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Research Article

Unravelling the Dynamics: Determinants Shaping Adoption of Resource Conservation Technologies in Wheat

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Abstract

The Indo-Gangetic Region characterized as agricultural production hub of India due to the dominance of rice-wheat cropping system. Widespread adoption of Resource Conservation Technologies (RCTs) is driven by multiple factors, to ensure long-term food security and environmental sustainability. The study investigates about determinants influencing adoption of surface seeding technology, zero tillage and rotavator through application of multivariate ordinal logistic regression. Data was collected for different socio-economic factors. The analysis revealed determinants such as farming experience, education, soil type and wheat variety significantly influenced adoption of Surface Seeding Technology. Zero tillage adoption was primarily influenced by soil type and wheat variety factors. Rotavator adoption, however was affected by maximum determinants including landholding size, age, farming experience, education, wheat variety and source of information. These findings highlight the need for data driven policies to promote adoption of RCTs tailored to specific necessities of the farming community.

Key words: Resource Conservation Technologies, Surface Seeding Technology, Zero tillage, Rotavator, Wheat

1. Introduction

Indian agriculture's journey to feed millions of mouths was a remarkable success attributed to proliferation of the rice-wheat system during the Green Revolution. The two staple cereals had instrumental role in ensuring 50 percent country's food and nutritional security (Timsina and Cornor, 2001), providing sustenance and employment opportunities to millions (Kumar *et al.,* 2019). The rice-wheat production system in the Indo-Gangetic Plains (IGP) feeds approximately one-fifth global inhabitants (Saharawat *et al.,* 2010; Samal *et al.,* 2017). Sluggish productivity of wheat in South Asia in the last two decades had been scrutinized raising questions on the long-term sustainability of the system(Meena *et al.,* 2016; Bhatt *et al.,* 2020). Intensive tillage practices had long been an integral part of conventional agriculture and long reliance on it had significant negative impacts, including soil degradation, resource depletion, loss of soil organic matter ultimately jeopardizing crop productivity (Morello *et al.,* 2018; Akter *et al.,* 2021; Tadjiev *et al.,* 2023). Consequently, there has been arising recognition of the need for transition towards conservation agriculture, a farming approach that strives to achieve profits via sustained production along with the conservation of natural resources (Devkota *et al.,* 2022; Khedwal *et al.,* 2023).

Resource Conservation Technologies (RCTs) are a key component of conservation agriculture that includes any management approach or technology that enhances the factor productivity (including land, labour, capital and other inputs). Several studies have documented different benefits of adoption of these technologies including gain in productivity and profitability, better resource use efficiency, increased environmental benefits such as energy-use efficiency, decrease in the environmental mitigation, higher physical water productivity, reduction in use and damage of natural resources etc. (Mondal *et al.,* 2021; Dey *et al.,* 2023).

Despite the demonstrated benefits, the adoption rates remain disappointingly low. Successful adoption of technology is affected by various factors including socio-economic, technical, financial, psychological, and biological factors. Socio-economic factors play a critical role as they directly shape farmer's capacity, motivation and willingness to adopt new interventions. The estimation of socio-economic factors allows better targeting, more effective design, improved resource allocation, behavioral insights and sustained adoption. It helps to identify micro level deficiency, regional imbalance, neglect of inter sectionality and overlooks policy impact. Understanding these dynamics is critical for removing the underlying barriers and promoting mass adoption of technology.

1.1. Critical gaps in RCT adoption in India

Researchers in India primarily emphasized on 'what RCTs can do' by conducting quantitative assessment of yield gains, technical and allocative efficiency and environmental impacts of RCTs. These studies had demonstrated various benefits of RCTs such as profitability, lower costs, reduced irrigation water use, and improved crop productivity. But over the years, researchers had overlooked the qualitative aspect *i.e.* socio-economic dimensions contributing to low adoption rates, income disparity and resource wastage. Adoption and sustenance of RCTs in India had faced regional imbalance with substantial research and development being conducted in Punjab, Haryan and Western Uttar Pradesh. Lack of studies in Eastern Indo Gangetic Plain highlights the need for more conclusive research on socio-economic dynamics affecting RCT adoption as variation is higher in the region. The present study is an empirical approach towards identifying the various determinants affecting the adoption of different resource conservation technologies in Eastern Uttar Pradesh.

2. Methodology

The survey was conducted in Eastern Uttar Pradesh, the selection was purposive because the region was the largest producer of wheat crop (Singh *et al.,* 2020). Data and information were collected using a well-designed pre-tested questionnaire on various aspects of the adoption and impact of different RCTs in the Indo-Gangetic Plains in India. The RCTs selected for the study were surface seeding technology, zero tillage and rotavator or rotary tillage. Conventional tillage was used as an RCT non-adopter in the study to compare the effects of the RCTs. In Eastern Uttar Pradesh, Chandauli and Mirzapur districts were purposively selected due to higher prevalence of the resource conservation technologies in these districts. For each technology one block in each district was selected purposively based on the highest/maximum adoption of the respective technology in that block. For surface seeding technology, Jamalpur block in Mirzapur and Niyamtabad block in Chandauli; for zero tillage Rajgarh block in Mirzapur and Niyamtabad block in Chandauli; for rotavator Shikhar block in Mirzapur and Chandauli block in Chandauli and for conventional tillage Narayanpur block in Mirzapur and Sakaldiah block in Chandauli were selected. In each block four villages were randomly selected under each RCT and conventional tillage. A list of RCT adopter and non-adopter farmers was prepared for each village and from the list 20 farmers were randomly selected. The selected farmers are sole adopter of one of the resource conservation technologies. A total of 160 farmers were selected for each RCT adopter category and 160 farmers were selected for non-adopter category, thus a total sample of 640 respondents was selected for the study.

2.1. Analytical Tool

To investigate factors affecting RCT adoption multivariate ordinal logistic regression was used. Multivariate ordinal regression models are appropriate when a vector of correlated ordinal response variables and covariates is observed for each unit or subject in the sample. In this study, multiordinal regression model was best fitted due to the ordinal nature of the dependent variables. The data pertinent to factors influencing the adoption of resource conservation technologies was analysed using the logit link function in ordinal regression with the help of SPSS software.

The model was used in the study in following form (Adeleke & Adepoju, 2010):

$$N_j\,(X) = \ln\left[\frac{\Pr\left(Y \leq \frac{j}{x1x2 \ldots\ldots xp}\right)}{\Pr\left(Y > \frac{j}{x1x2 \ldots\ldots xp}\right)}\right]$$

$$= \gamma_0 + \beta_1 x_1 + \ldots\ldots \beta_p\, x_p + \mu$$

where,

Y = Adoption of resource conservation technologies

$X_i\,(x_1, x_2, \ldots.. x_p)$ = Vector of explanatory variables

γ_0 = Intercept

$\beta_1, \beta_2 \ldots\ldots \beta p$ = logit coefficients

μ = random variable

Table 1: Description of variables used in the model

Variables		Description
Social factors	Level of Adoption	|Adopter = Adopted any RCT Non-adopter = Not adopted any RCT
	Age of respondent	Age of respondents was measured in years Young = <35 years, Middle age = 35-50 years, Old = > 50 years
	Education level	For education, formal education was considered Illiterate = No education, Primary level = upto 7th class, Secondary level = 8th to 12th class, Higher education = Graduation and above
	Family size	Family size measured as total number of family members residing together in a household Small = 0-2 members, Medium = 3-8 members, Large = >8 members
	Land holding size	Land holding size measured in hectares Marginal = <1 ha, Small = 1-1.99 ha, Semi-medium = 2-3.99 ha, Medium = 4-9.99 ha, Large = > 10 ha
	Farming experience	Farming experience refers to the years spent in farming enterprise by the farmers Low = upto 8 years, Medium = 9 to 15 years, High = above 15 years
Agronomic factors	Soil type	Major soil types prevalent in study area were considered they were: Loam soil, Clay loam soil, sandy loam soil and clay soil
	Wheat variety	Major varieties of wheat grown in the area is considered such as Shriram, HUW-234, HD- 2967, Shreeram super 303 and others
Mediating factor	Source of information	Formal source of information = Govt. authorities, KVK, University, Extension officials Informal sources of information = farmers of same village or neighbouring village, NGO, TV/Newspaper, Own experience

3. Results and Discussion

3.1 Socio-Economic Profile

A comparative summary of socio-economic status of different resource conservation technologies adopters is represented in Table 2. The respondents of mechanized RCTs belong to old age group with average age above 50, whereas SST adopters were youngest among the three belonging to middle age group. The variation in ages was moderate within each group. The education level across the three groups was similar, with respondents being educated upto secondary level. The average family size was consistent across all groups with 8 members in each respondent's house. The average landholding size under all three RCTs was nearly 1.7 ha suggesting that majority adopters were small farmers. All the adopters had high farming experience, around 20 years or more signifying farmers had been adopted farming through inheritance. Agriculture was the primary occupation for majority respondents across all three RCTs. The average annual income was in the range of Rs 45000- 50000 indicating the poor status of the farmers of the region. High standard deviations suggest wide variations in income within each group.

Table 2: Socio-economic profile of RCT adopters

Variables	Codes	SST Mean (SD)	Zero tillage Mean (SD)	Rotavator Mean (SD)
Age of respondent	Years	48.2 (14.6)	54.9 (13.5)	51.8 (14.07)
Education level	Code	1.7 (0.91)	2.08 (0.84)	2.14 (0.72)
Family size	Number	7.6 (4.06)	7.5 (3.4)	7.5 (3.02)
Land holding size	Hectare	1.8 (2.06)	1.7 (1.46)	1.7 (1.38)
Farming experience	Years	20.6 (13.2)	21.4 (10.7)	19.5 (10.5)
Occupation*	Code	1	1	1
Annual Income	INR/annum	474865 (505546.8)	490843.8 (397898.7)	452753 (441554)

* For occupation mode was calculated. Code for occupation: 1- Agriculture, 2- Agriculture + Dairy, 3- Agriculture + Service, and 4- Agriculture + Business

Code for Education: 1- Illiterate, 2- Upto Primary school, 3- Upto Middle School, 4- Secondary/10th, 5- Higher Secondary/12th, and 6- Graduation and above

3.2 Determinants affecting adoption

The dependent variable, i.e. adoption of RCT(s), and independent variables/ factors affecting adoption of the respective RCT were ordinal and were categorised into different sub-categories. Hence multi ordinal logistic regression was used to determine factors influencing the adoption of resource conservation technologies in the wheat cropping system. The various factors of adoption taken under study were landholding size, age, family size, education, farming experience, soil type, wheat variety and source of information. Based on RCT adoption, the respondents are categorised as adopters and non-adopters.

3.2.1. Surface Seeding Technology

The factors/ parameters of adoption were coded and categorised based on the scales outlined in the methodology. The Proportional Odds Model (POM) was fit to the data, and the results are summarized in Table 3. The table shows that farming experience, education, soil type, and wheat variety significantly influenced adoption of SST. For the factor farming experience, the reference category was high farming experience. Notably, farmers with low farming experience had a positive and substantial effect on adoption suggested by an odds ratio of 6.7. This indicates low experience farmers have 6.7 times more chance of adoption than farmers with high farming experience; the elevated adoption rate was attributed to the fact that low-experience farmers mainly belonged to of young and middle age with better access to latest information technology. In terms of education, primary and secondary literate farmers were tended to adopt 4.2 and 2.5 times respectively compared to graduates (reference category) suggesting basic education as primary driver in raising awareness and encouraging adoption. Soil type acted as critical determinant in adoption of SST, primarily due to the technology's better suitability in waterlogging areas having clayey soils. All the non-reference soil types (i.e. loam soil, clay loam and sandy loam) coefficients were significant at a 5 percent probability level. Farmers having land with loam soil, clay loam, and sandy loam significantly adopted the technology lesser than clay soil land farmers (reference category) having odds ratio of 0.05, 0.143 and 0.002 respectively. Discussing, the wheat variety determinant the study found that SST adopters cultivating HUW-234 tended to adopt the technology 0.79 times lesser than reference category variety. The model was fit to the data through the maximum likelihood estimation method and the model was observed to be significant, leading to the rejection of the null hypothesis. The model's goodness of fit was determined by Pearson chi square test and the value was computed by covariate pattern. The test suggests the model to be significant indicating a satisfactory fit between observed values and predicted values.

3.2.2. Zero Tillage

The determinants of zero tillage adoption were coded, and analysed using logistic regression model. The estimates are tabulated in Table 4. Among various determinants studied, soil type and wheat variety significantly influenced the adoption of zero tillage. The regression coefficients associated with determinant soil type were statistically significant at 1 percent probability level. The negative sign of coefficients indicates that in comparison to clay

Table 3: Estimates of factors affecting adoption of surface seeding technology

Factors	Response	Coefficient (bi)	S.E.	Wald	Significance (p)	Odds ratio
Landholding Size	Marginal (<1 ha)	-1.279	1.324	0.934	0.334	0.278
	Small (1-2 ha)	-0.775	1.319	0.345	0.557	0.461
	Semi-medium (2-4 ha)	-0.717	1.323	0.294	0.588	0.488
	Medium (4-10 ha)	-1.341	1.390	0.931	0.334	0.262
	Large (> 10 ha)	0[a]				1
Age	Young (< 35 years)	-0.584	0.974	0.359	0.549	0.558
	Middle age (35-50 years)	0.315	0.359	0.769	0.380	1.370
	Old (> 50 years)	0[a]				1
Family Size	Small	-0.069	1.074	0.004	0.949	0.934
	Medium	-0.521	0.366	2.027	0.154	0.594
	Large	0[a]				1
Farming experience	Low (upto 8 years)	1.904**	0.847	5.051	0.025	6.715
	Medium (8-15 years)	-0.123	0.420	0.086	0.770	0.884
	High (above 15 years)	0[a]				1
Education	Illiterate	-0.022	0.627	0.001	0.972	0.978
	Primary (upto 7th class)	1.433*	0.743	3.721	0.054	4.192
	Secondary (8th to 12th class)	0.898**	0.369	5.929	0.015	2.455
	Graduation and above	0[a]				1
Soil type	Loamy soil	-2.990**	0.788	14.393	0.000	0.050
	Clay loam	-1.944**	0.796	5.960	0.015	0.143
	Sandy loam	-6.135**	0.955	41.242	0.000	0.002
	Clay soil	0[a]				1
Wheat variety	Shriram	-0.719	0.504	2.032	0.154	0.874
	HUW-234 (Malviya -234)	-1.312**	0.665	3.892	0.049	0.797
	HD- 2967	0.490	0.618	0.629	0.428	1.040
	Others	0[a]				1
Source of Information	Informal	-0.117	0.292	0.161	0.688	0.964
	Formal	0[a]				1
Chi-Square		223.48				
-2 Log Likelihood		200.57				
Cox and Snell R^2		0.39				
Nagelkerke R^2		0.53				

a' - This parameter is set to zero because it is redundant.

*10% significance **5% significance

soil farmers (reference category), those with loam soil, clay loam soil, and sandy loam soil were less likely to adopt zero tillage indicated from the odds ratio 0.698, 0.404, and 0.515 respectively. Thus, clay soil significantly increases adoption rate due to its high suitability due to better water retention properties in comparison to other soils. In contrast, determinant wheat variety had positive and significant effect on zero tillage adoption. Farmers cultivating the varieties Shriram, Shreeram super 303 and HD-2967 showcased higher adoption rates compared to farmers cultivating other varieties (reference category). The odds ratio of adoption were 1.46 times higher for Shriram, 1.28 times higher for Shreeram super 303 and 1.47 times higher for HD-2967. This trend suggests due to better compatibility farmers cultivating the specific wheat varieties were more likely to adopt zero tillage. All the other determinants had no significant effect on zero tillage adoption. Maximum likelihood estimates depict the model is statistically significant, confirming the relevance of the included determinants. The model was a good fit as the model accurately fits the above data affirming the model's reliability in explaining the variability in above model.

Table 4: Estimates of factors affecting adoption of zero technology

Factors	Response	Coefficient (bi)	S.E.	Wald	Significance (p)	Odds ratio
Landholding Size	Marginal (<1 ha)	-0.866	2.371	0.133	0.715	0.855
	Small (1-2 ha)	-0.353	2.375	0.022	0.882	0.946
	Semi-medium (2-4 ha)	0.707	2.391	0.088	0.767	1.067
	Medium (4-10 ha)	-0.060	2.420	0.001	0.980	0.962
	Large (> 10 ha)	0^a				1
Age	Young (< 35 years)	0.449	0.796	0.318	0.573	1.022
	Middle age (35-50 years)	-0.300	0.368	0.667	0.414	0.952
	Old (> 50 years)	0^a				1
Family Size	Small	1.112	1.012	1.208	0.272	1.170
	Medium	-0.264	0.353	0.560	0.454	0.977
	Large	0^a				1
Farming experience	Low (upto 8 years)	-0.877	0.528	2.765	0.096	0.887
	Medium (8-15 years)	0.078	0.383	0.041	0.839	1.020
	High (above 15 years)	0^a				1
Education	Illiterate	-0.669	0.597	1.255	0.263	0.913
	Primary (upto 7th class)	-0.577	0.648	0.792	0.373	0.934
	Secondary (8th to 12th class)	0.179	0.378	0.224	0.636	1.032
	Graduation and above	0^a				1
Soil type	Loamy soil	-3.673***	0.894	16.877	0.000	0.698
	Clay loam	-7.194***	1.188	36.694	0.000	0.404
	Sandy loam	-5.229***	0.932	31.469	0.000	0.515
	Clay soil	0^a				1
Wheat variety	Shriram	3.097***	0.869	12.710	0.000	1.460
	HUW-234 (Malviya -234)	2.325**	0.922	6.362	0.012	1.282
	HD- 2967	3.106**	0.951	10.671	0.001	1.471
	Others	0^a				1
Source of Information	Informal	0.284	0.329	0.746	0.388	1.047
	Formal	0^a				1
Chi-Square		325.85				
-2 Log Likelihood		241.28				
Cox and Snell R^2		0.44				
Nagelkerke R^2		0.59				

a' - This parameter is set to zero because it is redundant.

*10% significance **5% significance

3.3.3. Rotavator

The estimates of the multi-ordinal analysis and proportional odds model was applied to identify determinants affecting the adoption of the rotavator are shown in Table 5. Among the eight determinants analysed, landholding size, age, farming experience, education, wheat variety and source of information significantly affected the rotavator adoption. The coefficients of all the landholding sizes were statistically significant at 1 percent probability level, but with negative signs suggesting farmers with smaller landholding size were less likely to adopt rotavator in comparison to large landholding farmers. The odds of adoption for marginal, small, semi-medium and medium landholding was 0.99, 1.06, 1.11 and 0.93 times lesser than large landholding size (reference category). For the age determinant, young age was statistically significant at 1 percent probability level. The table indicates that young farmers were 1.134 times in all likelihood to adopt rotavators compared to old age farmers (reference category). Medium farming experience was statistically significant at 5 percent probability level, but the negative coefficients suggest the adoption rate was 1.3 times lower for moderately experienced farmers compared to high

Table 5: Estimates of factors affecting adoption of rotavator

Factors	Response	Coefficient (bi)	S.E.	Wald	Significance (p)	Odds ratio
Landholding Size	Marginal (<1 ha)	-14.156***	1.002	199.674	0.000	0.996
	Small (1-2 ha)	-13.426***	0.986	185.432	0.000	1.061
	Semi-medium (2-4 ha)	-12.806***	1.049	149.164	0.000	1.117
	Medium (4-10 ha)	-14.334***	1.025	184.389	0.000	0.934
	Large (> 10 ha)	0[a]				1
Age	Young (< 35 years)	1.688**	0.867	3.794	0.049	1.134
	Middle age (35-50 years)	0.415	0.522	0.629	0.428	1.025
	Old (> 50 years)	0[a]				1
Family Size	Small	0.347	1.118	0.097	0.756	0.918
	Medium	-0.176	0.438	0.161	0.688	1.013
	Large	0[a]				1
Farming experience	Low (upto 8 years)	-1.059	0.670	2.502	0.114	0.918
	Medium (8-15 years)	-1.298**	0.593	4.795	0.029	0.912
	High (above 15 years)	0[a]				1
Education	Illiterate	-1.282	0.787	2.652	0.103	0.902
	Primary (upto 7th class)	-2.221**	0.887	6.269	0.012	0.840
	Secondary (8th to 12th class)	-0.169	0.517	0.107	0.743	1.003
	Graduation and above	0[a]				1
Soil type	Loamy soil	-11.290	57.130	0.039	0.843	0.835
	Clay loam	-24.305	119.110	0.042	0.838	0.788
	Sandy loam	11.131	57.131	0.038	0.846	0.844
	Clay soil	0[a]				1
Wheat variety	Shriram	-21.084	79.764	0.070	0.792	0.592
	Shreeram 303	3.849***	1.095	12.353	0.000	1.407
	HD- 2967	-0.984**	0.457	4.622	0.032	0.829
	Shreeram Gold	12.805	106.093	0.015	0.904	1.471
	Others	0[a]				1
Source of Information	Informal	0.859**	0.429	4.008	0.045	1.065
	Formal	0[a]				1
Chi-Square		432.64				
-2 Log Likelihood		139.66				
Cox and Snell R^2		0.604				
Nagelkerke R^2		0.805				

a' - This parameter is set to zero because it is redundant.

*10% significance **5% significance ***1% significance experience farmers. This shows modern farmers were a bit reluctant in adopting the new technology. In contrast to SST, education didn't play a positive role in rotavator adoption, as educated farmers less tend to adopt rotavator. Farmers educated up to primary level 2.2 times less likely to adopt rotavator compared to reference category (graduate and above), the major cause for less adoption among primary level educated farmers was the skeptic attitude of farmers regarding use of agri-machinery. Consistent with trends visible in case of SST and Zero tillage, wheat variety was a prime factor significantly influencing rotavator adoption. Varieties Shreeram super 303 and HD-2967 were statistically significant at 1 and 5 percent probability levels respectively. Farmers cultivating Shreeram super 303 were 3.8 times more likely to adopt rotavator, in contrast to this, farmers cultivating HD-2967 odd ratio was 0.9 times less than reference category. Informal source of information is the most reliable source for the respondents as farmers who received information from these sources adopted rotavator 0.85 times more than those who relied on formal sources. The model was fit to the data, and the significance value in the table was less than 0.05 (i.e. at a 5 percent level of significance), thus accepting the alternate hypothesis that there is a significant difference in the baseline and final models. The studied data had goodness of fit with the fitted model.

Summary and Conclusion

The present study provides empirical evidence on the socio-economic and agronomic determinants influencing the adoption of Resource Conservation Technologies (RCTs) in the rice–wheat system of Eastern Uttar Pradesh. The findings confirm that adoption is not uniform across technologies but is mediated by distinct sets of factors.Incorporation of socio-economic factors through this study adds value to the comprehension of adoption dynamics and bridges a too often ignored gap in the existing literature. Surface Seeding Technology was significantly shaped by farmers' education, farming experience, soil type, and wheat variety, whereas Zero Tillage adoption was largely contingent on soil type and varietal compatibility. In contrast, rotavator adoption was influenced by a broader range of variables, including landholding size, age, education, farming experience, wheat variety, and access to information sources. These findings emphasize that RCT adoption is extremely context-dependent, with technology appropriateness differing across socio-economic groups as well as biophysical environments. Significantly, the evidence emphasizes that uniform promotion strategies will not be able to bring about mass adoption.

Based on the observations few technology specific policy implications can be deduced which are mentioned below:

1. Mass adoption of mechanized RCTs (*i.e.* zero tillage and rotavator) can be promoted through custom hiring centres, the support can be targeted towards small and marginal farmers where they can pay on per use basis.
2. Certain wheat varieties were associated with adoption of different RCTs; promotion of such high adoption wheat varieties should be done along. Promotion of varietal mechanization packages including provision of compatible wheat variety seeds along with training of RCTs.
3. As zero tillage and surface seeding technology adoption were higher in clay soil regions/lowland areas, government should tailor soil-specific advisories and training modules to highlight the benefits of above technologies and also conduct location specific field demonstrations to showcase the efficacy of both RCTs.

Thus, adoption of resource conserving technologies will boost the growth the Indian agriculture sustainably and can be promoted through data driven policies.

Author Contributions

The contribution made by all the authors is given below:

Anwesha Dey: Conceptualization, Methodology, Data Collection, Formal Analysis, Writing – Original Draft Preparation.

Avdhesh Sharma: Data Collection, Data Curation, Writing – Review & Editing.

Yash Gautam: Literature Review, Validation, Writing -Editing.

H.P. Singh: Supervision, Guidance, Critical Review of Manuscript, Final Approval of the Version to be Published.

Conflict of Interest Statement

The authors declare that they have no known financial or personal relationships that could have appeared to influence the work reported in this paper.

Ethical Approval Statement

The study did not require formal ethical approval as it involved only farmer surveys without any intervention; however, informed consent was obtained from all participants, and data confidentiality was strictly maintained.

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No

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