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Full Length Research Paper

Factors Influencing Tea Farmers' Decision to Adopt Vietnamese Good Agricultural Practices in Northern Vietnam

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This study investigates the determinants affecting farmers' adoption of Vietnamese Good Agricultural Practices (VietGAP) for tea production that involves decisions to convert to new farming methods and allocate farmland. We employed a binary logit model and a tobit model to examine relevant factors influencing the decisions to convert and allocate farmland, respectively, for VietGAP tea production in Northern Vietnam. A total of 326 tea farmers, including 116 adopters and 210 non-adopters of the VietGAP method, were surveyed in the study area. Estimation results of the econometric models revealed significant and positive impacts of variables such as number of family laborers, tea farm size, tea price, access to irrigation systems, ratio of tea income, and attendance of VietGAP training on the above mentioned decisions. Although the variable of machinery status (mechanization) had a positive and significant effect on farmers' decision to expand tea-producing farmland under VietGAP standards, other important variables such as farming experience and age of the tea farm negatively affected the conversion decision and farmland allocation. This study's findings provide useful information for policy making regarding how VietGAP tea production should be implemented and disseminated in tea-producing areas where tea farming significantly contributes to households' total income. Moreover, government intervention to overcome the negative effects of small farm size and investment in active irrigation systems is significant for converting and expanding VietGAP tea production in the long run. Lastly, providing suitable, labor saving mechanization options will be a good incentive for farmers to increase land allocation toward VietGAP production.

Keywords: VietGAP tea production, conversion decision, farmland allocation, logit and tobit models, Northern Vietnam

INTRODUCTION

Tea production plays an important economic and cultural role in Vietnam. Tea is one of the most economically efficient crops in Vietnam, after coffee (Tran et al., 2004), and it is ranked seventh out of the top 20 exported agricultural products. Tea's total export value was estimated at $224.6 million in 2012 (Vietnamese Tea Association, 2012). Moreover, the tea-production sector offers employment opportunities for about 400 thousand households, particularly in rural and mountainous regions, and it has created over 1.5 million jobs in its entire value chain (General Statistics Office, 2011). Vietnamese people in both rural and urban areas have had a tea drinking habit for a long time, especially fresh tea.

Policy changes and technology advancements such as innovative policies (in 1986), the introduction of new

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breeding varieties, better pest and disease control, and improved fertilizer use have been prominent in agricultural production in Vietnam. These changes have significantly contributed to rapid agricultural growth in recent decades, converting Vietnam from a food-importing nation to a leading food exporter in the world market. The intensive agriculture and farming models using agrochemical compounds and fertilizers were considered, like in other developing countries, as the main contributors for increasing agricultural production (Clevo et al., 2001; Tilman et al., 2002). However, as a consequence of the agricultural intensification process (Jansen et al., 1996), high intake of chemical compound residues in consumed food was reported in Vietnam (Kuruthachalam et al., 1992). The use of highly toxic pesticides was restricted because of a number of acute poisonings reported in the mid-1990s. However, incidents of food-borne diseases are still a problem in Vietnam (Kim, 2002). In 2001, 245 cases of food poisoning were attributed to microbiological, agrochemical, and other unknown sources. Consequently, consumers are extremely concerned about agrochemical residues in food products (Figuie, 2003). Improper use of chemical compounds in terms of dosage and type has caused harm to human health and the environment (Wasim at al., 2009). For instance, more than 7,000 cases of food poisoning from pesticide residue were reported in Vietnam in 2002, causing 277 deaths in 37 out of the 61 provinces (Hoi et al., 2013). In fact, the number of deaths may be relatively higher if indirect exposure to pesticides is also considered.

To improve food safety and restore the trust of consumers, the Ministry of Agriculture and Rural Development (MARD) implemented a program called “safe vegetable” in 1995. The program aims to educate farmers on the proper use of fertilizers and pesticides as well as of water from non-polluted sources. Then, in 2008, MARD issued a new standard called Vietnamese Good Agricultural Practices (VietGAP) based on the Hazard Analysis Critical Control Points (HACCP) and the principle of ASEAN GAP (Ha, 2011; Nguyen, 2008). Tea production using VietGAP has been strongly encouraged in Vietnam since 2009.

The issue of technology adoption in agriculture has been studied widely. These studies generally focused on two directions: The first focuses on the technology adoption process at the firm level (Feder et al., 1985); the second direction aims to determine the significant factors associated with adopters of VietGAP (McNamara et al., 1991; Rahm and Huffman, 1984). Although there have been many studies on the adoption of technology packages and farming practices (Feder et al., 1985; Kim et al., 2005; Ramirez and Shultz, 2000), the scope of these studies was limited to European nations. While many researchers explored the production efficiency of tea farmers in Vietnam, few studies focused on farming practice adoption. To our knowledge, no previous study has analyzed the two-stage decision process to adopt new agricultural practices in tea production. The study by Tran (2009) was the first attempt to analyze the conversion from conventional to organic tea farming in Vietnam. However, this study only focused on the first step of decision making in the adoption process. Similarly, some other relevant studies on the adoption of farming systems in Vietnam explored only the one-stage decision of farmers as discussed above (Chi and Ryuichi, 2002; Loan et al., 2016). We address this limitation by analyzing two-stage decision-making processes in agricultural production undertaken by tea farmers. Therefore, this study was conducted to identify the factors that influence tea farmers’ adoption of VietGAP standards that involve decisions of conversion and land allocation. The findings will be helpful for policymakers to understand farmers’ behaviors and promote the diffusion of VietGAP tea production across regions on a large scale and for different crops.

STUDY METHOD AND DATA COLLECTION

Model specification

VietGAP is a production approach implemented to prevent or minimize the risk of hazards that occur during production, harvest, and postharvest handling (MARD, 2008). VietGAP requires farmers to adopt a different production practice that is certified by authorized Vietnamese organizations. When introduced to new production practices and management, tea farmers will have more options, and they will decide whether to maintain their farms as conventional farms or convert to the new production practices. As discussed above, the adoption decision is a process of extending knowledge and understanding over a period of time, and it takes place through the following two stages. First, farmers decide whether to adopt the new agricultural production practices. Second, they consider the land allocation for new production methods (Martin et al., 2012). In the scope of this study, we aim to analyze the factors that influence this two-stage adoption decision.

Two indicators that are often used to measure the adoption decision of agricultural production practices are the decisions to convert and allocate a proportion of farmland (Feder et al., 1985). A conversion decision indicates whether a farmer is an adopter, and farmland allocation measures the intensity of adoption, which is generally measured by the proportion of farmland allocated for new production and management practices. Since the conversion decision, namely the dependent variable, falls into two cases, it is considered a zero-one variable. The linear probability model could be used to analyze the decision to adopt. However, coefficient estimation using ordinary least squares with a binary

dependent variable has some drawbacks such as inclusion of a heteroskedastic error structure, inefficient parameter estimation, and predicted probability over one or less than zero (Greene, 2003). Therefore, there is a need to use a more appropriate alternative approach. Dichotomous choice data models such as logit and probit are commonly used to model the adopter behavior (Greene, 1990). These models have an advantage as they enable a more in-depth analysis of a farmer's choice regarding a single technology. A logit model was chosen for use in this study, and it can be described as follows:

$$Y^* = X'\beta + \delta, \quad (1)$$

$Y = 1$ (adopter) if $Y^* > 0$, and 0 if $Y^* < 0$,

where Y^* is a dependent variable referred to as a latent variable and Y is the observed choice. In the econometric theory, the logit model assumes that adoption is a function of a latent variable, such as a socioeconomic variable, that has a functional relationship with the probability of adoption and its determinants. The intensity of adoption could be measured as the proportion of tea farmland allocated for the application of VietGAP standards. In the case of Wooldridge (2002), it is suggested that the tobit model is an appropriate approach, which is specified as follows:

$$Y_i = X_i \beta + \varepsilon_i, \quad (2)$$

where Y_i is the proportion of farmland allocated for VietGAP tea production, X_i is a vector of variables that capture the characteristics of the farm and farmer and other related features, β is a vector of unknown coefficients to be estimated, and ε is an error term that is assumed to be independently distributed with a mean of zero and a constant variance. The β coefficients measure the marginal effect of each exogenous variable on the adoption level.

Site selection and data

The study was conducted in Northern Vietnam where tea production accounts for 62% of the national total. This region is known as the most productive area and provides the best quality tea in Vietnam. A field survey was undertaken in three districts that represent the main tea production areas: Thai Nguyen city, Dai Tu, and Dong Hy districts of the Thai Nguyen province. Primary data were collected in the survey in 2016 using structured questionnaires through face-to-face interviews similar to previous studies. Farmers in districts where VietGAP tea production has been growing in popularity were categorized as adopters and non-adopters. A total of 360 surveyed farmers were divided into 130 VietGAP adopters and 230 conventional tea farmers. However, after accounting for valid and complete responses and data availability, the final sample comprised 116 VietGAP tea farmers and 210 conventional tea farmers. The excluded observations did not provide enough data and necessary information required as expected.

Definition of data variables

Conversion decision or adoption status of tea production methods and proportion of land allocation for VietGAP tea production are used as outcome variables to assess farmers' two-stage decisions to adopt new methods. A series of variables are selected to describe farm characteristics and farmers' behaviors that may impact the farmers' adoption decisions. Previous studies showed that farmers' behaviors could be affected by socioeconomic characteristics such as education level, labor, and income, among others (Coady, 1995; OECD, 2008). Meanwhile, features of crops and agricultural products, such as input, output price, and irrigation status, are also believed to have strong relationships with new crop production and management methods. All variables used in the models were tested for collinearity. Detailed descriptions of the variables are presented in Table 1.

The expected relationship between dependent and explanatory variables in analyzing production method adoption is based on theoretical underpinnings and previous research. For example, Abdulai et al. (2008) revealed that households with more laborers available to work on the farm would adopt new production methods more often than smaller households. The study by Feder et al. (1985) confirmed that farmers with larger farmlands were more willing to adopt new production technologies. In addition, Cristina and Otsuka (1994) noted that irrigation availability is also an important factor influencing farmers' decisions to apply technology.

RESULTS AND DISCUSSION

Comparative statistics of explanatory variables of production methods

Descriptive statistics and significance tests for adopters and non-adopters of VietGAP tea production are presented in Table 2.

Several characteristics of farmers, including gender, formal education, farming experience, tea farm size, and credit access, are insignificantly different between adopters and non-adopters. Most tea growers (about 48% of the farmers) have basic secondary school education, and there is little difference between the education of the two farmer groups. On average, a tea grower owns about 0.35 hectares of tea farmland with 21 years of farming experience. Other important features of adopters and non-adopters such as number of family

Table 1. Definition of variables used in the models

Variables	Definitions
Adoption status	Farmer's adoption status (1 = VietGAP, 0 = conventional)
Adoption level	Adoption level measured in proportion to land allocation
Gender	1 if the farmer is male; 0 otherwise
Formal education	Formal education level (1-pri, 2-sec, 3-hig, 4-voc, and 5-uni)
Family labor	Number of family members involved in agricultural activities
Farm experience	Years of tea farming experience of the farmer
Age of tea farm	Number of years the tea farm has been cultivated
Tea farmland	Total tea area measured in hectares
Fresh tea price	Price of fresh tea sold at the farm gate
Irrigation access	1 if the tea farm is actively irrigated; 0 otherwise
Ratio of tea income	Percentage of tea income over total household income
Credit access	1 if the farmer has access to credit; 0 otherwise
VietGAP training	1 if the farmer attended VietGAP training; 0 otherwise
Mechanization	1 if the farmer owns laborsaving machines; 0 otherwise

Note: 1-pri: primary; 2-sec: secondary; 3-hig: high school; 4-voc: vocational training; and 5-uni: university level.

Table 2. Descriptive statistics and comparison of explanatory variables between groups

Variables	Mean			Diff.	t-value
	All samples	Adopters	Non-adopters		
Gender	0.598	0.603	59.5	0.008	0.1443
Formal education					
primary	0.075	0.060	0.090	0.030	0.9614
secondary	0.475	0.465	0.481	0.015	0.2672
high school	0.377	0.379	0.376	0.003	0.0556
vocational	0.064	0.094	0.048	0.047	1.6623
university	0.003	0	0.0047	-0.0047	0.7444
Family labor	2.898	3.078	2.800	0.278***	2.6291
Farm experience	22.303	21.293	22.862	-1.569	-1.5679
Age of tea farm	9.414	8.724	9.795	-1.071**	-2.5761
Tea farmland	0.353	0.369	0.343	0.025	1.3787
Fresh tea price	20.375	20.802	20.140	0.662***	2.5309
Irrigation access	0.681	0.879	0.571	0.308***	6.0005
Ratio of tea income	0.621	0.665	0.596	0.068***	3.4485
Credit access	0.150	0.163	0.142	0.021	0.5051
VietGAP training	0.690	0.888	0.581	0.306***	6.0338
Mechanization	0.616	0.810	0.509	0.301***	5.5822

Source: Author's surveyed data (2016)
Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Diff. is the difference between the adopter and non-adopter of VietGAP and equals the mean of the adopter minus the mean of the non-adopter.

laborers, age of tea farm, tea price, irrigation access, ratio of tea income, and VietGAP training, have statistically significant differences. Specifically, households with more available laborers working in agriculture are more likely to belong to the VietGAP adopter group. Moreover, farmers who adopt VietGAP tea production would receive higher prices for fresh tea and depend more heavily on income from tea. Additionally, VietGAP tea farmers have better irrigation systems and have participated in more agricultural training sessions. Finally, the status of machinery ownership is relatively different between groups; adopters of the VietGAP tea production method often own more laborsaving machinery than farmers engaging in conventional tea production. On the other hand, farmers who adopt VietGAP tea production often own younger tea farms than other farmers do.

Factors affecting the conversion decision of tea farmers

The estimated coefficients and related indicators of the parameters in the logit model are presented in Table 3. Among the variables involved in farmers' characteristics,

Table 3. Factors influencing farmers' conversion decisions regarding tea production

Variables	Coefficients	Std.err	z-value	p>|z|
Dependent variable (1 if a farmer adopts VietGAP tea production, 0 otherwise)				
Gender	-0.137	0.299	-0.61	0.545
Formal education				
secondary	-0.535	0.478	-0.97	0.504
high school	-0.278	0.512	-0.47	0.404
vocational	0.216	0.523	0.28	0.780
university	-	-	-	-
Family labor	0.453***	0.183	2.76	0.000
Farm experience	-0.056***	0.019	-2.91	0.003
Age of tea farm	-0.132**	0.053	-2.47	0.012
Tea farmland	2.225***	0.868	2.64	0.008
Fresh tea price	0.128*	0.061	2.07	0.038
Irrigation access	1.134***	0.423	2.52	0.009
Ratio of tea income	2.441***	0.920	2.62	0.009
Credit access	0.101	0.393	0.27	0.787
VietGAP training	2.089***	0.368	5.47	0.000
Mechanization	0.697	0.377	1.90	0.057
_Constant	-6.878***	1.625	-4.43	0.000

Source: Author's surveyed data (2016)
Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Std.err is the standard error.

farming experience and family laborers are significant factors in the decision to adopt the new tea production method. Estimation results indicate that farmers who have more family laborers working on farms would shift from conventional farming to VietGAP tea production. The positive and significant effects of family labor are similar to the finding reported by Abdulai et al. (2008). This can be explained by the relative labor-intensive nature of VietGAP tea production. Thus, more family laborers would be greatly advantageous for applying labor-intensive farming practices. The formal education of farmers has no significant effect on the first-stage decision (conversion decision) about whether or not to adopt VietGAP production, because the knowledge acquired by farmers through formal education is very basic and not relevant to the technical knowledge of crop production. This finding implies that farmers' formal education does not promote the decision to convert from conventional farming to VietGAP production. This is contrary to the finding of Marc et al. (2012). Tea farmers who are more experienced or own older tea farms are often afraid of risks related to a VietGAP farm, and they would prefer to maintain conventional tea farm practices. According to surveyed data, most farmers stated that the selling prices of tea products are not relatively different between conventional and VietGAP tea products. Moreover, Vietnamese farmers do not have access to direct marketing channels for VietGAP products. Both types of tea growers must sell their products through the same mediums. As a result, small producers or tea farmers have no power to determine the market price. In fact, the higher selling prices of VietGAP tea can not cover its higher production cost. Interestingly, traders and collectors do not require VietGAP certificates for tea products when they bargain at the farms' gates and in the market.

Farm characteristics also play an important role in farmers' adoption decisions. The finding indicates that farmers possessing highly aged tea farms would prefer conventional farming to VietGAP tea production. They claim that shifting to new tea production methods would be riskier (waste more time and labor) for generating income, as a higher output price is not assured by any contract with companies and traders when they sell their products. The estimation coefficient of the price variable is only significant at the 10% level. The finding shows that the price of fresh tea would not be very encouraging for farmers to apply VietGAP standards to tea production. Although tea farmers would expect higher prices for VietGAP tea, they, in fact, do not receive higher prices in comparison with conventional tea products. Moreover, consumers and traders do not care about VietGAP certification at all and often bargain for both types of products at the same price. An additional explanation of this situation is the lack of transparent marketing channels for VietGAP agricultural products in Vietnam. The authorities do not have strict control on the origin of the products sold in the market: VietGAP and other tea products are often mixed together. Especially, a VietGAP label could be reused for conventional tea. Thus, consumers seem to lose their trust in good product trademarks. Farm size plays an important role in encouraging the conversion decision of farmers. Larger tea farmlands would spread the risk for farmers when

applying new production practices. This finding is the same as reported by Feder et al. (1985). Irrigation access has a positive and statistically significant effect on adoption status, which is consistent with Cristina and Otsuka (1994). This implies that access to active irrigation systems would promote a conversion from conventional to new tea production under VietGAP standards. This is partially in line with the initial requirement of VietGAP that tea farms need to be controlled with water irrigation systems. In addition, actively irrigated tea farms would reduce risks such as yield loss for farmers in the context of drought and climate change. This result is also consistent with the finding of Marc et al. (2012), who analyzed the factors influencing farmers' adoption of modern rice technologies in the Philippines.

The ratio of tea income, the explanatory variable, has a highly significant effect on farmers' adoption decision at the 1% significance level. This implies that farmers who depend on tea income more heavily would have more incentive to convert to the VietGAP production method. This is because families would invest more labor time and pay more attention to tea farming. As a result, they may face less risk and expect higher income from the adoption.

Technical capacity enhancement activities have been highly recognized in the adoption of new production practices. In this study, the variable of participation in VietGAP training has a positive and significant impact on the adoption decision. The training session enables farmers to understand the process of VietGAP tea production more fully, and it also equips them with the necessary knowledge to minimize relevant risks. This result is in line with the finding of Marc et al. (2012) and Martin et al. (2012), who studied factors influencing the adoption of system technologies in the Philippines and modern rice technology in Timor-Leste, respectively. Other explanatory variables of the model that do not have significant impacts on farmers' conversion decisions include gender, tea price, credit access, and machinery status. Remarkably, credit is generally one of most important factors involving farming investment and production, but credit access is insignificant because VietGAP is labor intensive rather than capital intensive. This led to a very small proportion of tea growers borrowing credit loans for tea production (15%) on average.

Factors influencing farmers' decisions of farmland allocation

As mentioned in the subsection on model specialization, tea farmland allocation for VietGAP tea production would be essential for analyzing the depth/intensity of farmers' adoption decisions. In the study, a tobit model is used to estimate factors influencing farmland allocation by tea growers. The results indicate that most estimated parameters are consistent with the estimation of the logit model, with the exception of machinery status. Farmers' features, such as gender and formal education, are found to be insignificant in farmland allocation decisions. Analysis of summary statistics indicates that about 85% of tea growers have formal education up to secondary school and high school levels. Knowledge acquired at this education level is basic, which is not relevant to the specific field of crop management. This may be an underlying reason for its insignificant impact on increasing farmland allocation. Tea is a perennial plant that takes several years to form a basic structure that provides stable yield and production. Thus, converting from a conventional to a new production method such as VietGAP requires careful consideration. In the study area, although young tea fields with unstable yield and production could be easily converted by tea growers, farmers owning older tea farms prefer the stable yield from conventional farming to VietGAP tea production. This can explain the negative and significant effect of tea farm age on farmland allocation for VietGAP tea production. Negative and significant coefficients of farming experience and age of tea farm imply that experienced farmers with older tea farms are less likely to convert to VietGAP production. Moreover, many tea growers confirmed that they did not perceive VietGAP tea as fetching a higher price than a conventional tea product. An additional reason might be that market control in terms of VietGAP product certification is not trusted by consumers in Vietnam. According to Pham et al. (2009), limited trust is the major reason for consumers not buying VietGAP products in the market. Thus, the price of fresh tea is not found to be strictly correlated with VietGAP tea production. The estimation result indicates that farmers would increase conversion if more family laborers were available to join farming activities as the VietGAP production method is labor intensive, as discussed in the previous section. This finding is in line with that of Martin et al. (2012), who studied the adoption of system technologies in Timor-Leste. As expected, tea farmers who own large farmlands would increase their farming area under VietGAP. In fact, a larger farming area would enable more opportunities for farmers to diversify their tea crops to receive higher income and minimize relevant risks if the new production approach is adopted. Farm features such as access to the irrigation system and machinery status are also found to have significant and positive effects. While access to active irrigation systems could enhance tea production or reduce risks of yield loss due to climate change and drought, ownership of laborsaving machines would increase farmland allocation under VietGAP, because the use of machinery would address the family labor shortfall, particularly in the harvest and post-harvest periods of tea production. Mechanization would be increasingly

Table 4. Factors affecting farmers' farmland allocation for VietGAP tea production

Variables	Coefficient	Std.err	t-value	p>|t|
Dependent variable: proportion of farmland allocation toward VietGAP tea production				
Gender	-0.043	0.1058	-0.41	0.679
Formal education				
secondary	-0.214	0.2044	-1.05	0.296
high school	-0.146	0.2183	-0.67	0.502
vocational	-0.0001	0.2725	-0.00	1.000
university	0.645	0.7478	0.86	0.389
Family labor	0.184***	0.0653	2.82	0.005
Farm experience	-0.020***	0.0066	-2.98	0.003
Age of tea farm	-0.052***	0.0192	-2.72	0.007
Tea farmland	0.910***	0.2891	3.15	0.002
Fresh tea price	0.044*	0.0213	2.07	0.039
Irrigation access	0.420***	0.1524	2.76	0.006
Ratio of tea income	0.863***	0.3202	2.69	0.007
Credit access	0.047	0.1381	0.34	0.731
VietGAP training	0.833***	0.1355	6.15	0.000
Mechanization	0.363***	0.1333	2.72	0.007
_Constant	2.514***	0.5602	-4.49	0.000

Source: Author's surveyed data (2016)
Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Std.err is the standard error.

important for farmers with a large tea farm size. The importance of tea as an income source is measured by the ratio of tea income to total household income. The variable is estimated to be positive and significant, suggesting that households with higher income from tea production are more likely to allocate more farmland for VietGAP tea production. This could be explained by tea production being the main income source for households; thus, farmers would look for new tea production methods that yield higher income. Another reason may be the greater time and attention they would invest in tea production given its importance as an income source. In turn, they could minimize the possible risks of the new tea production methods adopted. The VietGAP training variable is estimated to have a positive and significant effect on land allocation. This finding is also consistent with the work of Martin et al. (2012).

Capacity enhancement activities enable farmers to fully understand a new production method and its advantages. Thus, participation in VietGAP training sessions held by extension agencies would encourage farmers to allocate more land for VietGAP tea production. Although credit is an important input of agricultural production, credit access is not found to have a significant impact on farmers' production decisions. In the study areas, only about 15% of the farmers borrowed credit loans for tea production, as presented in Table 4. These loans are mainly used to invest in fixed rotation and processing machines, while variable inputs such as fertilizers and labor cost could be afforded by households. Even input suppliers are ready to provide fertilizers to farmers on credit.

CONCLUSION AND IMPLICATIONS

This study is the first effort toward providing insight into farmers' decision-making process regarding the adoption of tea production practices in Northern Vietnam. Among such practices, the Vietnamese government has promoted the conversion from conventional farming to VietGAP tea production in recent years. The primary focus of this study was to determine the factors affecting tea farmers' decision to adopt VietGAP standards for their tea farms. Econometric models were used to analyze the determinants of tea farmers' decisions regarding conversion and farmland allocation. The estimation results demonstrate that these decisions were mainly driven by the characteristics of farms and tea farmers. Availability of family laborers or machinery in farming activities would make a significant contribution toward promoting the conversion and expanding of farmland for VietGAP tea production. Another important reason for adopting VietGAP standards was tea production scale. Large-scale tea producers are more likely to adopt new tea practices and increased land allocation for VietGAP tea because they can utilize their machinery and other production tools. Moreover, if tea producers have better infrastructure, especially irrigation systems, it also positively supports their adoption and allocation decisions. Although formal education was not found to directly promote the conversion, technical education for raising the understanding of this production method is a key factor driving farmers' adoption of VietGAP tea production and the related land expansion. Conversely, longer farm experience and the age of tea

farms are unique factors that hinder farmers' decisions to adopt new production.

Some policy implications can be drawn from the findings of this study. Firstly, a positive and significant effect of tea farmland implies that government intervention to reduce the negative effects of small farm size would be a good incentive for farmers to adopt and disseminate VietGAP tea production. Secondly, investing in an active irrigation system and improving it would encourage tea farmers to convert to new production methods and increase land allocation as well. Thirdly, the effect of tea farmers' knowledge about VietGAP production supported the need for technical training courses through extension services. Thus, gaining financial support and funding sources should be given further attention in order to deliver such training for promoting VietGAP production. Lastly, providing suitable laborsaving machinery would be a good incentive for promoting tea land allocation for VietGAP production.

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