farmers' risk perception can vary regardless of the statistical or objective measure of risk (Ramsey et al., 2019). With heightened interest in encouraging conservation practices under limited cost-share funding support, it is important to know the influence on conservation behavior of perceived risk. Such research can provide insights into a policy discussion about designing an effective and efficient suite of conservation practices in regional natural resource management. The objective of this study is to provide, through a stochastic analysis from a case study of variable nitrogen rate application following a cover crop in corn production, empirical insights into farmers' risk preferences and incentives, and how these factors relate to their adoption of recommended conservation alternatives. This paper provides a practical contribution to the adoption literature and provides valuable information for the design of an efficient policy for on-farm conservation practice of nitrogen application in corn production.

The following sections describe the case study background, research design of cover crop planting treatments, field results, economic methods, discussion of results, and conclusion.

BACKGROUND

Several studies have focused on emphasizing the role of nutrient management practices for addressing nonpoint source pollution. Among those practices are cover crops, where some of the benefits include reducing soil erosion by providing ground cover (Zuzel et al., 1993), enhancing soil moisture retention (Williams et al., 2009). Other benefits include giving weed control, improving soil structure, improving water infiltration, improving organic matter in the soil, reducing the loss of total nitrogen (N) (Bauer et al., 1993; Sainju et al., 2002; SARE and CTIC, 2014), and contributing toward fertilizer needs of the subsequent crop (Ladd et al., 1981). Despite many benefits, the decision to implement cover crops is significantly tied to on-farm production costs and related economic factors as well as the risk nature of the farmers. There have been mixed results concerning the inclusion of cover crops in crop production enterprises, mostly citing management challenges. In addition, there have been anecdotal reports of cover crop costs not fully recovered in overall net returns. Snapp et al. (2005) showed that cover crops in corn and soybean in Michigan did not lead to any significant improvement in net gains. Similarly, Foltz et al. (1993) showed that the inclusion of covers in the corn-soybean rotation did enhance soil fertility and reduced erosion but did not achieve net returns improvement, while Helmers et al. (1986) showed through an enterprise budget analysis that crop diversity through the inclusion of cover crops led to improved net returns.

Field research has shown some evidence of yield improvements in cash crops following cover crops (Fageria et al., 2005). The increase in net returns from fields with cover crops is not just cropping yield improvement but, in some cases, fertilizer use efficiency. Among many species of covers grown for various soil management reasons, green manure covers, usually legumes, are developed for their ability to fix nitrogen to supplement nitrogen requirements for the following cash crop. Reductions in fertilizer use as a result of the cover crop with minimal to no significant decrease in the yield of cash crops can improve overall net returns. Field research has shown that corn following hairy vetch resulted in no nitrogen application, whereas corn following fallow required 134 kg ha^{-1}. The net returns were tied both to yield advantage and reduction in fertilizer expenses (Hanson et al., 1993). Growing legume cover crops does not necessarily limit fertilizer benefits for the subsequent crop (Boquet et al., 1997; Fageria et al., 2005). However, legume cover crops usually have more significant potential for accumulating nitrogen than nonlegumes (Ebelhar et al., 1984; Tanaka et al., 1997). Winter cover crops grown during an otherwise fallow period as one of the nutrient management strategies have been shown to affect N availability and consequently yield a subsequent cash crop (Miguez & Bollero, 2006). Production methods are vastly different across regions because of varying soils, weather, and the interaction of various complex factors. Hence, adding empirical values, wherever possible, and understanding management practices and their contribution to overall net benefits from a production enterprise perspective is warranted.

Farmers may perceive risks from variable nitrogen rate applications following a cover crop in corn production. One research highlights the connection between farmers' expectations of yield risk perceptions and nitrogen application (Ramsey et al., 2019). Different rates of nitrogen application following a cover crop may impact corn yield and variation. Farmers' perception of the riskiness of variable rate application prior to adoption will influence the adoption decision. As individuals differ in their risk-taking (or risk-avoiding) behavior, comparison of net farm income distributions from a set of management alternatives (e.g., fertilizer management, surge valves for irrigation efficiency improvement, etc.) under general assumptions of the utility function can assist with incentives needed to motivate change. Understanding how risk perception affects adoption could help increase participation in programs. The mean-variance and stochastic dominance approaches were used for modeling risk attitudes associated with conservation decision making. The framework allowed for the comparison of the efficient set of alternatives (Hardaker et al., 2004). Pendell et al. (2007) used the stochastic dominance method to examine the net returns of continuous corn production under conventional and no-till systems and quantify the value of carbon sequestration credits to improve farmer adoption of the no-till system. An alternative to previous methods is the efficiency approach, explained in detail in the Methods section of this manuscript, used to identify a set of conservation alternatives over a range of risk aversion coefficients. The method has been used in conservation evaluation studies, for example, to evaluate the risk efficiency of no-till rice in Arkansas (Watkins et al., 2008) and residue management and tillage alternatives in corn and soybean production systems (Archer & Reicosky, 2009).

Using farm-level data for an economic analysis combined with stochastic simulation to provide a long-term financial outlook enables filling the gaps in information with a direct application in framing conservation policy. Besides, evaluating the profitability of nutrient management strategies and the risk efficiency of those alternatives over a range of risk preferences can allow for the estimation of risk premiums or incentives necessary to motivate change in practices.

MATERIALS AND METHODS

Site Characteristics and Treatment Design

The field studies were established during the fall in Beauregard Parish (county), located in the southwestern part of Louisiana in a dryland field. The soil was a Caddo-Messer silt loam, which is relatively low in soil fertility and moderately well-drained soils. The parish (county) has an average of 220 days of the growing season. Prior to planting the cover crops, a soil test was taken for phosphorus, potassium, sulfur, and zinc. The field was fertilized based on the recommendations for these nutrients. All field plots were planted to corn the year before the plots were established. The plots were 12 rows by 292 meters in length and were arranged in a randomized complete block design with three replications. Observed yield data were from fields using crimson clover (CC) as a cover crop followed by corn. The field trials were conducted in 2016–2017 and repeated in 2017–2018 (Table 1). Crimson clover was broadcast in late October at 19 kg ha^{-1} and was terminated from the middle of March to early April, which is expected to quickly mineralize and recycle the cover crop N to the following crop (Weinert et al., 2002). Corn hybrid planted was Terrell 28R10 at 74,131 plants per hectare. Row spacing was 76.2 centimeters. Once corn reached the two-three leaf stage, nitrogen applications were applied. Four nitrogen rates were compared: 112, 140, 168, and 196 kilograms nitrogen application per hectare. Each nitrogen rate was replicated three times in a randomized complete block design. Harvest dates were between the last week of August and the first week of September. The 196 kilograms nitrogen application per hectare is the growers' "standard" rate.

Corn Yield and Cover Crop Biomass

Before planting corn, the crimson clover was terminated to obtain biomass production and percent nitrogen content. Before the herbicide application, biomass production was measured by taking hand clippings in one square meter in eight different locations for each plot on the termination date. Samples were dried in an oven, and dry matter production was determined.

In 2016–2017 and 2017–2018, 199 and 132 kg ha^{-1} of N for the following corn crop was available as a result of cover crop use, respectively (Table 1). The effect on corn yield as a result of cover crop use and fertilizer treatments was measured in each of the four treatment plots by harvesting 12 rows per replication per treatment. The average yield from three replications for each treatment was calculated at 15.5% moisture content.

By using the SAS software, the PROC ANOVA procedure is selected to perform an analysis of variance for the randomized complete block design. Multiple comparisons of means were examined through the Fisher's least significant difference test. In both years, there are no differences in yields across all four nitrogen treatments (Table 2). The yield was slightly lower in 2017–2018 but was not significantly different among treatments. The relatively lower return was due to poor weather during the time of planting and harvesting. Based on the

Table 1. Cover Crop Termination and Corn Planting Dates, Cover Crop, 2016–2017 and 2017–2018

Cover Crop Planting Date	Cover Crop Termination Date	Corn Planting Date	Dry Matter (kg ha^{-1})	% N Content	N in Soil (kg ha^{-1})
10/15/2017	03/30/2017	04/01/2017	7,053	3.2	199
10/20/2018	03/25/2018	03/28/2018	4,292	3.4	132

Notes: kg dry matter ha^{-1}, % N content, and kg N ha^{-1} from biological N fixation.

Table 2. Nitrogen Rates and Corn Yields for 2016–2017 and 2107–2018

N/ kg ha^{-1}	2016–2017 Yield (kg ha^{-1} @15.5%)	2017–2018 Yield (kg ha^{-1} @15.5%)
112	11,748.7[a]	10,470.9[a]
140	11,789.1[a]	10,309.5[a]
168	11,748.7[a]	10,309.5[a]
196	11,634.4[a]	10,470.9[a]

[a] means followed by the same letter are not significantly different at P = 0.05 in 2016 and P = 0.10 in 2017, LSD.

average yields of 11,769 kg ha^{-1} for this region and the nitrogen requirements of corn (0.45 kg of nitrogen per 67.2 kg of corn produced), the minimum amount of fertilizer savings could be 84 kg ha^{-1} (196 – 112 = 84), that is, the farmer's revenue would be the same if the application amount was either 196 kg ha^{-1} or 112 kg ha^{-1}.

Simulation and Risk Analysis

This study combined the input prices, output price, and potential corn yield data with the U.S. Corn long-term projections report data to estimate long-term profitability (USDA, 2018). The report provides projections for the U.S. agricultural sector to 2027.[2] The variable costs of production and farm price were obtained from the Louisiana State University Agricultural Center crop budgets (Deliberto et al., 2017). The average nitrogen cost and average corn price used in the estimation are US$0.82 kg^{-1} and US$0.056 kg^{-1}, respectively, for the initial years in the analysis using the information from the projections report for future years. The long-term net returns accounting for the time value of money are aggregated to obtain the NPV estimate. The NPV represents the long-term profitability of on-farm benefits achieved through conservation such as cover crop implementation (Adusumilli et al., 2016).

The Monte Carlo simulation method is used to obtain the distribution of the net present value (NPV) based on the stochastic distribution of corn price, nitrogen price, and corn yield. A sample of values for all stochastic variables is selected simultaneously, and the process is repeated 1,000 times to estimate the cumulative distribution function (CDF) for the stochastic outcomes. The simulations are carried out using Microsoft Excel software. Specifically, CDF is derived for nutrient scenarios 112, 140, 168, and 196 kg ha^{-1}.

Based on the simulated distributions of the NPV, a risk analysis is conducted. Stochastic efficiency with respect to a function (SERF) was used to rank the nutrient management scenarios over a range of risk aversion levels. The SERF method has more discriminatory power to rank alternatives than stochastic dominance approaches (Hardaker et al., 2004). SERF requires specifying the farmers' utility function, and the inverse of the utility function can be computed based on ranges in the absolute, relative, or partial risk aversion coefficient, as appropriate. The utility function allows calculating a certainty equivalent (CE), which is the dollar amount associated with a risk-free option (or the current practice) that provides the same expected utility as a risky option (or an alternative practice). The utility weighted risk premium is the difference between the CEs of the alternatives being evaluated.

CE values over a range of absolute risk aversion coefficients (ARACs) are calculated. The ARAC represents a decision-maker degree of risk aversion. If ARAC > 0, ARAC = 0, and ARAC < 0, the decision-makers are classified as risk-averse, risk-neutral (profit maximizer), and risk preferring. The upper ARAC value was calculated using the following formula proposed by Hardaker et al. (2004):

$$\text{ARAC}_w = \frac{r_r(w)}{w} \tag{1}$$

where $r_r(w)$ is the risk aversion coefficient with respect to wealth (w). Here $r_r(w)$ was set to 4 (very risk-averse), as proposed by Anderson and Dillon (1992). Following Hardaker et al. (2004), we calculated appropriate ARAC by dividing the risk aversion coefficient with an overall average of wealth, which is the production enterprise's overall net returns, including any management practices. Given a negative exponential utility function as suggested in Hardaker et al. (2004), the estimated ARAC values (ranging from 0.00 to 0.0098) were used to derive CEs. The SERF analysis was conducted in SIMETAR (Richardson et al. 2003).

CE graphs were constructed to display ordinal rankings of nutrient management strategies across the specified range of ARAC values. Graphical presentation of SERF results facilitates the presentation of ordinal rankings for decision-makers with different risk attitudes. The nutrient strategy with the highest CE level at a given level of risk aversion is optimal because it maximizes utility. The differences in CE values between any two alternatives will give the utility weighted risk premium. The risk premium is the minimum amount of money an individual would need to justify a switch from a current production practice to another alternative. Risk premiums determine the confidence of a decision-maker in a preferred risky alternative (Mjelde & Cochran, 1988) and are estimated using the following formula:

$$RP_{A,B,ri} = CE_{A,ri(w)} - CE_{B,ri(w)} \quad (2)$$

where $CE_{A,ri(w)}$ and $CE_{B,ri(w)}$ are the certainty equivalents of alternatives A and B, respectively, at a given risk aversion level of $r_{i(w)}$ and $RP_{A,B,ri}$ is the resulting utility weighted risk premium.

RESULTS

Present values of future net returns, from on-farm demonstration plots, for the corn production system following a crimson clover cover crop, are estimated. The NPV estimates under four nutrient strategies are presented in Table 3. Under the conventional practice, that is, without accounting for the nitrogen supplied through cover crop use, at 196 kg ha^{-1} of nitrogen fertilizer, the NPV is in the range of US\$289 to US \$459 ha^{-1} with a mean value of US\$367 ha^{-1}. On the other hand, the NPV estimates were in the range of US\$398 to US\$586 ha^{-1} with a mean value of US\$467 ha^{-1} when the N-supplied through cover crop use is largely accounted (112 kg ha^{-1}). Farmers' net return under the 196 kg ha^{-1} nutrient strategy in a production year implies that this farmer did not account for (entirely ignored) the nitrogen supplied by the cover crop and applied fertilizer as usual. Net returns under the columns 112, 140, and 168 kg ha^{-1} represent accounting for N-availability and practicing good farming practices.[3] It is not unusual for farmers to have different nutrient strategies. Their argument often is that the increase in yield is not justified by the money spent on additional fertilizer. On the other hand, current seasonal effects also reflect production practice choice. A production year with greater than average rainfall is believed to wash away nutrients from the soil and would warrant an aggressive application the following production year. Thus, the agronomic component of the current research highlights the potential impacts of conservation on the ground, and the economic part evaluates the net returns of the practices.

The implementation of additional activities (planting and terminating cover crops) can add to the overall costs of production. Hence, the results below present long-term net return discounted to present value, NPV, where some of the production costs can be supplemented through a reduction in input use. It is not unreasonable to assume that farmers that have invested the time and money in conservation practice, cover crop in this case, are likely to account for the nutrient benefits provided

Table 3. Simulated NPV, for Various Levels of N Fertilizer Application following Cover Crop Use, Estimated Using Mean Yield, Mean N Price (US\$0.82 kg^{-1}), and Mean Corn Price (US\$0.056 kg^{-1})

	Nitrogen Use (kg ha^{-1})			
	112	140	168	196
	US\$ ha^{-1}			
Mean	467	417	383	367
St. Dev.	51	51	48	42
Minimum	398	329	292	289
Maximum	586	532	489	459

Notes: 196 kg ha^{-1} reflects not accounting for N supplied by cover crop; also reflects most risk-averse farmers; 112 kg ha^{-1} reflects accounting for N supplied by cover crop and conservative approach, slightly risk-averse farmers.

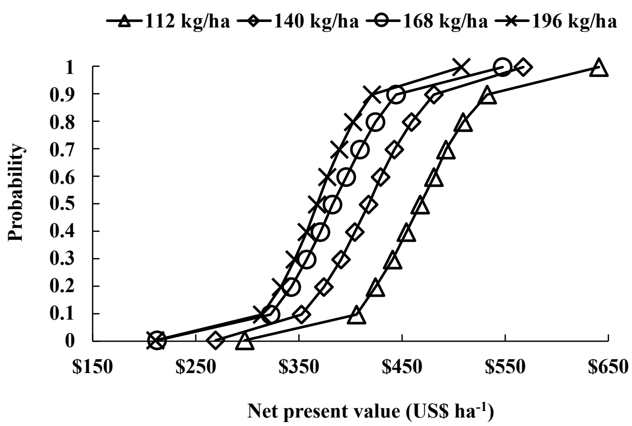

Figure 1. CDF approximations of simulated net present values for nutrient strategies.

by the conservation practice, although some farmers express concerns over using less than required nitrogen use. They cite the potential loss of insurance coverage if deviating from recommended nitrogen fertilizer application amounts, impacting the progress of the crop to normal maturity.[4] The distributions of NPV, which allows us to examine scenarios accounting for the stochastic nature of the prices of inputs and output, are presented in Figure 1. Figure 1 shows the CDF approximations of simulated NPVs. The CDFs show that largely accounting for N supplied by the cover crop is the dominant alternative.

Certainty equivalents and risk premiums are presented for the nutrient strategies in Table 4. At ARAC = 0, an individual is considered risk-neutral (an expected-profit-maximizing individual), and as ARAC becomes more positive, the individual is more risk-averse. CE values decrease slightly as individuals are more and more risk-averse; however, the decrease is not significantly different. The results indicate that the CE values within nutrient management strategies are significantly different among risk-neutral farmers and risk-averse farmers.

The results need careful understanding. Application of fertilizer by largely accounting for N supplied through the cover crop in this analysis is considered a less risky alternative as it is an efficient alternative. The 112, 140, and 168 kg ha^{-1} represent those alternatives. However, on the ground, the farmer might prefer applying a certain amount of fertilizer to minimize any unexpected yield losses. So, from the farmers' perspective, the most conservative alternative in the analysis, 112 kg ha^{-1}, is estimated as the preferred nutrient management strategy, which largely accounted for N availability from the use of the cover crop.

Table 4. Certainty Equivalents and Risk Premiums for Each Nutrient Management Strategy under Various Absolute Risk Aversion Coefficients

	Absolute Risk Aversion Coefficients				
Nitrogen use, kg ha^{-1}	0.00	0.0024	0.0049	0.0073	0.0098
	Certainty Equivalents (US$ ha^{-1})				
140	422	419	416	413	410
168	384	381	378	375	372
196	366	364	361	359	357
112	467	464	461	458	455
	Risk Premiums for Shifting to 112 kg ha^{-1} (US$ ha^{-1})				
140	–45	–45	–45	–45	–45
168	–83	–83	–83	–83	–83
196	–101	–100	–100	–99	–98
112	0	0	0	0	0

As described before, the utility-weighted risk premium represents the minimum sure amount the farmer would need to be paid (or would pay) to move from the preferred (or less preferred) practice to the less preferred (or preferred) alternative at a specific risk aversion level. For an expected-profit maximizer (risk-neutral farmer), the farmer would need to be paid US$45 ha^{-1} to move from a nutrient strategy of 112 kg ha^{-1} to one of 140 kg ha^{-1}. Given that SERF accounts for all the advantages of the stochastic dominance methods, is more transparent, and has more discriminatory power in comparing alternatives, we are confident about our results. Even in the risk-averse group of farmers, a similar result is observed; however, the premium amount is the same. Specifically, those currently applying 112 kg ha^{-1} would need to be paid US$83 ha^{-1} to move from their current practice to 168 kg ha^{-1}, and the premium amount does not change in the risk-averse group of farmers. Both these scenarios reflect those who would account for the N-availability in the soil provided by the cover crop use and adjust their nutrient application amounts in corn production. On the other hand, a risk-neutral farmer would need to be paid US$101 ha^{-1} to move from 112 kg ha^{-1} to 198 kg ha^{-1}. The amount decreases slightly for more risk-averse farmers in this case. Larson et al. (2001) are only one of the few studies that evaluated cover crop use and nutrient management strategies using a stochastic framework; however, they used the dominance approach but did not estimate risk premiums. Figure 2 displays the certainty equivalents for all four alternative nutrient strategies at each level of risk aversion from zero to 0.0098. As illustrated in Figure 2, the CEs for all nutrient strategies slightly decrease as the farmer becomes more risk-averse. The 112 kg ha^{-1} nutrient strategy has the greatest CE for each ARAC level, which suggests that the 112 kg ha^{-1} nutrient strategy is the dominant alternative, followed by 140 kg ha^{-1}, 168 kg ha^{-1}, and last by 140 kg ha^{-1}.

The premiums present the farmers' willingness to pay (or accept) to move to a preferred (or less preferred) strategy. The premiums can serve as an important policy discussion item. Conservation incentives through NRCS are provided for the implementation of practices to mitigate soil and nutrient losses from agricultural lands. The premiums estimated indicate incentives necessary to initiate a change in practice implementation. In addition, considering that farmers are not homogenous in their practices as well as their perceptions of risk and uncertainty, the premiums can be used to design (redesign) programs that offer cost-share assistance to farmers implementing conservation practices. Although the program was designed to encourage conservation stewardship behavior, it could be improved by accounting for heterogeneity among farmers.

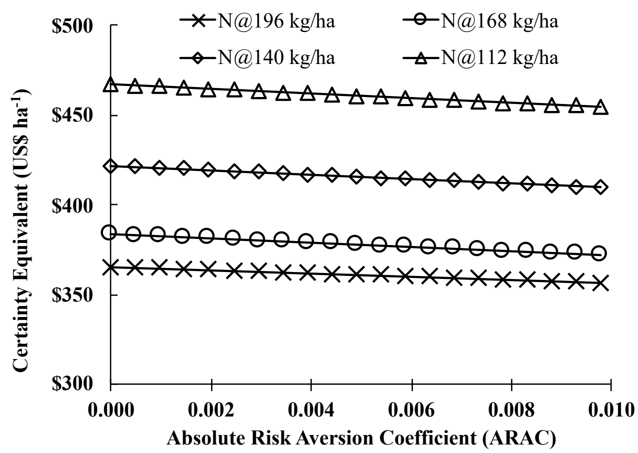

Figure 2. Certainty equivalents (US$ ha^{-1}) for corn production following cover crop and nutrient strategy, estimated using SERF framework over absolute risk aversion range of 0.00 to 0.008. ***Note:*** **Graph legend should be read as N@196 kg ha^{-1} represents nitrogen application at the rate of 196 kg ha^{-1}.**

CONCLUSION

The analysis presents the decision-maker with alternatives that provide an overall evaluation of farm profitability under four different nitrogen strategies following cover crop use. The analysis shows, using field data, that there is potential to inform farmers to optimize nutrient strategies and make operational changes that reduce costs and increase overall farm profits compared to a no conservation strategy. The study, while estimating net returns, accounts for planting and management costs of cover crops.

The estimated net returns and CEs suggested that nutrient strategies that largely account for N supplied by cover crop or available in the soil (i.e., 112, 140, and 168 kg ha^{-1}) are more efficient than the strategy that entirely ignores the N-availability supplemented through the cover crop (i.e., 198 kg ha^{-1}). Benefits, not quantified in the NPV analysis presented here, from nutrient reduction can reach beyond farm boundaries. As a result, reduction in nitrogen use that does not significantly lower yields and overall farm profits aligns with the risk-averse nature of the farmer, contributing toward achieving conservation goals.

The utility weighted risk premiums are estimated using the SERF framework to account for the heterogeneous nature of farmers in implementing conservation practices. The results presented indicate farmers' confidence in nutrient strategies and the minimum amount of cost-share assistance needed to initiate a change in nutrient use practices. In addition, as conservation dollars play a crucial role in initiating conservation practice implementation (Adusumilli et al., 2014), it is essential to evaluate and provide guidance on incentive amounts that can result in higher participation in such programs. Moreover, using farm-level data to aid in such decision-making can offer more reliability in the estimates. There might be several reasons for some farmers to adopt certain practices more than other practices. This analysis can provide a view of the performance of cover crops within cropping niches, from a farm profitability and risk-behavior standpoint, accounting for idiosyncrasies as well as the stochastic nature of the markets and associated variables.

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NOTES

1. Land retirement programs require certain agricultural lands to be taken out of agricultural production and placed into a conservation-oriented use. Working land programs allow private land to remain in production, while implementing various conservation practices to address natural resource concerns specific to the area.

2. The long-term projections cover agricultural commodities, agricultural trade, and aggregate indicators of the sector. The projections are based on specific assumptions about macroeconomic conditions, policy, weather, and international developments. The projections are one representative scenario for the agricultural sector for the next decade and reflect a composite of model results and judgment-based analyses.

3. The 2018 Farm Bill clarifies that cover crop practices are to be considered a good farming practice if terminated according to USDA guidelines.

4. After the passage of the 2018 Farm Bill, the USDA removed barriers to cover cropping and helped alleviate some of the concerns farmers have with cover crops.

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