Economic, Demographic, and Farmer's Perspective on Cover Crop Adoption: A Survey Approach

Bonny Amin
Department of Agricultural Sciences, College of Applied Arts, Texas State University

Introduction

Cover cropping (CC) can enhance soil health, economic, and environmental sustainability, however adoption rate is 3~5% across the USA. Because the benefits and challenges due to adopting cover crops are site-specific and heterogeneity of farmers perspective, economic and demographic factors vary nationwide.

Background of the Study

Recently, there has been a lot of interest in agriculture due to cover crops' agronomic advantages, which include enhanced cash crop output, nitrogen restoration, and erosion prevention. However, to get these advantages is uncertain and probably rather changeable depending on the economic, demographic and farmers' perspective. Policy makers and conservationists are also interested in the elements that impact a farmer's decision to adopt cover crops or not.

Justification of the Research

The United States has long supported cover crops because they are beneficial to adopt sustainable farming system improving soil health, economic returns and environmental benefits. There is still relatively little knowledge on cover crop adoption and most research treat adoption as a binary variable. Whether adoption is a continuum of practice and regression analysis might assist to identify the potential factors of adoption.

Review of Literature

Economic

Cover crops can increase profitability by increasing in yield gain, savings on fertilizer, returning from cover crop, reducing tillage operations, savings on herbicide use, and enhancing soil health, whereas the total variable costs include seed, planting, fertilizer application, and termination (Blanco, 2012).

Demographic

Due to different explanatory factors in aspect of acreage, diversity, and complexity of cover crop use farmers who are educated and experienced are likely to adopt cover crops while negatively correlated with dependence on farm revenue (Moore, 2016).

Farmers' Perspective

A variety of factors contributed to the variation in adopting cover crops including social aspects of farmers, their perception to cover crops, conservation agency influence, existence of experts, conservationist, as well as agency and private sector cooperation. Also, topography, cattle farms, organic production, and regional incentive-based initiatives were additional significant influences on cover crop adoption (Popovici, 2023).

Research Objectives

It is necessary to identify potential reasons for non-adoption and rank them by their relative importance to increase technology adoption and design efficient policy interventions. It is also necessary to determine whether the introduction of cover crop species produces benefits and whether the introduction of cover crops is a profitable practice.

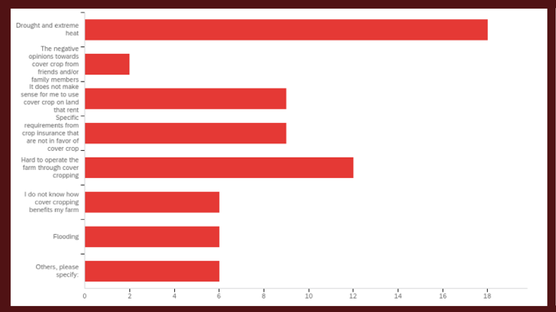
Key objectives of the research

- To identify decisive factors for cover crop adoption in terms of economic, demographic, and farmers' perspective.
- To better understand challenges, factors, and opportunities of cover crop adoption.
- To make an appropriate decision support tools (DSTs) that helps in increasing cover crops acreage.

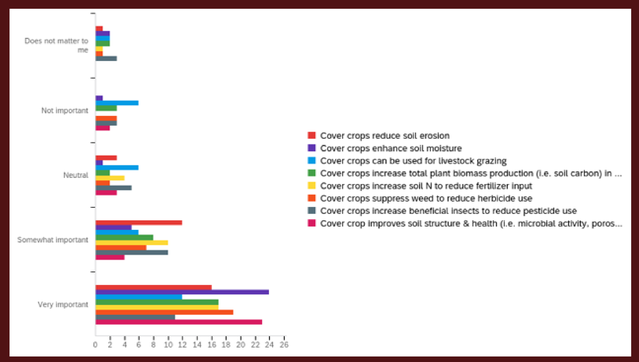
Overall, to find critical challenges behind less adoption of cover crops to increase the adoption rate across the southern Texas.

Data Analysis

Regression Analysis: To look at the relationship between the adoption of cover crops by farmers (the dependent variable) and several factors influencing their choices, including financial gains, social and environmental factors multiple regression model will be used. The regression coefficient will be calculated to investigate the link between cover crop adoption and factors influencing cover crop adoption. The factors influencing farmers' adoption of cover crops will be determined using the multiple regression model as follows.



Major climate, soil, or economic problems farmers faced



Farmers' perspective on challenges of cover crop adoption

Materials and Methods

Survey

Survey questionnaires were distributed via online through Qualtrics including closed and open-ended questions with convenience sample size following a cross-sectional design.

Analysis

The survey results will be analyzed and described using logistic regression model and qualitative analysis. The dependent variable, farmers' chance of adopting cover crops, will be measured by the regression model, considering their perspective, economic, and demographic aspects. Farmers' opinions on cover crops, the reasons behind heterogeneity and its patterns will be ascertained through qualitative data analysis.

Key parameters

- Economic (total gross annual sales)
- Demographic (age, farm size, gender, race, and years of experience in farming)
- Farmers' perspective (benefits and challenges)

Data Analysis

$Yi = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + ei$

Here, Yi = Cover crop adoption, X1 = Age of farmers (in years), X2 = Farm size (total acreage.), X3 = Gender of farmer, X4 = Total gross annual sales (in USD), X6 = Farming experience (in years), $\beta 1, \beta 2, \ldots\ldots, \beta 5$ = regression coefficient, $\beta 0$ = intercept, ei = regression error

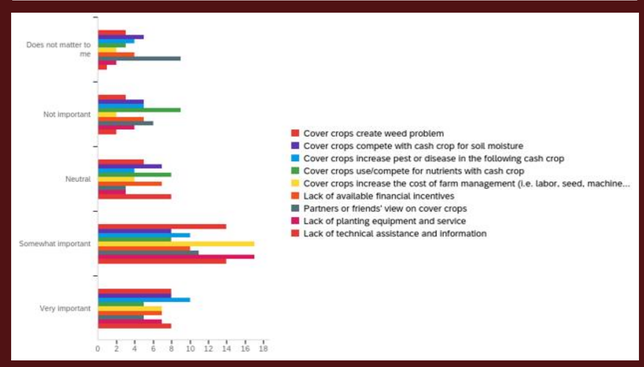
Qualitative data analysis: From the open-ended questions, qualitative data analysis will be used to identify farmers' economic concerns, patterns, and trends.

Adp	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Age	.114	.409	0.28	.781	-.688	.916	
F_size	-.562	.309	-1.82	.069	-1.169	.044	*
Gen	.106	.733	0.14	.885	-1.33	1.542	
T_sales	.156	.497	0.31	.753	-.818	1.131	
F_years	-.087	.374	-0.23	.817	-.819	.646	
Constant	5.999	6.239	0.96	.336	-6.229	18.226	

Mean dependent var		0.533 SD dependent var	0.507
Pseudo r-squared		0.367 Number of obs	30
Chi-square		15.216 Prob > chi2	0.055
Akaike crit. (AIC)		44.239 Bayesian crit. (BIC)	56.850

*** p<.01, ** p<.05, * p<.1

Table 4: Logistic regression of cover crop adoption



Farmers' perspective on benefits of cover crop adoption

Results and Discussions

Economic

It was found from the pilot study (n=30) that cost sharing or incentives would encourage farmers to use cover crops. Additionally, it came to light that the adoption of cover crops is positively but marginally impacted by the farms' total yearly gross sales.

Demographic

The results of the regression model indicated that the adoption of cover crops is significantly impacted negatively by farm size, or total acreage operated.

Farmers' Perspective

Cover crops improve soil structure and health, enhance soil moisture, and suppress weed which are the key benefits of cover cropping. In contrast, cover crop increase farm management cost, lack of planting support and lack of technical assistance hinders farmers from adopting cover crops.

Conclusion

Natural resource constraints in agriculture are having a substantial negative impact on the global economy. Water scarcity, soil erosion, changing weather patterns, and rising temperatures are all impeding the growth of agriculture. Conversely, agriculture accounts for 25% to 30% of the world's greenhouse gas emissions, which makes it a major contributor to climate change. Hence, conservation farming techniques, like cover crops adoption, may help combat the causes of environmental degradation in the future while increasing crop yields. Therefore, from the research findings policymakers will be able to design farmers' friendly conservation programs considering heterogeneity and diverse perspective of farmers to encourage cover crop adoption across the Southern Texas.

Acknowledgement

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