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## **Analysis of Factors Determining the Productivity of Rice in Terai Belt of Nepal**

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### **Abstract**

Rice is the main staple crop to contribute to ensure food security in Nepal. Rice contributes about one-fifth of the total agriculture GDP and occupies the largest share in terms of area and production in Nepal. However, the rice production and productivity are not satisfactory, and the country has to import rice in a large quantity every year. Terai, the southern belt of Nepal is known as the food-belt of the country, where more than eighty percent of farm households are actively engaged in rice production. The study aimed to assess the factors determining rice productivity among farmers in the Terai belt of Nepal. The study also examined the existing constraints faced by farmers during rice production and marketing. Farmers having land size less than two hectares were selected randomly by three-stage sampling procedure from the registered farmer groups in Prime Minister Agriculture Modernization Project (PMAMP) Rice Zone, Siraha district in 2018/2019. In addition to the secondary information, a pre-tested semi-structured survey schedule was used to collect the primary information from rice growers. The data were analyzed with the aid of descriptive and multiple regression statistics. The results of the multiple linear regression model revealed that access to irrigation facility, educational status of farmers, and farmers' participation in the training programs related to rice production have significant positive effects on rice productivity. Furthermore, an indexing technique used to rank the constraints faced by the farmers showed that insufficient irrigation facility (0.77), incidence of diseases and pest (0.64), limited availability of labour (0.58), low market price of the produce (0.51) and poor access to quality seeds (0.44) were the major hindrances faced by farmers during rice production and marketing. The findings of the study underscore the need of strengthening training programs and proper arrangement of irrigation facilities for increasing the productivity of rice. Similarly, provision of quality inputs, technical support for disease and pest management, farm mechanization and proper pricing of the produce could convert the constraints into opportunities and encourage rice growers to increase the rice productivity.

**Key words:** Farm mechanization, food security, food-belt, irrigation, multiple linear regression

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## **Introduction**

Agriculture remains an integral part of Nepalese economy, contributing to 26.5 percent in national Gross Domestic Product (GDP) and absorbs two-third of the labor market (MoALD, 2018). Rice solely shares nearly 20 percent to the agricultural gross domestic product (AGDP) and almost 7 percent to GDP (MoAD, 2015). It provides more than 50 percent of grain requirement and more than 30 percent of calorie requirement for Nepalese people (Dhungel & Acharya, 2017). It is grown in 1.49 million hectares producing 5.61 million tones with productivity of 3.76t/ha in FY 2018/19 (MoALD, 2018). About 70 percent of the total rice area is located in the Terai, 5 percent in the inner Terai whereas mid-hills and mountains occupy only about 23 percent and 2 percent respectively (Adhikari, Mehera, & Haefele, 2013). Terai is also known as the “Granary of Nepal” where more than 84 percent of farm households are actively engaged in rice production (CBS, 2011). Siraha district of Province 2 is situated in the Terai region of Nepal having tropical climate with hot summer and cold winter (DADO, 2016). The land area under rice cultivation in the district was 50,197 hectares with production 172,176 metric tons (MoALD, 2018). The productivity of rice in the Siraha is less (3.43mt/ha) as compared to Province 2(3.72mt/ha) and national yield (3.76mt/ha) in FY 2018/19 (MoALD, 2018). The increasing demand of rice by about 10 percent each year compelled the country relies on India for rice imports. The possibility of expanding the arable land is also difficult; so there required an extra production has to come through increase in productivity (Dhungel & Acharya, 2017). Thus, it is necessary to explore the factors determining the productivity of rice and constraints faced by the farmers during rice farming so as to convert the constraints into opportunities and motivate the farmers to enhance the rice productivity.

## **Methodology**

A multistage random sampling was implemented to select the representative sample. Initially, Siraha district was selected purposively for the study. Secondly, out of 41 registered farmer groups in Prime Minister Agriculture Modernization Project (PMAMP) Rice Zone, Siraha; 27 registered farmer groups with 766 members were selected considering the potential for rice production. Finally, eighty (80) rice producers having land size less than two hectares were selected randomly from the chosen farmer groups. A pre-tested semi structured interview schedule was used to collect the primary information. The secondary data were collected from various sources and an extensive review of literature. A multiple linear regression model was used to analyze the determinants of productivity of rice. Furthermore, the indexing technique was used to construct an index for prioritizing the problems as per farmer’s perception.

## **Results and Discussion**

### ***Socio-economic and Farm Characteristics of Rice Farmers***

The study showed that the average age of rice producers was about 48 years and average household size of 7.51. Similarly, mean rice cultivated land was 0.87 hectare in the study area. Majority of farmers (67.5%) were literate (Figure 1) but only 21 percent had participated in the training programs related to rice production (Figure 2). Moreover, the study revealed that about half (47.5%) of the farmers were deprived from the irrigation facility (Figure 3) and 27.5 percent were the family with their member abroad for the employment opportunities (Figure 4).

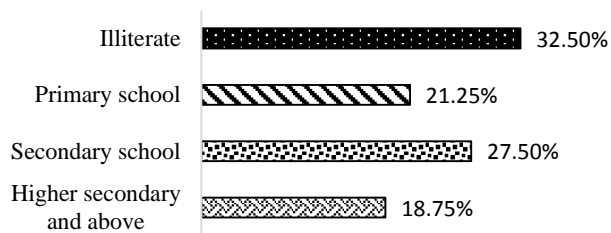


Figure 1. Education level of household head

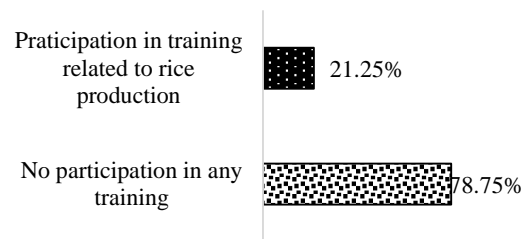


Figure 2. Participation in rice training

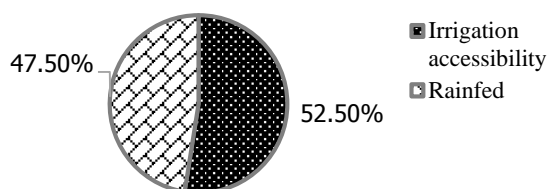


Figure 3. Access to irrigation facility

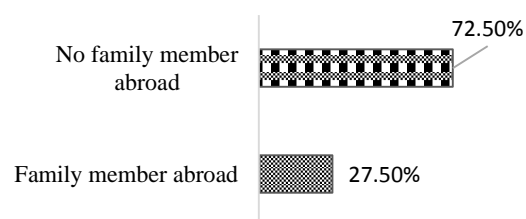


Figure 4. Family with their member abroad

### ***Effect of Socio-economic and Farm Characteristics on Productivity of Rice***

The results of multiple linear regression model showed that the accessibility of irrigation facility ( $p=0.000$ ) and the level of education attainment of the farmer ( $p=0.005$ ) were significant and positive. It shows that the farmers with an access to irrigation facility had 0.57 times (57%) more productivity of rice as compared to those farmers with no/limited access to irrigation facility holding other factors constant. The quality and yield of rice depends on quality, frequency and timing of an irrigation as per crop need and availability (Lohanee, Regmi, & Parajuli, 2017). Similarly, with an increase in number of schooling years by one, the productivity of rice increases by 0.054 times (5.4%) holding other factors constant. Ohen and Ajah (2015) also observed the higher output of rice when rice producers were educated. Moreover, the participation in the training programs by rice producers had positive and significant ( $p=0.034$ ) effect on productivity of rice at 5% level of significance. It shows that those farmers who had participated in the training programs related to rice production had 0.37 times (37%) more productivity compared to those farmers who had not participated in training activities holding other factors constant (Table 1).

Table 1. Determinants of productivity of rice

Variables	Coefficients	Standard error	t- values	p-values
Age of household head	.0084403	.0085042	0.99	0.324
Education of household head	.0543114***	.0188157	2.89	0.005
Economic active people	-.0067883	.0449289	-0.15	0.880
Rice cultivated area	.0911143	.1690398	0.54	0.592
Irrigation facility	.5795947***	.1362157	4.25	0.000
Family member abroad	-.1395666	.1602605	-0.87	0.387
Participation in rice training	.3759475**	.1737433	2.16	0.034
Constant	3.548549	.5210294	6.81	0.00

Number of observation (N) =80,  $F(7, 72) = 6.96^{***}$ ,  $\text{Prob}>F = 0.0000$ ,  $R\text{-square}=0.4037$ , Adjusted  $R\text{ squared} = 0.3458$ , Variance Inflation Factor (VIF)=1.35(mean VIF)

Dependent variable is productivity of rice in kg/ha \*\*\* Significant at 1% level, \*\* Significant at 5% level, \* Significant at 10% level

### ***Constraints associated with Rice Farming***

Farmers perceived that limited irrigation (0.77) and the incidence of diseases and pest (0.64) are the major bottlenecks in increasing rice production and productivity followed by the limited

availability of the labour (0.58). Similarly, low market price of the produce (0.51) and poor access to quality seeds (0.44) were found as fourth and fifth problems respectively faced by the farmers during rice production and marketing in the study area (Table 2).

Table 2 Major constraints faced by farmers during rice production and marketing

Constraints	Index Value	Ranking
Limited Irrigation	0.77	I
Incidence of diseases and pest	0.64	II
Limited availability of labour	0.58	III
Low market price	0.51	IV
Poor access to quality seed	0.44	V

### Conclusions and Outlook

The findings of multiple linear regression showed that access to irrigation facility, educational status of farmers and farmers' participation in the training programs related to rice production were the factors determining the productivity of rice in Siraha district, Terai belt of Nepal. Similarly, farmers faced the limited irrigation was the major problem followed by incidence of diseases and pest. The finding suggests that a higher education level, training programs related to rice production and proper arrangement of irrigation facilities could support for increasing the productivity of rice. Furthermore, with an access to quality inputs, technical support for disease and pest management, farm mechanization and proper pricing of the produce provides an opportunity for increasing the rice production and productivity.

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