



## Factors determining credit access of tomato farmers in a selected area of Bangladesh

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### Abstract

Tomato farming has emerged as a commercial business in Bangladesh that demands a lot of credit support from financial institutions. This study aims to estimate the factors determining credit access of tomato farmers in a selected area of Bangladesh. Probit regression model is employed to estimate the determinants of credit access. About 60 tomato farmers are randomly selected from Mymensingh district. About 66% farmers have not yet got the credit access. Moreover, credit accessibility is influenced by different factors. Probability of credit access increases with years of schooling, own asset and productivity of tomato farmers. Educated farmers are aware about the rules of financial institutions while own asset and high production of tomato farmers assure the credit providers about timely payback. In addition, Probability of credit access reduces with the farmer's age. Tomato productivity and export of Bangladesh can be increased through timely credit accessibility of tomato farmers.

**Keywords:** credit access, tomato, Bangladesh

### 1. Introduction

Tomato (*Lycopersicon esculentum*) is one of the major vegetables produced in the world that occupies about 60% of total fresh vegetable production in the world in 2016 (FAOSTAT, 2016) [12]. Within last few decades, tomato production has achieved massive growth that amplifies incomes for laborers, empowered women and created new employment opportunities particularly for landless farmers in developing countries like Bangladesh (SOFA team *et al.*, 2011; Weinberger & Genova, 2005) [23, 26]. Bangladesh has experienced about 6.5 times increase in tomato production after 1971 (FAO, 2016) [12]. The massive growth of tomato production and yield are presented in figure 1.

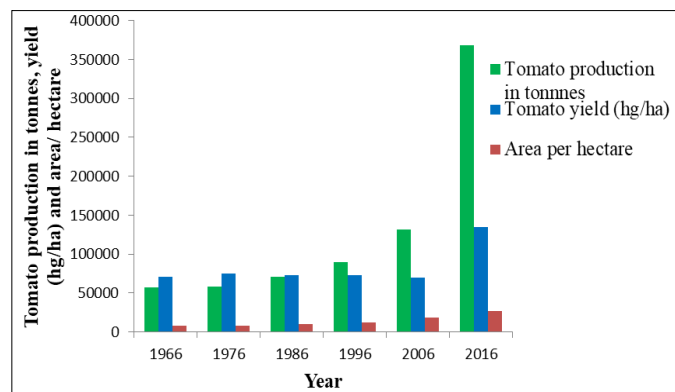


Fig 1: Production, yield and area of tomato

Commercial farming of tomato has contributed a lot for increasing tomato productivity. Huge capital is required for

running commercial tomato farms. Irrigation, pesticides, fertilizer, labor and seeds occupy vital part of total variable cost of production but economic condition of most farmers cannot meet the expense of massive capital requirement that causes low productivity of tomato. Moreover, tomato farmers cannot apply inputs timely while farming mostly depends on seasonality. For example: few tomato varieties grow in winter while few produce in summer season. So, timely credit facility for financing tomato farms is very urgent but the supply of credit is not readily available for them. Non-institutional credit is available but it is provided very small in amount for arranging social rituals such as marriage or funerals. Non-institutional credit is not enough for tomato farming. On the other hand, institutional credit is provided by Nationalized Commercial Banks, Private Banks, Bangladesh Krishi Bank, Grameen bank and NGO's. Government of Bangladesh has provided subsidized institutional credit to vegetable farmers at low interest rate for purchasing inputs (Bangladesh Bank, 2014-15) [7]. Collateral of farm is mandatory for receiving institutional credit. Own asset of farmers can be used as collateral but most of the farmers are landless. They are farming in leased lands that cannot be utilized as collateral. Without enough collateral, farmers are ineligible to get institutional credit. In addition, few factors such as education, tomato production, traing and age may influence the credit access of farmers. Educational qualification of tomato farmers increases their off-farm earning and consciousness about the rules and regulations of financial institutions. Farmers training facility assists them to know modern farming techniques that assist them to increase productivity. Increasing tomato production can facilitate the payback of loans by enhancing

income and savings of farm.

Few studies have carried out in the world on credit access of farmers. Saqib *et al.* (2017)<sup>[22]</sup> examine the factors influencing farmers' access to agricultural credit in a flood disaster risk-prone area in Pakistan. Adams (2015)<sup>[4]</sup> investigates Dzorwulu vegetable farmer's level of access to microcredit and its influence on farmer's investments decisions. Agbo *et al.* (2015)<sup>[3]</sup> examine the access to credit by vegetable farmers in Nigeria with Owerri agricultural zone of Imo State, Nigeria. Anang *et al.* (2015)<sup>[5]</sup> estimate factors influencing access to loan and determinants of loan size. Mayowa (2015)<sup>[19]</sup> analyze the determinants of loan acquisition from the Land Bank of South Africa by smallholder farmers in peri-urban areas of Mopani District in Limpopo province. Yehuala (2008)<sup>[28]</sup> estimates the factors affecting smallholder farmer's access to formal credit and the status of women and different wealth groups. Kacem and Zouariz (2013)<sup>[16]</sup> identify the socioeconomic factors that influence farmers' access to the microcredit in Tunisia. Chauke *et al.* (2013)<sup>[10]</sup> pursued to ascertain factors that affect smallholder farmer's access to credit sources in the Capricorn District Municipality of Limpopo Province, South Africa. Dzadze *et al.* (2012)<sup>[11]</sup> identify factors that limit or increase smallholder farmers' access to formal credit in the Abura Asebu Kwamankese district of the central region of Ghana. Quagraine *et al.* (2010)<sup>[21]</sup> estimate factors the utilization of credit facilities in fish production in Kenya. In spite of these studies, factors affecting credit access of tomato farmers has not been carried out in Bangladesh. The objective of this study is to estimate the factors determining credit access of tomato farmers in a selected area of Bangladesh.

## 2. Materials and Methods

### 2.1 Sampling procedure and data description

Mymensingh district has been selected purposively for data collection due to the concentration of tomato farmers and fund limitation. This is an emerging tomato producing area of Bangladesh that experienced about 98% growth in last 8 years. About 6800 MT tomato is produced in 2015 (BBS, 2015-16)<sup>[9]</sup>. Sixty sample respondents of tomato farmers are selected randomly from this district and geographical position of Mymensingh is identified in figure 2. A pre-tested interview schedule and direct interview method is used for data collection. Cross-sectional data is collected about input used in production process, the output produced, credit accessibility, socio-economic characteristics of farmers, cost of inputs and return from output. Researcher and few graduate students are employed in data collection process.

Data used for estimating determinants of credit access are showed in table 1. Dependent variable is credit access which is binary variable. Farmers having credit access are identified as 1 and otherwise 0. Independent variables are farmer's age, education, training, own asset and quantity of output per hectare. Age, education and own assets of farmer are continuous while training is binary variable. Age and education are measured in years while own asset is measured in Bangladeshi Tk. If farmers get training, they are denoted as 1 otherwise 0. These socio-economic characteristics of tomato farmers are hypothesized to have a positive influence on credit accessibility.



Fig 2: Study area in Bangladesh

### 2.2 Methods

Decision making behavior of an individual has already studied in the literature from different view point. For example: Decision making on technology (Alabi *et al.*, 2012; Moon and Balasubramanian, 2004; Adesina and Zinnah, 1993)<sup>[2, 20, 11]</sup>, credit (Saqib *et al.* 2017; Mayowa, 2015; Anang *et al.*, 2015; Agbo *et al.* 2015; Quagraine *et al.*, 2010)<sup>[22, 19, 5, 3, 21]</sup>, food items (Baker, 1999; Magnusson and Cranfield, 2005)<sup>[6, 18]</sup> and agriculture diversification (Windle and Rolfe, 2005)<sup>[27]</sup>. Logit or probit models are used for explaining the choice behavior of a binary dependent variable. Both models have few limitations. Logit model cannot show random taste variation and it cannot be used with panel data when unobserved factors are correlated over time for each choice. Although probit model can handle the problems, assumption of normal distribution may not provide an adequate representation of random components that can lead inappropriate model forecasts (Train, 2003)<sup>[24]</sup>.

This study utilized probit model to estimate the effect of different factors on tomato farmer's credit accessibility (Gujarati, 2003)<sup>[13]</sup>. The decision of the  $i$ th tomato farmer's credit access depends on an unobservable utility index  $I_i$ . This utility index is determined by different explanatory variables such as age, education, training, own asset of farmers. The utility index  $I_i$  can be expressed in equation 1.

$$I_i = \beta_1 + \beta_2 X_i \quad (1)$$

Here,  $X_i$  is the explanatory variable like education of farmers. It can be assumed that there is a critical or threshold level of the index denoted as  $I_i^*$  and farmers can access to credit if utility index can exceed the critical value. It can be further assumed that threshold  $I_i^*$  is normally distributed with equal mean and variance. Probability of  $I_i^*$  is less than or equal to  $I_i$  that can be computed from the standardized normal CDF in equation 2.

$$P_i = P\left(Y = \frac{1}{X}\right) = P(I_i^* \leq I_i) = P(Z_i \leq \beta_1 + \beta_2 X_i) = F(\beta_1 + \beta_2 X_i) \quad (2)$$

Where  $P\left(Y = \frac{1}{X}\right)$  means the probability of an event occurs given the value of the X i.e. explanatory variable and  $Z_i$  is the

standard normal variable with mean zero and variance  $\sigma^2$ . F is the standard normal CDF that can be written as

$$F(I_i) = \frac{1}{\sqrt{2\pi}} \int_{-\alpha}^{I_i} e^{-\frac{z^2}{2}} dz$$

$$= \frac{1}{\sqrt{2\pi}} \int_{-\alpha}^{\beta_1 + \beta_2 X_i} e^{-\frac{z^2}{2}} dz \tag{3}$$

To obtain utility index  $I_i$  as well as  $\beta_1$  and  $\beta_2$ , inverse of  $I_i$  need to be taken that is shown in equation 4.

$$I_i = F^{-1}(I_i) = F^{-1}(P_i) = F^{-1}F(\beta_1 + \beta_2 X_i) = \beta_1 + \beta_2 X_i \tag{4}$$

Where,  $F^{-1}$  is the normal CDF.

Parameter estimates from this model have not any economic sense. A meaningful interpretation of the effect of explanatory variables can be obtained by calculating marginal effect. Marginal effects of explanatory variables show the impact of one unit change in each of the explanatory variable on the probability of credit access of tomato farmers. Derivative of probability of credit access with respect to education is shown in equation 5.

$$\frac{dP_i}{dX_i} = \frac{d}{dt} F(t) * \frac{d}{dX_i} dt$$

$$= \frac{d}{dt} F(\beta_1 + \beta_2 X_i) * \frac{d}{dX_i} (\beta_1 + \beta_2 X_i)$$

$$= F(\beta_1 + \beta_2 X_i) \beta_2 \tag{5}$$

Where,  $t = \beta_1 + \beta_2 X_i$

The model is estimated using maximum-likelihood procedure of estimation using STATA 14 software.

### 3. Result and Discussion

#### 3.1 Summary Statistics

The descriptive statistics of tomato farmers are showed in table 1. Average productivity of tomato per hectare is about 21523 kg ranging from 9000 kg to 40000 kg. Average productivity of tomato is lower than Karim *et al.* (2009) [17]. Karim *et al.* (2009) [17] found that average yield of BARI hybrid tomato was found 32780 kg per hectare. Mean age of tomato farmers is much higher than Hasan (2011) [14] and lower than Quagraine *et al.* (2010) [21]. Mean years of schooling is about class 7 ranging from 0 to 16. Quagraine *et al.* (2010) [21] found that at least 74% farmers passed secondary level in Kenya. In addition, about 35% farmers have received training in the study area which is very low. Average own asset of farmers is about Tk. that can be used as collateral for loan. Available collateral of tomato farmers assist them to get the credit.

**Table 1:** Data description of tomato farmers

Variables	Credit access			
	Mean	Standard deviation	Min	Max
Credit access (If yes=1, No=0)	33.33	47.53	0	100
Productivity (kg ha <sup>-1</sup> )	21523	5902	9000	40000
Age (Years)	42	13	23	70
Education (Years of schooling)	7	5	0	16
Training (If taken=1, not taken=0)	35	48	0	100
Own asset (Amount in taka)	46967	31763	0	150000

#### 3.2 Factors affecting credit access

Different factors influence the credit access of tomato farmers that is shown in table 2. Besides this, goodness of fit of the model such as chi-squared statistic and pseudo-R squared are also presented. Pseudo  $R^2$  is 70% and the chi-squared statistic

is calculated by using LR statistic test. The value of the test is 53.17 which reject the null hypothesis that all slope coefficients are 0 at 1% level of significance. These measures show that used model has reasonable explanatory power and fitted the data sensibly.

**Table 2:** Probit estimation for tomato farmers

Variable Description	Estimated coefficient	Standard error	Marginal effects	P-value
Constant	-4.57	4.13		0.26
Training	1.85	1.23	0.31	0.13
Age	-0.18	0.08	-0.01	0.04**
Education	0.33	0.17	0.03	0.04**
Productivity	0.00	0.00	0.00	0.10*
Own Asset	0.00	0.00	0.00	0.04**
No of observation	60			
Pseudo R <sup>2</sup>	0.84			
Chi Square	64.69			

(Significance level: \*\*\* for 1% and \*\* for 5%)

Results of probit estimation found that four out of the five

estimated coefficients are statistically significant. Tomato

farmer's own asset, education and age are significant at 5% while farmer's quantity of output produced is significant at 10%. The estimated coefficient of education is 0.33 and the positive coefficient of years of schooling suggests that probability of access to credit will increase with the rising of years of schooling. Moreover, the estimated marginal effect of farmers is 0.03 that means if years of schooling increase by 1 year, probability of credit access rises by 3%. Education eases the path of attending seminar, symposium and workshops. By attending these programs, they can enhance their knowledge about new farming techniques that helps them to increase productivity. Moreover, they are familiar with the rules and regulations of bank and NGO's loan that increase the probability of receiving credit. Saqib *et al* (2017)<sup>[22]</sup> and Dzadze (2012)<sup>[11]</sup> found the consistent result while Agbo *et al.* (2015)<sup>[3]</sup> found the opposite result. Besides this, age of tomato farmers has negative effect on credit access. The marginal effect of age is -.01 that means if farmer's age increases by 1 year, probability of credit access reduces by 1%. Generally, aged farmers are risk averse and they are not interested to bear risk adhere to credit repayment. Saqib *et al* (2017)<sup>[22]</sup> found similar result while Quagraine *et al.* (2010)<sup>[21]</sup> and Agbo *et al.* (2015)<sup>[3]</sup> found the opposite result. In addition, positive coefficient of training shows the positive effect of training on credit access. Trained farmers probability of receiving credit is 31% higher than untrained vegetable farmers although this variable is insignificant.

The estimated coefficient of own-asset of farmer's is 0.00 that is very negligible. The positive effect associated with this variable suggests that farmers having larger own-asset would have a greater probability of access to credit. In addition, marginal effect of farmer's own asset is very small and negligible. Collateral is the precondition for receiving institutional credit. Own-asset of farmers is used as collateral of loan that raises the probability of credit access. Quagraine *et al.* (2010)<sup>[21]</sup> and Agbo *et al.* (2015)<sup>[3]</sup> found the consistent result. Besides own asset, quantity of tomato produced positively influence the probability of credit access. Marginal effect of quantity produced is very small. More production of tomato can increase the income and savings of tomato producer that raises the probability of timely payback of credit. The constant term is negative that shows that tomato farmers of Bangladesh cannot utilize credit for farming.

#### 4. Conclusion and policy implication

Credit access of tomato farmers is significantly affected by different factors such as age, education, own asset and quantity produced by farmers. Education of farmers has significant positive effect on credit access that means probability of access to credit will increase with years of schooling. Besides education, farmers having larger own-asset have greater probability of credit access. Quantity of tomato produced has significant positive influence on probability of credit access. More productivity helps them to increase income, savings and probability of timely pay back of credit. Age of farmers has significant negative effect on tomato farmer's credit access. Besides these, negative constant term shows that tomato farmers of Bangladesh cannot utilize credit for tomato farming.

As capital requirement for commercial tomato farming is

increasing, credit access of tomato farmers is inevitable. Different institutions such as Nationalized Commercial Banks, Private Banks, Bangladesh Krishi Bank, Grameen bank and NGO's can provide special credit facility for purchasing necessary inputs like pesticides, fertilizer, labor, irrigation and seeds. Furthermore, these institutions should bear in mind the seasonality of tomato farming. In addition, training and education facility for tomato farmers is low. Government tries to arrange more training facility for tomato farmers by different government and non-government officials. Trainers can encourage aged farmers for receiving credit facility because it will help them to increase productivity and farm income. Increasing income assist to enhance own asset of farms and pay back loans that increase the probability of credit access. Therefore, this study has contributed to the existing literature of credit accessibility of tomato farmers and its determinants that helps the policy makers to provide appropriate policy for increasing tomato productivity and export.

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