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# Factors Affecting Adoption of Improved Rice Varieties among Rural Farm Households in Central Nepal


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**Abstract:** The use of improved high yielding crop varieties is an important avenue for reducing hunger and food insecurity in developing countries. Using cross-sectional data obtained from a survey conducted during 2013 crop season, we performed a probit model (plot-level analysis) to determine the probability of adopting new improved rice varieties (NIRVs) by smallholder farmers particularly from two main agro-ecological regions (hills and tropical plain terai regions) of Central Nepal. The results revealed that education, extension services and seed access play significant roles in adoption decisions. Additionally, farm and field characteristic variables such as farm size, endowment of favorable land type (e.g. lowlands), and animal power (e.g. oxen) are the key factors influencing the probability of adopting NIRVs. The results showed that technology specific variables (e.g. yield potential and acceptability) are significant for explaining adoption behavior, implying that it is important to take farmers' preferences to varietal characteristics into consideration in the design of a research and development program. Given the significant role played by extension and access related variables, increased emphasis on information dissemination, field demonstration, and farmers' participatory research and training programs to popularize new rice varieties and enhance their adoption rate are required. This also suggests that policy intervention should be made on improving the educational status of farming households, and developing programs on varietal package of rice seed which offer farmers a variety of choices among the appropriate pools of germplasm. Such programs ultimately help farmers develop more profit-oriented behavior which are necessary to enhance adoption rate, production and food security in the long run.

**Key words:** adoption; improved rice variety; probit model; tropical terai region; technology specific characteristic

Productivity improving crop technology can be an option for rural farmers to get rid of hunger and food insecurity by increasing production, reducing food price and making food more accessible to the poor. The use of high yielding crop varieties facilitates the growth of agro-processing enterprise and non-farm sectors, and stimulates the transition from low productivity subsistence agriculture to a high productivity agro-industrial economy (Just and Zilberman, 1988).

Further, developing and promoting the adoption of yield increasing crop varieties in a sustainable manner helps improve livelihood of rural farmers (Asfaw et al, 2012). Rice, the largest crop industry in South Asia including Nepal, has special significance and economic importance in agricultural development and poverty reduction (Gumma et al, 2011). Therefore, increasing rice productivity and production is essential to ensure national food security, reduce poverty, and safeguard against volatility of the rice market. However, adoption of new yield increasing rice varieties in Nepal is fairly low (40%) and its share in national contribution has been declining over the years (Pandey et al, 2012).

In terms of area and production, rice is the largest

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crop followed by maize and wheat, and a main staple crop in Nepal. Rice accounts for 46% of the cereal cultivated area and 55% of the production share (CBS, 2011). However, Nepal has the lowest productivity in cereal crops including rice in the South Asian region where population growth rate surpasses the growth rate of cereals, and thus becomes one of the most food-insecure countries in the region (Joshi et al, 2012). Various reports related to agriculture and food security assessments in Nepal have noted that low agricultural productivity is an important constraint on the achievement of national food security in Nepal (Bohle and Adhikari, 1998; Gittelsohn et al, 1998; Seddon and Adhikari, 2003; FAO, 2010; Pyakuryal et al, 2010; Sanogo and Maliki, 2010). Additionally, we lack adequate understanding and accurate information about recent changes in rice area over the years to design appropriate production plans and technology targeting schemes in the country (Gauchan et al, 2012). In this context, it has been a challenge for Nepal to increase production and productivity of rice in order to feed ever increasing population and achieve national food security. With the realization of this milieu, government had hammered out more pro-farmer strategies to promote the adoption of improved crop varieties and new technology with the support from donors and international support organizations, but very little has been achieved so far.

Rice production in Nepal largely depends on climatic variability, as most of rice is produced in rain-fed environment. For example, rice production and yield have noticeable fluctuation, which increase during the favorable monsoon seasons, but drop sharply during unfavorable years (Gauchan et al, 2012; Poudel et al, 2013). Also, rice is grown extensively under a wide range of agro-ecological regions (hills and terai), covering hill terraces, intermountain basins, river valleys, and flat lowland plains bordering to India. Terai exists mostly the low land type and the majority of plots are under irrigated (e.g. Chitwan and Rautahat districts in this study), whereas hill region (Kavre and Nuwakot), the main source of irrigation remains local streams, ponds, rain flood. About three-fourths (74%) of the paddy is produced in the flat lowland of the terai and the rest (26%) in the hills and mountains (Pandey et al, 2012).

Nepal's agriculture is characterized by marginal and small landholdings where land endowments are scattered in different plots or parcels. This is because ever increasing population has put pressure on land to be fragmented, averaging 3.3 parcels per household (Gauchan et al, 2012). Since the size of parcels is small, commercializing and adopting new agricultural technologies has been a difficult task and almost impossible. This hinders smallholders to increase production, generate income and improve livelihood. Farmers own and cultivate rice on different lands or field types based on topographical sequence, soil quality and irrigation source. Farmers also subdivide parcels into plots and subplots to fit the varieties of their own choice (Gauchan et al, 2012). Therefore, farmers' perceptions of new varieties are particularly important in determining which variety they will adopt (Sall et al, 2000). Further, farmers' perceptions of the technology-specific attributes of crop varieties are the major factors in determining adoption and use intensity (Adesina and Zinnah, 1993). As stated by Joshi and Pandey (2006), analyzing farm level data from rain-fed environment in Nepal, farmers' perceptions of varietal characteristics play key roles in determining technology choices. Therefore, there is a need for adoption studies to consider farmers' perceptions of technology specific attributes in the assessment of rice variety adoption decisions. Thus, this study aims to determine the factors among not only farm and farmers' characteristics but also farmers' perceptions of technology specific characteristics in technology adoption decisions relating to improved rice varieties based on the plot level data in Central Nepal.

The adoption of high yielding crop varieties by farmers in developing countries has been viewed as the solution to lower incomes in agriculture over the years (Besley and Case, 1993). As a result, many donor agencies have invested substantial resources in agricultural technologies in developing countries. However, most of the new agricultural technologies have not fully achieved the desired goals (Faltermeier and Abdulai, 2009). This observation has, therefore, spawned numerous studies about agricultural technology adoption and their impact on smallholders' welfare in developing countries in the recent years (Besley and Case, 1993; Doss and Morris, 2000; Mendola, 2007; Becerril and Abdulai, 2010). These studies focused on the adoption of single agricultural technology rather than a bundle of innovations that might enhance agricultural productivity in an integrated approach. For example, if a farmer adopts only one technique rather than a series of packages that includes implying new types of fertilizer, improved planting and weeding methods, new pesticides and irrigation