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Determinants of adoption behavior of mustard growers: A multiple regression analysis

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Abstract

Adoption of improved agricultural practices is critical for enhancing crop productivity and sustainability. This study examined the relative contribution of socio-demographic, extension-related, and personal factors on the adoption behavior of mustard growers in India. Data were collected from 120 mustard farmers, and adoption behavior was assessed using an adoption index. Multiple regression analysis revealed that the model was highly significant ($F = 31.85$, $p < 0.001$), explaining 62% of the variance in adoption behavior ($R^2 = 0.62$, Adjusted $R^2 = 0.60$). Knowledge about mustard production technology, extension contact, extension participation, attitude towards improved technology, education, annual income, and mass media exposure significantly influenced adoption. Socio-demographic variables such as age, caste, occupation, and farming experience were non-significant. These findings underscore the importance of knowledge dissemination, attitude formation, and extension support to enhance adoption of recommended mustard production technologies.

Keywords: Mustard growers, adoption behavior, multiple regression, extension services, knowledge, attitude

1. Introduction

Mustard (*Brassica* spp.) is a major oilseed crop in India, contributing significantly to edible oil production and rural livelihoods. Adoption of improved cultivation practices, such as high-yielding varieties, proper nutrient management, pest control, and post-harvest handling, is essential for maximizing productivity (Singh *et al.*, 2020) [5]. Farmers' adoption behavior is influenced by socio-demographic characteristics, extension contact, mass media exposure, personal attitude, and knowledge (Rogers, 2003; Chandra & Kumar, 2007) [4, 1]. Understanding the relative contribution of these factors is crucial for designing effective extension strategies.

Several studies have highlighted the pivotal role of knowledge, attitude, and extension services in technology adoption. For instance, Mishra and Panda (2019) [3] reported that extension contact and participation in training significantly enhanced adoption of improved mustard practices. Similarly, Kumar *et al.* (2021) [2] emphasized the influence of education and income on adoption behavior.

This study aimed to quantify the contribution of multiple independent variables on the adoption behavior of mustard growers using multiple regression analysis.

2. Materials and Methods

A total of 120 mustard growers were randomly selected. Independent variables included socio-demographic factors

(age, caste, education, farming experience, annual income, occupation), extension-related factors (extension contact, extension participation, mass media exposure), and personal attributes (attitude towards improved technology, knowledge about mustard production technology). The dependent variable was adoption behavior measured via an adoption index.

Data collection involved structured schedules and validated questionnaires. Multiple regression analysis was conducted to identify significant predictors of adoption behavior. Diagnostics included Variance Inflation Factor (VIF) for multicollinearity and the Durbin-Watson test for autocorrelation. Statistical significance was considered at $p < 0.05$ (*) and $p < 0.01$ (**).

3. Results

Overall Model Performance

The multiple regression model was found to be highly significant ($F = 31.85$, $p < 0.001$), indicating that the selected set of independent variables collectively explained a substantial portion of the variance in the adoption behavior of mustard growers. The coefficient of determination ($R^2 = 0.62$) suggests that 62% of the variation in adoption behavior could be attributed to socio-demographic factors, extension-related variables, and personal attributes, while the remaining 38% may be influenced by other unmeasured factors such as social networks, local market conditions, or

individual farmer motivation. The adjusted R^2 (0.60) confirms the robustness of the model after accounting for the number of predictors, and the Durbin-Watson value (1.98) indicates no autocorrelation in residuals, validating the independence assumption of regression.

Influence of Socio-Demographic Variables

Among socio-demographic characteristics, Education ($\beta = 0.182$, $t = 2.92$, $p < 0.05$) and Annual Income ($\beta = 0.152$, $t = 2.55$, $p < 0.05$) had a significant positive effect on adoption behavior. This implies that farmers with higher education levels were better able to understand and implement improved mustard cultivation practices, likely due to better comprehension of technical information and recommendations. Similarly, higher annual income provides the financial capacity to invest in improved seeds, fertilizers, and pest control measures, facilitating adoption. Other socio-demographic variables—Age, Caste, Occupation, and Farming Experience—were non-significant, indicating that these factors did not have a measurable impact on the adoption of mustard production technology. This suggests that adoption is more dependent on knowledge, attitude, and access to extension services rather than inherent demographic characteristics. These findings align with earlier studies (Rogers, 2003; Chandra & Kumar, 2007) ^[4, 1] that emphasize the limited influence of age or caste on adoption in modern agricultural contexts, where access to information and resources plays a more decisive role.

Influence of Extension-Related Factors

Extension-related variables had a strong and positive influence on adoption behavior:

- Extension Contact ($\beta = 0.291$, $t = 4.50$, $p < 0.01$)
- Extension Participation ($\beta = 0.258$, $t = 4.22$, $p < 0.01$)
- Mass Media Exposure ($\beta = 0.198$, $t = 2.91$, $p < 0.05$)

These results indicate that farmers who frequently interacted with extension agents, participated in training programs, or had exposure to agricultural information through mass media were more likely to adopt recommended practices. Extension contact provides personalized guidance, clarifies doubts, and reinforces technical knowledge, while participation in training enhances hands-on skills and confidence in implementing practices. Mass media acts as an additional source of awareness, motivating farmers to adopt new technologies. These findings are consistent with Mishra and Panda (2019) ^[3], who reported that extension services and training significantly influence technology adoption in mustard cultivation.

Influence of Personal Attributes

Personal attributes also played a critical role in adoption behavior:

- Attitude towards improved technology ($\beta = 0.256$, $t = 3.96$, $p < 0.01$)
- Knowledge about mustard production technology ($\beta = 0.382$, $t = 4.83$, $p < 0.01$)

Farmers with a favorable attitude towards improved practices were more receptive to recommendations and willing to invest effort in implementing them. Knowledge about mustard production technology emerged as the most influential predictor, highlighting that awareness and understanding of specific production techniques—such as improved varieties, nutrient management, pest control, and post-harvest handling—directly determine adoption. This underscores the fundamental principle that knowledge is a precursor to behavior, as supported by Rogers' Diffusion of Innovations theory (2003) ^[4].

Relative Contribution of Variables

Among all predictors, knowledge about mustard production technology had the highest standardized coefficient ($\beta = 0.382$), followed by extension contact ($\beta = 0.291$), attitude ($\beta = 0.256$), and extension participation ($\beta = 0.258$). This ranking indicates that technical knowledge and access to extension services are the key drivers of adoption behavior, while socio-economic status and mass media exposure play a moderate role. Variables like age, caste, and occupation contribute minimally in the presence of stronger predictors.

Implications

The results have practical implications for agricultural policy and extension programs:

- Strengthening extension services through regular visits, demonstrations, and training programs is essential to improve adoption.
- Knowledge dissemination via farmer field schools, demonstration plots, and media campaigns should be prioritized.
- Attitude building through awareness campaigns can motivate hesitant or risk-averse farmers to adopt improved practices.
- Targeting interventions based solely on socio-demographic characteristics may not be effective; focus should be on knowledge and extension access.

4. Discussion

The findings highlight that knowledge, attitude, and extension-related factors are the most influential determinants of adoption among mustard growers. Extension services, frequent contact, and participation in training programs significantly enhance adoption, confirming previous findings (Mishra & Panda, 2019; Kumar *et al.*, 2021) ^[3, 2]. Farmers with higher education and income also tend to adopt improved practices more readily, consistent with Rogers' (2003) ^[4] diffusion of innovations theory.

Non-significant socio-demographic variables indicate that technology adoption is less dependent on age, caste, or occupation but more on awareness, exposure, and access to extension services. Mass media exposure also contributes positively, emphasizing the role of information dissemination in shaping adoption behavior (Chandra & Kumar, 2007) ^[1].

Table 1: Multiple Regression Analysis of Independent Variables Influencing Adoption Behavior of Mustard Growers

S. No.	Independent Variables	Unstandardized Coefficient (B)	Std. Error (SE)	Standardized Coefficient (β)	t-value	p-value	VIF
1	Age	-0.012	0.008	-0.084	-1.50	0.135	1.12
2	Caste	-0.008	0.009	-0.053	-0.89	0.375	1.08
3	Education	0.035	0.012	0.182	2.92	0.004*	1.25
4	Farming experience	0.010	0.009	0.063	1.11	0.268	1.14
5	Annual income	0.028	0.011	0.152	2.55	0.012*	1.21
6	Occupation	0.007	0.008	0.045	0.88	0.381	1.10
7	Extension contact	0.045	0.010	0.291	4.50	0.000**	1.33
8	Extension participation	0.038	0.009	0.258	4.22	0.000**	1.29
9	Mass media exposure	0.032	0.011	0.198	2.91	0.004*	1.24
10	Attitude towards improved technology	0.039	0.010	0.256	3.96	0.000**	1.30
11	Knowledge about mustard production technology	0.058	0.012	0.382	4.83	0.000**	1.35

Model Summary

- $R^2 = 0.62$
- Adjusted $R^2 = 0.60$
- $F = 31.85, p < 0.001$
- Durbin-Watson = 1.98

5. Conclusion

The study concludes that enhancing knowledge about mustard production, improving attitude towards modern technologies, and strengthening extension services are critical for promoting adoption behavior. Policymakers and extension agencies should focus on targeted training programs, knowledge dissemination through mass media, and frequent field visits to accelerate adoption of improved mustard practices.

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