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Factors affecting adoption of improved rice varieties and its impact on farm income: Evidence from Nepal

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Introduction/Need for Research

Current trend of agricultural productivity has seriously threatened the livelihood and food security of rural people in Nepal. The use of improved high yielding crop varieties remains an option to reduce hunger, poverty and food insecurity in developing world. Rice is, by far, the most important staple crop of Nepal cultivating under 35 % of the total cultivated area,with the lowest productivity in South Asia. Farmers are still using traditional, low yielding varieties and havenot been able to realize the full yield potential and outputs. Therefore, there is an utmost need to examine the factors of low production and adoption of high yielding varieties by farming households.

Objectives

To determine the factors influencing adoption of improved rice varieties (IRVs) and their impacts on farm income among rural farm households in Central Nepal.

Research Methodology

A survey was conducted during 2013 crop season in Central Nepal. We used a multistage random sampling technique to select the sample. A total of 416 farm households were drawn randomly from eight villages of four districts namely Kavre, Nuwakot, Chitwan and Rautahat (Fig.1)

Figure 1. Map of Nepal showing study area (Source: MoAD, 2013)

We employed the Heckman sample selection model as specified below:

$$U_i = X_i'\gamma + u_i \quad with \; U_i = \begin{cases} 1 & \text{if a farmer adopts a new rice variety} \\ 0 & \text{otherwise} \end{cases} \qquad (1)$$

where U_i is a binary dependent variable, X_i' represents independent variables, γ denotes parameters to be estimated, u_i is the error term.

$$Y_i = \beta_0 + X_i'\beta_1 + U_i\beta_2 + \lambda_i\beta_3 + \mu_i \qquad (2)$$

where Y_i is the log of annual farm income, X_i' represents household and farm characteristics, U_i is a dummy for IRV adoption, λ_i is mills ratio to correct selection bias, μ_i is a random term.

Research Results

Summary statistics and estimated coefficients are presented in the Tables below:

Table 1. Descriptive statistics and variable specifications

Variables	Description	Mean (SD)	Hypothesized effects
Age	Age of household head in years	44.54 (10.81)	+, -
Gender	=1 if the household head is male	0.71 (0.45)	+
Education	Years of formal education of the head	7.84 (3.37)	+
Family labor	Number of active family members	3.12 (0.98)	+
Farm size	Cultivated land area in the current year	0.66 (0.28)	+
Land type	=1 if household own irrigated land/plot	0.51 (0.50)	+
Bullocks	=1 if household own bullocks	0.54 (0.49)	+
Extension	=1 if receives extension services	0.65 (0.47)	+
Seed access	=1 if seed is available at local store	0.45 (0.49)	+
Distance	Distance to nearest market (km)	12.59 (5.92)	-
Road access	=1 if farm is linked to the road	0.56 (0.49)	+
Off-farm work	=1 if participate in off-farm work	0.76 (0.42)	+, -
Yield potential	=1 if the adopted variety to yield more than the local one	0.75 (0.42)	+
Acceptability	=1 if it is easier to sell grain from improved seed compared to local one	0.51 (0.50)	+

Source: Author's survey (2013).

Table 2. Probit estimates of the adoption of improved rice varieties

Variables	Coefficients	z-Value	Marginal effects
Gender	0.052 (0.254)	0.20	0.006
Age	0.163 (0.066)	2.43***	0.021
Age squared	-0.002 (0.001)	-2.40***	-0.001
Education	0.116 (0.045)	2.56***	0.014
Family labor	-0.257 (0.118)	-2.17**	-0.032
Farm size	1.525 (0.897)	1.70**	0.188
Land type	0.819 (0.245)	3.33***	0.101
Bullocks	0.538 (0.238)	2.26**	0.066
Wealth index	0.133 (0.089)	1.49*	0.016
Extension	0.405 (0.294)	1.37**	0.049
Seed access	0.436 (0.243)	1.80**	0.053
Distance	-0.018 (0.021)	-0.84	-0.002
Off-farm work	-0.082 (0.264)	-0.31	-0.010
Yield potential	1.397 (0.358)	3.90***	0.172
Acceptability	0.495 (0.228)	2.17**	0.061

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Figures in parentheses are standard errors.

Table 3. Parameter estimates for the farm income

Variables	Coefficients	*t*-value
Gender	-0.008 (0.049)	-0.17
Age	-0.001 (0.002)	-0.60
Education	0.032 (0.009)	3.28***
Family labor	0.059 (0.022)	2.62***
Farm size	0.849 (0.149)	5.66***
Wealth index	0.056 (0.016)	3.38***
Off-farm work	-0.212 (0.051)	-4.09***
IRVs adoption	0.131 (0.062)	2.09**
Distance	-0.008 (0.003)	-2.05**
Road access	0.050 (0.046)	1.07
Mills ratio	-0.016 (0.005)	-3.07***

Notes: *** p < 0.01, ** p < 0.05. Figures in parentheses are standard errors.

Conclusions and Policy Implications

In light of ongoing debates about increasing agricultural production and food security for smallholder farmers in developing countries,this study examines the factors influencing adoption of improved rice varieties and its impact on farm income in Nepal. The study finds a positive and significant impact of IRVs on farm income, while heterogeneous factors determine the probability of IRVs adoption. Our result entails farmers' wealth status specific policy instrument to promote adoption and generate higher income for ensuring food security of rural farm households. Given the significant role played by extension-related variables, investment in extension should be encouraged. Educating farmers by formal or informal (e.g. adult learning) ways to enable them benefit from research and extension will increase the adoption rate.

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Factors Affecting Adoption of Improved Rice Varieties and Its Impact on Farm Income: Evidence from Nepal

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Abstract

The use of improved, high yielding crop varieties by rural farm households remains an option to reduce poverty, hunger and food insecurity in developing world. However, many smallholders in developing countries have not been able to use improved crop varieties. The sizable proportion of Nepalese farmers is still using traditional, low yielding rice varieties. Rice is, by far, the most important staple crop of Nepal which is grown under 35 % of the total cultivated area. However, Nepal's rice productivity is amongst the lowest in South Asian region. This study aims to determine the key factors that influence the adoption of improved rice varieties (IRVs) and their impacts on farm income among rural farm households in Central Nepal.

The data for this study were obtained from a survey conducted during 2013 crop season. We used a multistage random sampling technique to select the sample. In the first stage, four districts namely Kavre, Nuwakot, Chitwan and Rautahat were purposively selected. In the second stage, 8 villages (two villages from each district) were selected. A total of 416 farm households were drawn randomly from the selected villages in the final stage. A farm household is assumed to maximize its utility function subject to resource constraints. Thus, the adoption decision was modeled in a random utility framework. We employed a Heckman sample selection model to analyze the data.

The results revealed that household characteristics such as age, education and family labor played a significant role in adoption decisions. Additionally, farm size, land type, bullocks and wealth index influenced farmers' decisions to adopt IRVs positively. Extension service and access to seed showed positive influence farmers' decisions to adopt IRVs. Further, adoption

decision appeared to be substantially influenced by yield potential and consumers' acceptability of the grains in the market. From the second stage analysis, we found that education, family labor, farm size and wealth index showed positive and statistically significant impact on farm income. More importantly, farm households who adopted IRVs were likely to have higher farm income particularly in Terai region. In contrast, off-farm work and distance to market had negative and statistically significant impact on farm income, suggesting that households located nearby market and employed in off-farm activities tend to have lower farm income than their counterpart households located further away from the market.

Given the significant role played by extension-related variables, investment in extension should be encouraged. Educating farmers by formal or informal (e.g. adult learning) ways to enable them benefit from research and extension materials will increase the adoption rate. Additionally, set up of result/output demonstration sites for IRVs in farmers' field to show the yield difference between improved varieties and the local ones, and promote farmers-to-farmers extension can be a viable way to increase adoption, farm income and food security in the long run.

Keywords: technology adoption, improved rice varieties, farm income, food security, South Asia, Nepal

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