Determinants of Adoption of Improved Rice Varieties in Northern Sindh, Pakistan

Abbas Ali CHANDIO, JIANG Yuansheng

(*College of Economics, Sichuan Agricultural University, Chengdu 611130, China*)

Abstract: Adoption of certified and improved high-yielding crop varieties is important avenue for increasing agricultural productivity and improving the living standard of the farmers in developing countries. The main objective of the current study was to examine factors affecting adoption of improved rice varieties by smallholder farmers in Northern Sindh, Pakistan. The random sampling technique was used to collect data from 220 smallholder rice farmers through the face to face interview. Data were analyzed using descriptive statistics and probit regression model. The empirical results showed that year of education ($P \leq 0.093$), farming experience ($P \leq 0.043$), soil quality ($P \leq 0.077$), farm machinery ownership ($P \leq 0.000$), access to market information ($P \leq 0.055$) and contact with extension agents ($P \leq 0.006$) had significantly positive influence on adoption of improved rice variety, while age ($P \leq 0.053$) had significantly negative effect.

Key words: adoption; technology; improved variety; smallholder farmer

Adoption of increasing agricultural new technology can be an important option for the farmers to get rid of hunger and food insecurity by improving crop productivity, reducing food price and making more food accessible for the poor households. Further, promoting the adoption of improved crop varieties in a sustainable manner helps to improve welfare of the households (Asfaw et al, 2012a). In Asia including Pakistan, rice is the staple food for the majority of the people, and has significantly economic importance in agriculture development and poverty reduction (Ali et al, 2014). It accounts for almost two million tons to our food requirements and is an important source of income generation of the rural households. In terms of area sown, rice is the third largest crop after wheat and cotton, and it is cultivated on over 2 724 000 hm^2 in 2016–2017 in Pakistan. It contributes for 3.0% in the value added in agriculture and 0.6% to the GDP (GOP, 2017). In Pakistan, rice is mainly grown in two provinces i.e. Punjab and Sindh. Both provinces

account more than 88% of total rice production (Abedullah and Mushtaq, 2007). Due to agro-climatic and soil conditions, rice is cultivated in upper and lower parts of Sindh Province of Pakistan. In Sindh, rice growers directly purchase improved and certified rice varieties through formal sectors including Sindh Seed Corporations (SSC), and Rice Research Institute (RRI) Dokri, Larkana, as well as private agricultural seed companies. These formal and private sectors supply more than 10%, and the remaining seeds are produced by the rice growers themselves. Government has been made efforts to increase rice cultivation area and per acre yield. The extensive researches and continued efforts by agricultural scientists over the last few decades in Pakistan has achieved better improvement in rice yield, which, however, is still much lower compared to the other rice producing countries. Adoption of improved and certified rice varieties is important for more profit and increasing rice productivity. However, improved and certified

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rice varieties have not been widely adopted in rice producing areas of Pakistan. The rice growers make use of unregistered and uncertified rice varieties whose yields are quite lower compared to the improved and certified rice varieties, due to various factors such as less access to certified seeds, lack of awareness of adoption of improved rice varieties (IRVs), lack of government subsidy, poor infrastructure, rising prices of fertilizers, shortage of irrigation and lack of credit facilities (Mirani et al, 2002; Abedullah and Mushtaq, 2007; Chandio et al, 2017). Majority of the rice growers typically use the last year's crop seeds instead of purchasing the seeds of improved released rice varieties. The non-availability and high prices of improved and certified variety seeds are the main reasons for its slow adoption and result in lower per acre rice productivity in Pakistan. According to Ghimire et al (2015), replacement of conventional rice varieties with improved varieties increases the rice crop productivity. The widespread adoption of diverse high-yielding rice varieties manifold the rice production in Bangladesh (Hossain et al, 2006). Adoption of IRV (AIRV) compared to the conventional variety doubles the returns for rice crop producers.

The determinants to the adoption of IRVs have been investigated for various countries including India (Kumar et al, 2016), Malaysia (Adedoyin et al, 2016), the Philippine (Mariano et al, 2012), Nepal (Ghimire et al, 2015), Bangladesh (Hossain et al, 2006), Benin (Dandedjrohoun et al, 2012), Nigeria (Tiamiyu et al, 2009; Ologbon et al, 2012), Ethiopia (Asmelash, 2012) and Kenya (Okello et al, 2016). Some studies conducted in Punjab Province of Pakistan mainly focus on technical efficiency of rice production and impact of institutional credit on rice productivity (Abedullah and Mushtaq, 2007; Khalid Bashir and Mehmood, 2010; Hussain, 2012). A study examining the determinants of IRVs with respect to Sindh Province is missing, therefore, this research aimed to fill this gap. The main purpose of the current study was to examine the socio-economic factors that influence AIRV in Sindh Province of Pakistan.

MATERIALS AND METHODS

Study area

Larkana and Shikarpur districts of Sindh Province, Pakistan were selected for the present study, where rice is one of the major widespread crops grown in overall regions, and is the prime source of income for major farmers in these districts. Larkana district is located in the northwest of Sindh Province, Pakistan, where the Zulifkar Ali Bhutto Agriculture College and Rice Research Institute is located. The geographical area of Larkana district is 7 423 km^2 with the total population of 1 927 066. Out of the total population, 557 012 (28.9%) live in urban areas, whereas 1 370 054 (71.1%) live in rural areas, respectively. An average household size of Larkana district is 5.9 (GOP, 2011). Further, Shikarpur district is located in the north of Sindh Province, Pakistan. The geographical area of this district is 2 512 km^2. An estimated population of Shikarpur district is 880 438. Out of the total population, 211 979 (24.1%) reside in urban areas, whereas 668 459 (75.9%) in rural areas. An average household size of Shikarpur district is 6.8.

Data collection

The primary data was gathered during the harvesting season of rice crop during November to December in 2016 by utilizing random sampling technique through a well-structured questionnaire. A total of 220 rice smallholder farmers were covered in this study with 140 and 80 randomly selected from Shikarpur and Larkana due to population size of these two districts, respectively (GOP, 2011). The survey covered a number of demographic and socio-economic variables that affect AIRV including age of the respondent head, year of education, household size, experience, landholding size, soil quality, farm machinery, market information and distance, credit accessibility and extension agents. The collected data were analyzed with the help of Stata software.

Analytical framework

Probit regression model has been widely utilized to evaluate the functional association among the probability of adoption and its determining elements (for example education, farm size, resource ownership and social status). The binary econometric models enable a more specific analysis of farmers' adoption of new technology (Langer, 2000; Belay, 2001; Zhou et al, 2008; Mariano et al, 2012; Muzari et al, 2012). This type of analysis provides more detailed information on the characteristics of the farmers who tend to adopt a specific technology. The probit regression model is preferred over the others because of its good properties, especially the assumption of normal distribution (Wooldridge, 2010). In this study, we used probit