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Title:	Determinants of Green Malta Cultivation Decision and Marketing					
	Channel Selection: Evidence from Bangladesh					
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Article Info:	ABSTRACT

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Research on the factors that influence the choice of marketing channel and green malta cultivation is insufficient in the perspective of Bangladesh. The purpose of this paper is to explore the factors that influence cultivation decision and marketing channel choice of green Malta. In addition, determinants of farmers' attitude and perception regarding Green Malta cultivation have been examined. A descriptive research approach has been used in the study. Data collection has been carried out from ninety (90) farmers in the districts of Pirojpur and Jhalokathi in Bangladesh. A well-structured questionnaire has been utilized and respondents were reached through in-person interviews. Descriptive statistics, logistic regression analysis, and multiple regression analysis have been employed to analyze the data. The results showed that the quantity of production has significant impact on the choice of marketing channels by the Malta farmers. The numbers of family members, access to loan facilities, and experience on marketing channels have significant effect on the decision to cultivate green malta. Results also showed that experience in farming and marketing channel has significant impact on attitude and perception toward green malta cultivation. Significant ramifications for the expansion of green malta production can result from the study's findings.

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# **INTRODUCTION**

There is a significant contribution of agricultural sector in the economy of

Bangladesh. Employment generation, GDP growth, and export earnings are heavily dependent on this sector (Habib, 2024). Production of fruits have mentionable share

in the overall agricultural production of Bangladesh and the level of production can be varied between <20000 tons to >600000 tons depending on many controllable and uncontrollable factors (Biswas et al., 2021). Due to climatic advantage and environmental conditions, farmers can cultivate numerous fruits in Bangladesh. Nevertheless, the orange market in Bangladesh is mostly import dependent and the domestic demand of orange is mainly filled by importing from China, India, Bhutan, Pakistan and many other countries (Kaysar et al., 2020). However, with so many farmers growing oranges and malta across the nation, things have altered significantly in the previous few years. Additionally, these two citrus crops yield higher profits than they did previously, and the country's soil is suitable for growing these fruits (Roy, 2023).

of Because great nutritional value, particularly in terms of vitamins and minerals, Malta is one of the important fruits that is also in high demand in Bangladesh. (Islam et al., 2017; Milon, 2019). According to Ibrahim and Yusuf (2015), Malta is full of vitamin C, a natural antioxidant that supports the human immune system. The fruit is rich in minerals such as potassium, calcium, magnesium, niacin, and others. properties of Malta help to prevent arteriosclerosis, cancer, kidney stones, cholesterol and blood pressure, contributing significantly to human health (Favela Hernandez et al., 2016). BARI Malta-1, also known as green malta, has been developed by the Bangladesh Agricultural Research Institute (BARI) in 2003 and The Department of Agricultural Extension (DAE) is trying to popularize and distribute this fruit in Bangladesh. In addition, this fruit has prospects of global production and consumption (Kaysar et al.. Nevertheless, there is a vacuum of research regarding the cultivation decision and marketing channel selection of Green malta. This research aims to bridge the research

gap by identifying the factors that impact the green Malta cultivation and marketing channel choices. This study proposes the following research questions in order to fill the research gap: Which factors influence farmers' decisions to cultivate Green Malta? Which factors affect the choice of marketing outlets among Green Malta cultivators? How do farmers perceive the economic and agronomic value of Green Malta cultivation?

In a systematic review, Begho et al. (2022) found that irrigation, education, credit, and income can influence farmers' decision to adopt agricultural practices. Wijesinghe, Wickramasinghe, and Kuruppu (2021) demonstrated that availability of credit, irrigation, and financial capacity can affect farmers' decision to cultivate certain vegetables. Velasco (2022) exhibited that financial capital and relevant knowledge of farming can significantly influence farming decision. However, the research did not find strong influence of farmers' age, sex, experience, and number of family members in cultivation decision.

A number of factors determine which marketing channel is best, and channel selection has a big impact on profitability (Panda and Sreekumar, 2012). Farmers can choose to sell directly to local collectors due to their previous negative experience of direct marketing to the final market. Moreover, shortage of capacity and skills to market agricultural items can motivate farmers to choose local middlemen (Mgale and Yan, 2020). Siddique et al. (2018) demonstrate that the marketing channel choices of citrus growers in Pakistan can be greatly influenced by price, collecting time, and quantity. Ermias (2021) showed that farmers can choose middlemen to market their agricultural production when the quantity of production is large. Moreover, access to market information can motivate farmers to directly sell to consumers and engagement in non-farm income activities can drive toward less agricultural

production which in turn can encourage direct marketing.

Considering the above facts, the current study aims to investigate the determinants of production decision, marketing outlet choice, and attitude toward the cultivation of green malta. The author reviewed prior works relevant to the objectives of the present study and identified variables relevant to research context.

### MATERIALS AND METHODS

Sampling Technique: The data collection has been conducted in Pirojpur and Jhalokathi district of Bangladesh. These districts have been chosen purposively due to extensive farming of Green Malta under the supervision of Smallholder Agricultural Competitiveness **Project** (SACP), Department of Agricultural Extension (DAE). The researchers have collected data from 105 farmers through purposive sampling method. After deleting inappropriate and incomplete responses, 90 (ninety) responses have been finalized for final analysis.

Research Methods: The study adopted diagnostic and descriptive research design. The study is quantitative in nature because quantitative research can provide better accuracy in the outcome (Saunders et al., 2000). Moreover, collection of numerical data and statistical analysis to examine the effect of determinants on farming and channel selection requires the adoption of quantitative research approach.

**Ouestionnaire Design** and Data **Collection:** A structured questionnaire with face-to-face personal interviews was used to collect the data from the farmers. The items of the questionnaire have been chosen from previous works. questionnaire includes multiple items to collect data on several essential socioeconomic characteristics of the study sample. Questions to measure socio demographic characteristics the participants have been chosen and adapted

from Maila (2019) and Velasco (2022). Socio-demographic variables included in the study are gender, age, number of family memebrs, education, ownership of land, access to loan facilities, access to irrigation facilities etc. Moreover, questions have been placed to collect information regarding the determinants of cultivation decision of Green malta (Maila, 2019; Velasco, 2022). The chosen factors are farmers' access to loan facilities. availability of irrigation facility, number of family members, experience in farming, experience in marketing channels, and education. Farmers' access to loan facilities. availability of irrigation facilities, and experience in marketing channel have been measured with dichotomous questions. Education level has been measured with attained academic degree and experience in farming has been measured with number of engagement in farming. dependent variable cultivation decision has been measured with the statement "Are you willing to cultivate Malta in long term?" with a Yes/No response choice suggested by Velasco (2022). The explanatory factors of channel selection have been adopted from Panda and Sreekumar (2012) and Masuku et al. (2001). The adopted factors are quantity of production, access to market information, experience in farming, non-farm income, and experience in marketing channels. Quantity of production has been measured with total production of green malta by a particular farmer in kilogram. Access to market information, experience marketing channels, and availability of non-farm income have been measured with dichotomous questions. The dependent variable measured whether farmers choose direct marketing to consumers or sell through middlemen (Panda and Sreekumar, 2012; Masuku et al. 2001). Five-point Likert type items were used to gather data about the attitude and perception of green Malta cultivation and the items have been adapted from Velasco (2022).

Data Analysis: Descriptive statistics have used analyze the been to sociodemographic features of the respondents, and logistic regression model was used to analyze the variables influencing the cultivation decision and marketing channel choices by the green Malta cultivation farmers. Furthermore, a linear regression model has been utilized to identify the determinants of attitude and perception toward green malta cultivation.

### **RESULTS**

The paper aims to investigate the factors that affect cultivation decision, channel selection, and attitude and perception toward green malta cultivation. Logistic regression and multiple linear regression analysis have been conducted to analyze significant factors of dependent variables of the study. Before that socio-demographic characteristics of the study participants' have been presented with frequency distribution. The socio-demographic details of the research participants are shown in Table 1.

According to the table, men make up 81.1% of the study participants. Just 8.9% of Malta farmers were over 50, whereas the majority (52.2%) were between the ages of 36 and 50. Just 1.1% of responders are masters or higher, while the bulk (61.1%) are below SSC. With respect to the size of their households, 67.8% of farmers had four to six people, 26.7% had one to three people, and just 5.6% had seven to nine people. According to the table, 16.7% of farmers do not own any land, but 83.3% of farmers grow on their own property. Additionally, the table indicates that roughly 67% of farmers sell directly to customers. Access to loan facilities is available to 77.8% of respondents. Sorting is primarily done by 73% of farmers as a value-adding activity, and 70% farmers have no experience regarding marketing channel.

Logistic regression analysis has been utilized to measure the influence of explanatory factors on the decision to cultivate green malta and Table 2 demonstrates the outcome of the logistic regression model.

The Cox and Snell R Square is a pseudo-R-squared measure that explains the proportion of variance in the dependent variable (decision to cultivate Malta). A value of 0.193 suggests that the included variables in the model can predict 19.3% of the decision to cultivate Green Malta. The Nagelkerke R Square is another pseudo-R-squared measure that provides an adjusted version of the Cox and Snell R Square and exhibits maximum possible R-squared value compared to a null model.

Table 1. Socio-demographic and farming characteristics of the respondents

Characterist ics	Category	Frequen cy	Perce nt	Cumulati ve Percent
Gender	Male	73	81.1	81.1
(type)	Female	17	18.9	100.0
A 000	20-35	35	38.9	38.9
Age (years)	36-50	47	52.2	91.1
(years)	50+	8	8.9	100.0
E1 d	Below SSC	55	61.1	61.1
Education (schooling	SSC	25	27.8	88.9
years)	HSC	9	10.0	98.9
years)	Master's or	1	1.1	100.0
	above			
Family	1-3	24	26.7	26.7
Members	4-6	61	67.8	94.4
(no.)	7-9	5	5.6	100.0
Land	Yes	75	83.3	100.0
ownership	No	15	16.7	16.7
Marketing	Middlemen	29	32.2	32.2
outlet	Consumer	61	67.8	100.0
Access to	Yes	70	77.8	100.0
loan	No	20	22.2	22.2
Availability	Yes	23	25.6	100.0
of Irrigation facilities	No	67	74.4	74.4
Non-farm	Yes	51	56.7	100.0
income	No	39	43.3	43.3
Experience	Yes	27	30.0	100.0
in	No	63	70.0	70.0
marketing channel				
Value	Sorting	66	73.3	73.3
addition activities	Washing	24	26.7	100.0
Market	Yes	64	71.1	100.0
information access	No	26	28.9	28.9
T.C:	Govt.	45	50.0	50.0
Information	employee			
source	TV/Radio	1	1.1	51.1
	Relatives/Frien	3	3.3	54.4

Characterist ics	Category	Frequen cy	Perce nt	Cumulati ve Percent
	ds			
	Training/Semi	25	27.8	82.2
	nars			
	Co-farmers	16	17.8	100.0

The Nagelkerke R Square value of 0.258 indicates that the model explains about 25.8% of the maximum possible variance in the dependent variable (decision to cultivate Malta). Moreover, the model's overall accuracy is at 69%, indicating a moderately good fit in predicting long-term cultivation decisions. Omnibus Tests of Model Coefficients (19.255, p<0.05) attests that the inclusion of independent variables has improved explanatory power of the

model. Hosmer and Lemeshow Test (11.662, p>0.05) also directs satisfactory model fit.

Table 2 shows that the number of family members, access to loan facilities, and experiences in marketing channels can significantly influence farmers' decisions to cultivate Malta. More family members, in particular, increase the likelihood of Malta's growth by approximately 3.9 times (B = 1.366, p < 0.05, Exp (B)=3.92); access to loan facilities increases the likelihood by approximately 4 times (B = 1.407, p < 0.05, Exp (B)=4.082); and marketing channel experience can increase the likelihood by 5 times (B = 1.645, p < 0.05, Exp (B)=5.181).

Table 2. Logistic regression model decision to cultivate Malta

Model Summary	Cox and Snell R Square 0.193		Nage	Nagelkerke R Square 0.258		
	Ac	•	Prediction			
Omnibus Tests of Model Coefficients Hosmer and Lemeshow Test						
19.255	(0.004)			1	1.662 (0.16	7)
Factors	В	S.E.	Wald	df	Sig.	Exp(B)
Access to loan	1.407	0.621	5.123	1	0.024	4.082
Irrigation facility	-0.356	0.592	0.362	1	0.547	0.700
No. of family members	1.366	0.546	6.271	1	0.012	3.921
Experience in farming	-0.015	0.041	0.129	1	0.719	0.985
Experience in marketing channels	1.645	0.653	6.345	1	0.012	5.181
Education	-0.601	0.349	2.968	1	0.085	0.548

The researchers conducted logistic regression analysis to examine the determinants of marketing channel choice of green malta. The outcome of the regression analysis has been presented in table 3.

Table 3 demonstrates that the model explains 45.3% variability of the decision to choice marketing channel (whether direct marketing or middlemen). The Nagelkerke R square shows that the maximum possible variance by the model is 63.3%. Omnibus tests of model coefficients (value=54.318, p<0.05) shows that the

independent variables have increased the explanatory power of the model. A satisfactory model fit has been supported through Hosmer and Lemeshow test (Value= 6.866, p<0.551).

Table 3 shows that the choice of marketing channel is significantly influenced by the amount of green malta produced. The choice of middlemen by farmers to market green malta increased as output levels rose [B=-0.020, p<0.05, Exp (B)=0.98]. The likelihood of selecting a direct marketing channel can increase by nearly three times when non-farm revenue sources are

available, however this effect is not statistically significant. Farming experience can also speed up the selection of

intermediaries, although this effect is not statistically significant.

Table 3. Logistic regression to analyze the variables influencing marketing channel choices

Model Summary	Cox and Snell R Square 0.453 Accuracy of Prediction		Nagelkerke R Square 0.633			
		86.7	%			
Omnibus Tests of Model	Coefficier	nts	Hosmer and	Lemesho	w Test	
54.318 (0.00)				6.866 (0	).551)	
Factors	В	S.E.	Wald	df	Sig.	Exp(B)
Quantity	-0.020	0.005	13.770	1	0.000	0.980
Access to market information	-0.623	0.796	0.612	1	0.434	0.537
Experience in farming	-0.007	0.050	0.019	1	0.891	0.993
Non-farm income	1.063	0.779	1.862	1	0.172	2.896
Experience in marketing channels	-0.248	0.869	0.081	1	0.776	0.780
Constant	3.286	1.053	9.735	1	0.002	26.744

The determinants of farmers' attitude and perception toward green malta cultivation have been investigated through regression analysis. The results of the regression model have been demonstrated in Table 4.

Table 4 exhibits that the model explains 30.8% of the dependent variable ( $R^2 = 0.308$ ; Adjusted  $R^2 = 0.249$ ) and the model demonstrate significant statistical fit (F=5.212, p<0.05). The analysis exhibits that experience in farming (B=0.234,

p<0.05) and experience with marketing channel (B=0.356,p < 0.001) significantly influence attitude and perception toward green malta cultivation. Therefore, with the rise in farming farmers' experience, attitude and perception toward green malta cultivation can increase in a positive manner. Additionally, farmers' experience with marketing channel also increases their positive attitude and perception toward green malta cultivation.

Table 4. Multiple linear regression to identify the determinants of attitude and perception toward green malta cultivation

Model Cummons	R Square		Adjusted R Square	
Model Summary	0.308	0.249		
	F-value with sign			
	5.212 (0.00	))		
Factors	Standardized Coefficients	t-value	p value	
Education	.153	1.471	.145	
Land Ownership	.089	.856	.395	
Access to loan/credit	.133	1.240	.219	
Access to market information	.036	.316	.753	
Experience in farming	.234	2.311	.023	
Non-farm income	053	509	.612	
Experience with marketing Channel	.356	3.494	.001	

#### DISCUSSION

The study aims to investigate the determinants of willingness to cultivate, choice of marketing channel, and attitude and perception toward the green malta cultivation. The study has notable findings. First off, having access to loans may increase interest in growing green malta. Farmers might intend to grow green malta have sufficient financial they once Previous research has resources. demonstrated that one of the main factors influencing cultivation decisions financial capacity (Begho et al., 2022; Velasco, 2022; Wijesinghe et al., 2021). Secondly, the study found that number of family members is positively related with the willingness to green malta cultivation. The possible explanation is with the rise in family members, farmers can employ more human capital for green malta cultivation. Ali and Rahut (2018) also found the influence of family size in cultivation decision. However, Velasco (2022) has not found any significant influence of number of family members in the cultivation decision of moringa. Thirdly, experience in marketing channels can enhance the willingness to cultivate green malta. Farmers with more marketing channel expertise and understanding may be more confident about selling possibilities, price swings, and demand dynamics. Thus, farmers' high levels of trust in the market's potential can translate into their intention to produce. Fourth, when output is high, farmers may opt to market green malta through middlemen; conversely, when production is low, farmers may choose marketing as their preferred marketing channel. When there is a high volume of agricultural production, Ermias (2021)showed that farmers intermediaries to market their products. Farmers may find it challenging to supervise the marketing of green malta in

substantial quantities. Fifth, experience in farming can enhance positive attitude and perception toward green malta cultivation. Consequently, experienced farmers have more confidence and can avoid initial skepticism regarding the cultivation of green malta. Sixth, experience in marketing channel can enhance positive attitude and perception toward green malta cultivation.

**Limitations:** The research has been conducted on a small sample size and the sample has been chosen through nonprobability sampling technique. The study has been conducted on a single region of Bangladesh. Therefore, the generalization of the findings is not possible. Moreover, the study is based on a cross-sectional dataset. Future studies can be based on longitudinal data. Additionally, experimental research design can be utilized to get the manipulation effects of chosen factors.

# **CONCLUSION**

The study aims to investigate determinants cultivation of decision. marketing channel selection, and attitude perception toward green cultivation. Data has been collected from green malta farmers and the determinants have been checked through logistic and multiple linear regression models. The outcome demonstrated that access to loan, experience in marketing channel, and number of family members positively impact cultivation decision of green malta. Moreover, farmers choose to sell green malta to the middlemen when their total production level rises. Otherwise, with a low production level, farmers choose direct marketing to consumers. Additionally, experience in farming and marketing channel can positively escalate farmers' positive attitude and perception toward green malta cultivation.

The study has significant implications based on the findings to expand the cultivation of green malta. In order to plant green malta, farmers should have adequate access to financial resources from both government and non-government sources. Moreover, farmers who have large family size can be targeted for encouragement regarding green malta cultivation. Additionally, farmers who might be

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engaged with large scale green malta cultivation should be made aware of regarding competent middlemen. Moreover, connection can be developed among large scale producers of green malta and middlemen of particular regions. Lastly, farmers who are experienced in farming and marketing of green malta can be given special focus to retain and escalate their green malta production capacity.

### **Conflict of interest**

The authors declare that there is no conflict of interest regarding the publication of this article.

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