



# **Hedmark University** of Applied Sciences

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**Master thesis**

**OPPORTUNITIES AND CHALLENGES OF COMPLYING LIME PRODUCTION  
WITH GLOBALGAP STANDARDS IN MEKONG DELTA OF VIETNAM**

**Masters in Sustainable Agriculture**

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## **Abstract**

Lime has been commonly cultivated in Vietnam for a long time. Its produce is exported to many countries around the world. Growers use more and more pesticide and fertilizer on their lime farm to protect the crop and increase their productivity. Therefore, the lime production causes many effects for the health of human and environmental issues. Nowadays, the issue of the food safety hygiene is concerned much more than they did in the past. In particular, the traceability of products, the levels of allowed residue pesticide, and the environment issues are set for producers. The EU is the largest which is the strict market with many rules. The complex standards will circle the food safety hygiene and social responsibility. The obstacle to the exporter of Vietnam's fruits is a guarantee of the quality of the fruits as well as to meet the standard requirements and market needs. To analyze this, a project was conducted to explore the implication of GlobalGAP standard for lime in Mekong Delta of Vietnam. This project has studied the knowledge of the producers and risk awareness to get an understanding of the growers under GlobalGAP standard. Moreover, this study also has analyzed the essential factors influencing the adoption of farmers to comply with the standard. Finally, it has been identified the benefits and difficulties of implementation of good agricultural practice. A questionnaire was designed to interview GlobalGAP and non-GlobalGAP farmers. About 30 GlobalGAP and 44 non-GlobalGAP farmers in Long An and Hau Giang province in the Mekong Delta, Vietnam were interviewed in 2015. The descriptive statistic, backward selection model, and SWOT analysis to analyze data. The research indicates that GlobalGAP farmers are aware of safe production. They applied allowed pesticide and herbicide list. Furthermore, backward selection model also shows that the compliance with GlobalGAP standards was influenced by the education level of farmers and external factors such as support policies, buyers, and the price of the lime production. Besides, the GlobalGAP farmers' awareness of health and environmental protection became better than non-GlobalGAP farmers did. They applied less fertilizer and used organic fertilizer to improve soil structure. However, the high costs of compliance are identified a major constraint to GlobalGAP producers, especially to small-scale farmers.

## **Sammendrag (Abstract in Norwegian)**

To have a Norwegian abstract is optional and may mostly be relevant for Norwegian students or Scandinavian to

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**LIST OF ABBREVIATIONS**

ESCAP	Economic and Social Commission for Asia and the Pacific
EU	European Union
FAO	Food and Agricultural Organization
GAP	Good Agricultural Practice
ISO	International Organization for Standardization
GRASP	GlobalG.A.P Risk Assessment on Social Practice
SPSS	Statistical Package for Social Sciences
SWOT	Strengths, Weaknesses, Opportunities and External
VFA	Vietnam Food Programme
VND	Vietnam Dong

## 1. INTRODUCTION

### 1.1 Background information

Improving food safety and quality is to protect public health, enter global market and contribute to economic development and food security (FAO, 2012). Foodborne disease is one of the significant challenges for the public health system over the world (Gould et al., 2013), especially in developed countries, with an estimation of 20% population suffered from the food-borne disease (Painter et al., 2013). According to a report from Vietnam Food Administration (2012), there have been 168 substantial outbreaks of food-borne disease in Vietnam, and it caused approximately 5,541 hospitalizations and 34 mortalities (Vietnamese Food Administration, 2012). The key causes of food safety-related health problem are the consumption of food contaminated with bacterial, viral, chemical agents, or parasitic, in which viral and bacterial are the two causes to lead illness (Luu, 2015). Gould (2013) illustrated that, in the United States, 790 of outbreaks were uniquely confirmed etiologic agent: microbiological agents caused 749 (94%); toxins and chemicals accounted for 39 (5%), and parasites made up 2 (0.2%) of these during 2009-2010.

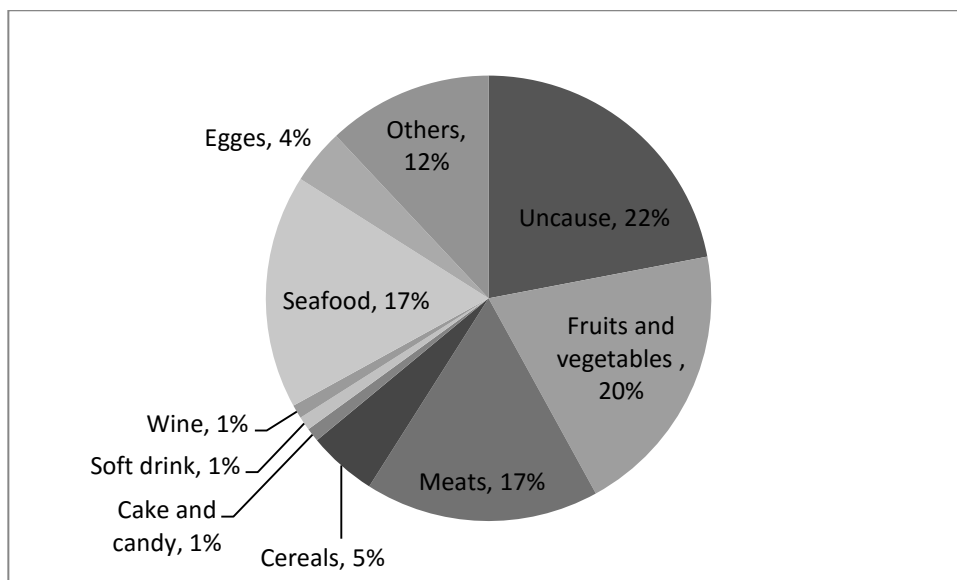


Figure 1: Set of poisonous foodstuff percentage (Source: Vietnam Food Administration, 2009)

The issue of food-borne diseases is comparatively considerable in Vietnam because of Vietnamese's characteristics in food production process and food consumption habits (Luu,



2015). The principal factors of contributing to food-borne diseases and infections in Vietnam are the proximate closeness of human and animal populations; lack of management production systems such as mixed species, unhygienic facilities, traditional habits, low levels of inspection commitment and no traceability (Carrique-Mas & Bryant, 2013). In Vietnam, the matters of food safety also have been serious in Vietnamese fruits and vegetables with the highest percentage of the poisonous foodstuffs set (figure 1) between 2004 and 2008 (Vietnamese Food Administration, 2009). Vietnam has been facing the big issue in improving its food safety and regulatory system, in particular, domestic production, and consumption.

In Mekong Delta, the capabilities of suppliers are really limited. They have low education level and lack quality knowledge which results in difficulty in understanding and complying quality awareness in their production process. More specific, many employees do not seem to understand the important value of the quality of their products affecting the quality of the final product sold in the markets (Loc, 2003). In the supply chain, suppliers, handlers, and retailers are completely not aware of the hazards of their products that had negatively affected the health of customers. This is because they were not trained enough knowledge in their practices. Particular, many Vietnamese growers did not accurately know the exact amount of fertilizer for their fruit trees (APCAEM, 2007). A survey of the Southern Fruit Research Institute (SOFRI) about using fertilizer for fruit orchards in the Mekong Delta showed that 58% of farmers did know how to choose correct kind of fertilizer for their soil and 32% of growers did not know the significant influence of the diverse nutrients on growth and develop od their crop (Tri, 2003). Another problem is that the fertilizer usage is not balance. Particularly, farmers often tend to fertilize much more the amount of nitrogen than the amount needed; compared to phosphorus and potassium component. They often like using a single component rather than a compound fertilizer.

According to Van Hoi (2013), the issue of pesticide residue in fruit and vegetable is serious in Vietnam because farmers often overuse pesticides for their farm at higher levels than advised level (Van Hoi, Mol, & Oosterveer, 2013). More specifically, the amount of pesticide used in Vietnam increased significantly from 15.000 to 76.000 tons during 1991 - 2005. Currently, Vietnam has been paying a high cost for depending on pesticide use. First, the almost pesticide has extensively been imported into Vietnam approximately \$500 million/year. Besides, Vietnam had to pay much higher costs for social and environmental issues affected by pesticides use, export opportunities lost because of the residues of

pesticide on products, and unstable agricultural productivities combined with an agroecosystem degraded. In Vietnam, in 2002, it was reported that more than 7.000 cases were poisoned by the pesticide residues on food, causing 277 deaths in 37 provinces of Vietnam (Van Hoi, Mol, & Oosterveer, 2009).

Vietnam is considered as an agricultural country because of almost Vietnamese people are living in the countryside (80%) and about 70% basing on agricultural production that is very important for their livelihood (Ogle & Phuc, 1997). Fruit plantations have significantly grown in the 1990s with 6.5 percentage of the area increased per year (APCAEM, 2007). However, the performance of agricultural sale for global and local markets has not developed proportionately because of the weaknesses of postharvest handling skill of fresh fruit, low productivity, production plantation unplanned, poor technologies and unsuccessful sales system. Therefore, the quality of the kinds of fruit is poor and it is not sometimes not met with the harsh requirements of importers. That is the reason why almost Vietnamese vegetables have been exported to some countries such as China, Russia,...where do not require to provide pesticide residue testing of the production process (D. L. Nguyen, 2006). It can be acknowledged that European is the biggest market for importing vegetable and fruit in the world, where consuming tropical vegetables and fruits are increasing day by day. However, the requirements of this market are very strict because EU market demands good quality products along with comparative price and safety. The demand for vegetables and fruit import into EU is approximately 80 million tons fresh fruits and more than 62 million ton of fresh vegetables. Exporting vegetables and fruits from Vietnam to EU is only a modest position, approximately 5.5-6 tons per year while the rate of export from developing countries into EU is 35-40% in Vietnamese vegetable and Fruit report (Acency, 2008). For many products in countries with strict requirements, they require providing official documents verifying compliance and safety measure to human health.

In the order to have sustainable agricultural production, many policies of sustainable agriculture production in many countries such as Kenya, Caribbean, Namibia, Colombia, Thailand and South Africa were deployed to improve safe food for both customers and animals, which did not damage environmental system (N. T. Nguyen, 2012). These policies have a positive effect on preservation and conservation of natural environment resources such as soil, water and air (FAO, 2005). Moreover, biodiversity and animal welfare were also created by sustainable agriculture production. Besides, economic and social viability were built up by the development (FAO, 1995). To meet the sustainable growth, many

standards of agricultural production such as Organic production, Good agricultural Practices (GAP), Best Management Practices (BMP) were created to improve food quality and safety, the health of the employee and environmental protection throughout improving practical management on farm systems. For instance, GAP standards' requirements have a positive effect on developing of economic, social and environment. The standard of GAP production also guarantees food safety and quality, environment-friendly as well as economic viability (FAO, 2003) . The organic production focuses on increase and promotion of biodiversity, the activities of biological soil, and biological cycles through the management of the practical farming system. Organic agriculture also contributes to the potential environment and the activities of society by rejecting usage of synthetic inputs. A case research of rice organic agriculture in Cambodia showed that many rice growers did not only get safe food but also improves their health from applying organic production. In addition, almost farmers joined the organic initiatives also increase their income thanks to a decrease in the cost of farm inputs (Beban, 2009).

Nowadays, many nations have started to apply the GAP standards on their farm as well as food systems such as nutrient management, integration of pest management and agriculture conservation (FAO, 2003). Moreover, to meet the requirements of global customers, global good agricultural practice (Global-GAP) have to assure the customers' demands about food production process on their farming around the world, reducing harmful influence of farm activities on natural environment, decreasing the usage of chemical inputs and protecting workers' health as well as work conditions.

Global-GAP standard is one of the significant standards of food safety in the world (FAO, 2012). Primarily a pre-farm-gate process standard, Global-GAP has increasingly been considered as a key reference for Good Agricultural practice (GAP) for worldwide food safety affairs. In countries including Australia, Chile, Denmark, France, Germany, Japan, Kenya, Mexico, New Zealand, Spain, and the UK. Global-GAP has been incorporated into domestic GAP standards, usually in the form of public-private joint ventures (Mitchell, 2008).

Global-GAP standards were initiatively started in 1997 as EuropGAP, which was created by retailers belonging to the Working Group of Euro-Retailer Produce. In 2001, EuropGAP got the first ISO 65 recognition for vegetables and fruits and began admitting its first compliant farmer certificates. Due to the growing concerns relating to food safety, health,

environmental impact, the standard has been spreader throughout Europe and beyond in the following years. Then, EuropeGAP standard was renamed GlobaGAP in 2007. The standard focuses mainly on food safety and also protects environmental aspects, the health safety of workers, welfare and traceability (Wysokiński, Gołasa, & Bieńkowska, 2012). Global-GAP standard covers documentation of all farm activities and farming inputs until the produce leave out the production area (Masood & Brümmer, 2014). However, the high cost of Global-GAP and its strict requirements are challenging for smallholder (Nyota, 2013). In addition, donor assisted farmers in Global-GAP adoption is often not stable. Therefore, growers abandon the Global-GAP standard because of the donors' the withdrawal (Subervie & Vagneron, 2012).

Like other countries, Vietnam also has adopted voluntarily global quality standards to join worldwide markets (Dirk, 2009). There have been about 150 Global-GAP certifications issued to Vietnamese producers (GLOBALG.A.P, 2011). For instance, production of rice, fruits, phantasies fish such as star apple and grapefruit have complied with Global-GAP standard (N. T. Nguyen, 2012). However, farmers have been facing many difficulties and challenges for production with the Global-GAP standard especially in the production process and outlet markets (News, 2010). In this case study, we focus on the adoption of the Global-GAP standard by growers of seedless lime in Mekong Delta of Vietnam.

Lime is one of the attractive fruits with their unique acidity and flavor and also provide as a source of industrial and food production (Bosquez-Molina, Domínguez-Soberanes, Pérez-Flores, Diaz-de-Leon-Sanchez, & Vernon-Carter, 2002). There is much kind of limes such as Mexico lime, key lime, Persian lime (FAO, 2003). Among them, the Persian lime (*Citrus x latifolia*) known with many names Shiraz Limoo, Bearss seedless, Tahitian, is the most common lime on the world and is grown globally with largest growers in Mexico (Plattner, 2014). The production of lime and lemon on the world has been growing annually since 1980, with an increase of globe production reaching 33,3 billion pounds in 2012, increase threefold from 1980's about 11,3 billion pounds.

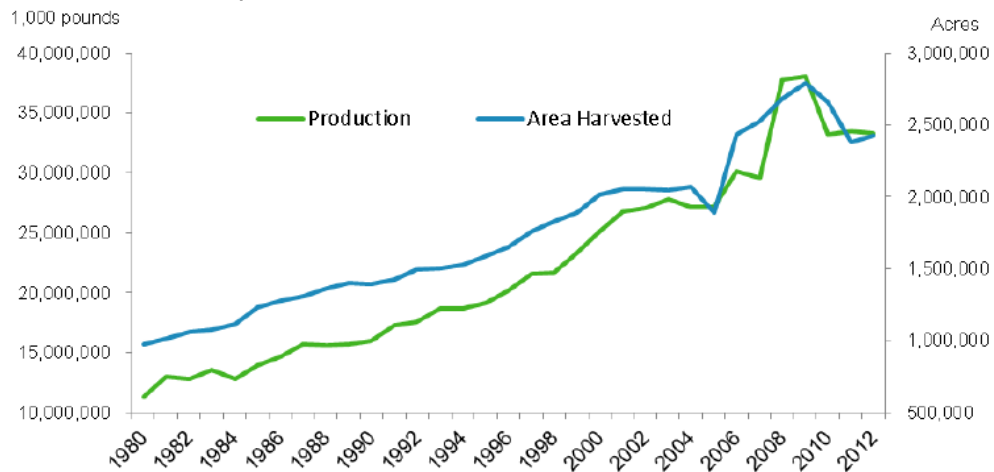


Figure 1.2 Lime and lemon globe production and area harvested during 1980-2012 (Source: United Nation, Food & Agriculture Organization, FAOSTAT)

Consuming of fresh lime on the world has been increased annually. In particular, the amount of fresh lime was imported into the European markets increasing from 85 thousand tons to 113 thousand tons during 2010-2014. The most significant increase was in 2012 and 2013 (figure 1.3) (CBI, 2015). Limes are grown in many countries in the world but almost lime is consumed in their respective local markets with the little amount sold to international markets (Plattner, 2014).

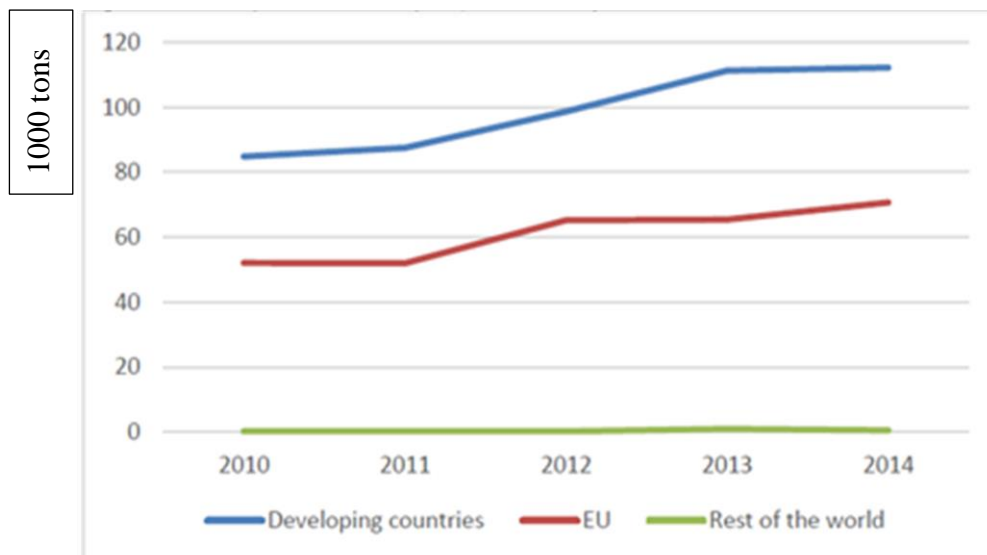


Figure 1.3 Imports of fresh lime on the world from 2010 to 2014 (Source: CBI, 2015)

In Vietnam, the Bearss lime, which was originally imported from California, is named seedless lime characterized with the larger size, hardness absence of seeds and thorns, and

longer fruit shelf life . The lime is suitable for the tropic climate of Vietnam. Currently, Seedless lime is commonly grown in Vietnam with a large area of seedless limes in the Mekong Delta, where an abundant supply of fresh river water allows farmers to irrigate their farms and produce limes throughout the year. Some regions have been growing lime as Long An (5000 ha) Tien Giang (5000ha) Dong Thap 1000 (ha), Hau Giang (500 ha), Can Tho, Vinh Long (Tuan, 2015). Bearss lime is sold to the Co.op Mart supermarket chain in Can Tho Ho Chi Minh City and other local companies. They are also exported to the Middle East and Europe, with selling prices of VND10.000-30.000 per kilo (News, 2015) . Exporters require Bearss lime with a particular shape, a specific size (not too small and not to large), not infected by insects, clean and glossy, no rough spots. The lime packed has to be green as the trees in boxes in extra-fine. It is hard to choose the goods Vietnam consistently good and preservation to meet exporters' requirements.

## **1.2 The problem statement**

The famrers would like to improve the quality of their produce as well as integrate their lime to Global markets in order to solve oversupply and get higher income. Custom ers demand products with safe and good quality. The farmers needed to apply production of advanced technology to enhance lime's quality and safety as well as the meet of international and domestic requirements. Finally, there is limited research on factors have a positive impact on compliance with the Global-GAP standards and their level of awareness among the smallholder farmers. This makes it difficult to design tailored policies to assist the farmers. This thesis is conducted to consider how the situation of lime production under Global-GAP standards has contributed to the development of rural sustainable agriculture in the Mekong Delta of Vietnam.

## **1.3 Hypothesis of the study**

- (i) The characteristics of farm and farmers have no influence on applying with Global GAP standards on their farm
- (ii) Compliance with Global-GAP standards does not influence traditional practice and the
- (iii) Lime production under GlobalGAP standard dose effect on environment around.

#### **1.4 The study objectives**

- How do farmers improve their product's quality by complying Global-GAP standard?
- Which benefits do farmers get from Global-GAP seedless lime production?
- Does compliance with Global-GAP on seedless lime really contribute to environment protection?
- Does effect of Global-GAP seedless lime production change agricultural practice and food customers' demand for rural development in the Mekong Delta in Vietnam?

In order to understand more about the studied issues, the specific research questions are figured out in details below:

- How has the cultivation of Global-GAP seedless lime impacted on the agricultural practice of the producers?
- Does compliance with Global-GAP seedless lime have a positive or negative impact on seedless lime production of non-Global-GAP farmers? What will the non-Global-GAP farmers expect from the effect of Global-GAP seedless lime production?
- Has the production of Global-GAP seedless lime affected resource used compared to non-Global-GAP production, considering use of fertilizer, pesticides, and herbicides?

#### **1.5 Limitations of the project**

The project was only conducted to two regions within Mekong Delta of Vietnam. The result could not be considered as generalisation because this project was included only 74 respondents. In addition, the respondents were only lime growers. Therefore, it could not find limited application to other citrus growing in Mekong Delta. Another limitation is that It could not be explored the culture of customers both Vietnamese and foreigners.

## 2. RESEARCH METHODOLOGY

### 2.1 The study area

In Vietnam, seedless lime can be cultivated mostly in Mekong Vietnam like Can Tho, Long An, Ben Tre, Hau Giang, Tra Vinh, Vinh Long, Tien Giang. Among them, Long An and Tien Giang Province have more planting areas than other regions. For this study, two regions namely Long An and Hau Giang province – were chosen as study areas, based on following criteria:

- They are uniquely production areas for growing lime under Global-GAP standards;
- They are potential areas for seedless lime production development;
- They are major production areas for exporting seedless lime to international markets;

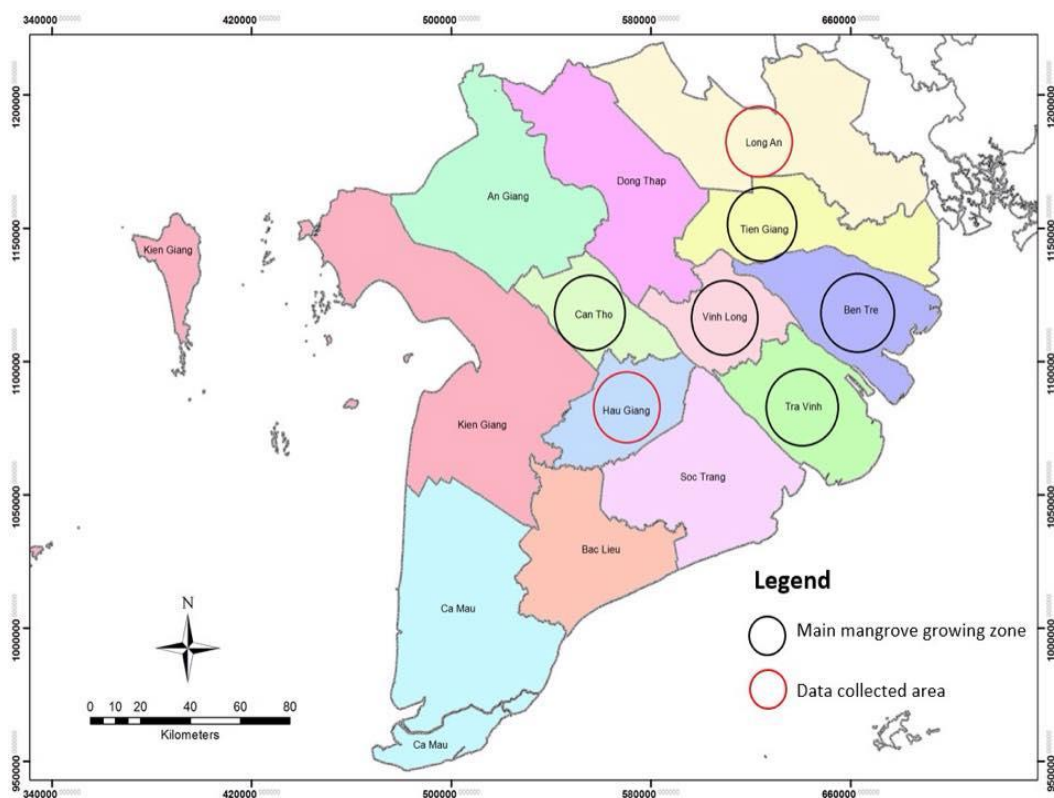


Figure 2.1 Main seedless lime growing areas in Mekong Delta of Vietnam  
(Source: <http://mekong-delta.org/map/>)



## 2.2 Data collection

In order to address our study questions, we carried out a survey in August 2015 among 30 compliant and 44 non-compliant farmers. It was not easy to contact the farmers. We contacted with a teacher who works in Can Tho University. She introduced us to the agricultural officer in Department of Agriculture and Rural Development of Hau Giang province and Long An province to ask their help. They gave us a list of Global-GAP-compliant farmers including address, name, age, area. We went to their house and farm to interview. We did not have an appointment before therefore we sometimes could not meet some farmers for interviews because they were often on their farm which is very far from their house.

To prepare for interviews, a questionnaire was structured carefully, in which many topics were arranged, including socio-economic and farm characteristics, agricultural production and input use, marketing, compliance with standards, training. Enumerators were bachelor's students from Can Tho University who obtained good background of horticultural production systems. They were trained one week both theoretically and practically before data collection starting.

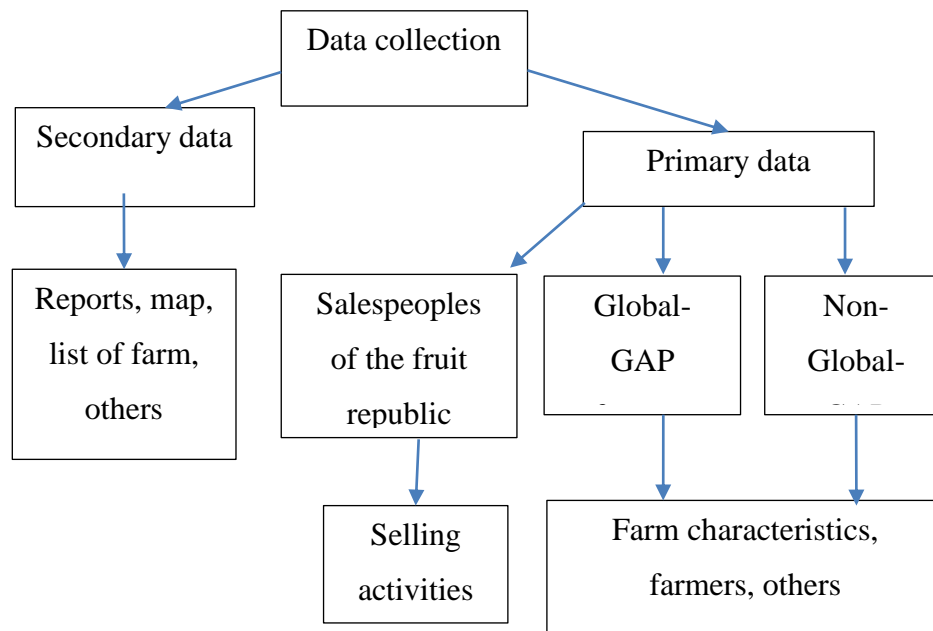


Figure 2.2 Procedure of data collection in Mekong delta of Vietnam

We interviewed 74 households about 2 weeks. Therefore, 30 are compliant Global-GAP farmers, 44 are non-Global-GAP-compliant farmers around research area. A questionnaire

(Appendix ) is created and is believed to get information better from many different farmers of both Global-GAP and non-Global-GAP cultivation because the farmers were different from their ages, education levels, professional experience.



Figure 2.3: Interview farmer in their house and their farm

Both compliant and non-compliant Global-GAP were selected randomly around research area. Such way of selection was believed to know if Global-GAP cultivation affected negatively or positively on non-compliant Global-GAP farmers and also to understand more deeply about the system of the Global-GAP Seedless Lime. In addition, agricultural officers in the Department of Agriculture and Rural Development and sellers of the Fruit republic Company were also an object in the questionnaire, who can help us understand Global-GAP Seedless Lime business and customers' demand.

### 2.3 Data analysis techniques

Descriptive, t-test, Chi-square test, logit model were used to analyze the data. Laptop. Statistical Package for Social Sciences (SPSS), R software, and Microsoft Excel were used for data management and analysis.

### **Descriptive methods**

The hand written records of some extra questions were typed while we were interviewing. The data were analyzed by independent – sample t-test to determine any significant difference between Global-GAP and non-Global-GAP farmers. Chi-square coefficient was calculated in order to study the significant differences among two samples. Many items were analyzed, including ages, experience, education, Global-GAP awareness, training, and marketing. Statistical analysis was conducted by means of SPSS 20.0 software.

A backward selection model was used to test the key factors influencing compliance with Global-GAP standards. Data is a number of farmers' the characteristics and factors which determine them collected. The response variable of this model is Global-GAP compliance or non-Global-GAP compliance. The independent variables are gender, education levels, age, farm size, support policies, selling activities, age plant.

### **SWOT analysis**

The farm system of the Global-GAP Seedless Lime in Mekong of Vietnam was evaluated through strengths, weaknesses, opportunities and threats (SWOT) analysis. The tool of the SWOT analyze helps sort an internal and external selection of the farming system. The strengths and weaknesses are internal to the systems and the opportunities and threats show external section (Zoller & Bruynis, 2007). The analysis is focused main problematic region.

### 3. STUDY RESULTS

#### 3.1 Descriptive statistics

The total sample used for study data analysis is 74 respondents interviewed in which 40,5% had applied with Global-GAP in their farm while 59,5% had not.

**Table 3.1 Descriptive Statistics of variable selection**

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age of farmers (years)	74	30	61	47,5	7,7
Education level of household head (years)	74	3	12	7,4	2,1
The size of the study areas (ha)	74	0,3	8,1	1,5	1,3
Price of lime (VND)	74	7500	9500	8501	641,3
Years of certification	30	1	3	1,7	0,1
Years of Thanh Phuoc cooperative membership	22	1	7	3,9	1,7
Amount of productivity per ha (ton/ha)	74	24,4	38,8	32	3,9
Years of lime	74	2	7	4,3	0,8
Amount of fertilizer per tree (gram)	74	250	550	364,1	89,3

As shown in table 3.1, the mean age of respondents in the research was 47,5 years with the lowest age 30 years old and the highest age 61 years old which is out of working age, The average level of education of the household heads was 7,4 years while the lowest level of others is 3 years. This showed that all interviewees are mostly literate. About 16,2 % of interviewees were female. The average size of land cultivated was 1,5 ha while the lowest area size is only 0,3 ha. The farm size shows that most of the farmers in the project can be considered as small-scale farmers. The average of seedless lime productivity produced per hectare per year was 31,9 ton. The average price of seedless lime was VND 8501 per kilogram with a minimum of VND 7500 and maximum of VND 9500 per kilogram (09/2015). The prices are mostly influenced by seasonal, demand of lime and buyers (exporters or brokers) (News, 2015). The average year of Global-GAP certification is 1,7 years with at least 1 year and highest at 3 years. Out of the 74 respondents interviewed, 30%

was members of Thanh Phuoc cooperative. The average age of seedless lime is 4,3 years with oldest at 7 years and youngest 2 years. The mean amount of fertilizer is 364,2 gram per tree compared to highest amount 550 and lowest amount 250 gram per tree. The average year of Thanh Phuoc cooperative is about 3,9 years. The Thanh Phuoc Cooperative was established by the desire of farmers under supports of Department Agriculture of Hau Giang province that support and guarantee techniques, training, fertilizer, and purchase for the farmers when they became members of the cooperative.

**Table 3.2 Assessment of quantitative variable between non-compliant and compliant producers**

Variables	P value	T-test
Age of household head (years)	0,008 <sup>***</sup>	2,7
Education levels (grade)	0,001 <sup>***</sup>	4,7
The size of farm (ha)	0,28	2,2
Price of lime (VND)	0,001 <sup>***</sup>	10,8
Amount of lime produced per hectare (ton/ha)	0,001 <sup>***</sup>	16,1
The number of years of plant (years)	0,182	1,3
Amount of fertilizer manured per root (gam)	0,001 <sup>***</sup>	7,4

\*\*\* = Significant at 0,01; \*\* =Significant at 0,05; \* =Significant 0,1 level.

The characteristics of chosen farm and farmers between GlobalGAP and non-GlobalGAP production are compared by Chi-square and T-test analysis method as presented in table 3.2 and 3.3. Education level, age, price, productivity, amount of used fertilizer, and training and contract farming were significant between the two groups. Others the size of farm, years of lime and gender were no significant difference between compliant and non-compliant farmers. Out of the 30 Global-GAP farmers, 86,4% were contracted by exporters and Thanh Phuoc cooperative to sell their products for a period time agreed with the flexible price depending on seasonal and demand. About 13,6% of Global-GAP lime sold for brokers. The Thanh Phuoc Cooperative is government organise support and guarantee techniques, training, fertilizer, and purchase for the farmers when they became members of the

cooperative. Seedless lime is grown some current years. Most of the non-GlobalGAP farmers (86,4%) did not have a contract for their production. Non-GlobalGAP farmers sold their lime with a lower price than the price of GlobalGAP lime because they sold to local markets and indirect to customers. Training is considered the significant skill of Global-GAP requirements. All Global-GAP-compliant farmers had got training on Global-GAP standards.

Table 3. 3 Assessment of quantitative variable between non-compliant and compliant producers

<b>Variables</b>	<b>GlobalGAP Production (%)</b>	<b>Non- GlobalGAP (%)</b>	<b>Chi- square</b>	<b>P-value</b>
<b>Gender</b>				
Male	86,7	81,8	0,3	0,57
Female	13,3	18,2		
<b>Contract farming</b>				
<b>Yes</b>	100	13,6	17,5	0,001***
<b>No</b>	0	86,4		
<b>Buyers</b>				
Exporters	83,3	22,7	1,1	0,3
Brokers	16,7	77,3		
<b>Traning</b>				
<b>Yes</b>	100	68,2	16,2	0,001***
<b>No</b>	0	31,8		

\*\*\* =Significant at 0,01; \*\*=Significant at 0,05; \*=Significant at 0,1.

### 3.2 The reasons of farmer on Global-GAP and non-GlobalGAP adoption

As presented in table 3.4, it is shown that there are many reasons which encouraged the farmer to apply Global-GAP standards with their lime farm. Firstly, donor support was an important reason for the adoption of GlobalGAP compliance. About 76,7% farmers complied with Global-GAP because of support donors. It is the fact that the costs of complying with Global-GAP standards were very high, including analysis of soil and water, the fee of audit and certification, training and so on. The donors paid for these fees when farmers agree with the donor on applying GlobalGAP and selling their product to the donors. The farmers just built a modern toilet, storages to kept pesticide, fertilizer, and equipment to meet Global-GAP requirements. The donors also made purchase guarantee to buy all

products contracted and they also provide some services, technical engineers to support the farmers when they need help. Another reason of about 46,7% compliant farmers was the sale of their lime while a few compliant farmers take care of another purpose like health or environmental protect.

Table 3.4 The perception of compliant farmers applying of Global-GAP production

<b>The reasons of GlobalGAP farmers</b>	<b>%</b>
Donor support	76,7
Purchase Guarantee	46,7
Enhance health of family and workers	13,3
Decrease costs of input	10
Price premium	6,7
Environmental protection	3,3

However, some GlobalGAP farmers noted that the price of Global-GAP lime was not really premium compared to the price of normal lime while they had to follow many complex requirements and paid much money for equipment and storage building. In case that maintaining of the donors was unstable, the farmers were afraid that they would not continue to comply with Global-GAP if donors left them.

The result indicated in table 3.5 shows that there are some reasons why many farmers can not apply with Global-GAP standards. The most major reason was high costs of compliant GlobalGAP fees reported by approximately 73,8% of the non-compliant farmers. It was reported that income of Vietnamese in citrus industry is about 50,000,000 VND per family per year (Nabeshima et al., 2015). The cost of GlobalGAP certification is about 30,000,000 VND per year. Therefore, there were no farmers in any 13 provinces to apply GlobalGAP standards if they did not receive support from donors (Nicetic, Van de Fliert, Van Chien, Mai, & Cuong, 2010). This was followed by difficulties in record keeping with 42,6% because the education level of the farmers is still low on average 6,5 years as presented in table 3.2. There were 11,9% farmers who do not know about Global-GAP standard because

most of GlobalGAP information came from the exporters and Thanh Phuoc cooperative through training class of GlobalGAP farmers. Non-GlobalGAP producers mostly supplied to domestic markets. For an extra amount of lime, they could be stored by other methods such salt lime to solve oversupply issue.

Table 3.5 The perception of non-compliant farmers about Global-GAP standards

<b>The reasons of non-compliant farmers</b>	<b>%</b>
The investment costs are so high	73,8
Difficulties in record keeping	42,6
Clack of support policies	28,6
Buyer do not need GlobalGAP certification	9,5
Absence of premium price	4,8
Unknown Global-GAP standard	11,9

### **3.3 The awareness of Global-GAP requirements**

The result of table 3.6 indicates the percentages of producers who had knowledge about rules of GlobalGAP standard. The respondents are collected into groups of those who had complied and those who had not complied though both of them were aware of these aspects. Out of the 74 respondents, approximately 81,1% took care of worker health, safety. Among them, it seemed that nearly 100% of those who complied with Global-GAP were aware of safe works while that number is just 68,2% in the non-Global-GAP-compliant category. All GlobalGAP farmers, about 83,3 % were aware of traceability regulation of the standard whereas the traceability of non-GlobalGAP lime was low about 6,8%. Information from the manager of the fruit republic company, although 100% compliant farmers had record keeping in their production process, the information of record keeping is unclear due to the farmers' education level. All the GlobalGAP producers had received training from GlobalGAP standards. Thanks to training class from the government, about 59,5% on-GlobalGAP farmers were aware of record keeping to manage their production process better.



It can be generally concluded from the table 3.6 that most farmers in the study area had paid attention to different aspects of Global-GAP standards.

**Table 3.6 The percentage of Global-GAP requirements between compliant and non-compliant farmers.**

<b>Global-GAP items</b>	<b>% Sample (N=74)</b>	<b>% Global- GAP (n=30)</b>	<b>% Non-Global- GAP (n=44)</b>
Site management	46	100	9,1
Risk assessment	43,2	100	4,5
Soil map	66	97,3	0
Technical service	70,3	100	44
Irrigation	29,7	73,3	44
Fertilizer use	51,3	84	6,8
Crop protection	69	100	52
Worker health, safety	81,1	100	68,2
Traceability	37,8	83,3	6,8
Waste and population management	79,7	96,7	56,8
Environmental protection	52,7	93,3	22,7
Record keeping	74,3	100	59,5
Training	83,7	100	72,7

### **3.4 Assessment of effect factors on compliant farmers' decisions**

#### **3.4.1 The explanation of chosen variables used in the model**

First of all, it was told that education level is one of the important factors which determine the farmers' decision to comply with Global-GAP standards. According to a study by Feder (1984), higher educated farmers take more opportunities to access advanced information and technology which can be applied for their production as well as a market range than their counterpart without education (Feder & Slade, 1984). It is quite easy to understand because the former is able to perceive, interpret and respond to new market trend more quickly than the latter. Asfaw (2009) also reported that Europe-GAP standards are more likely to be adopted by those producers with a high level of education higher than the others (Asfaw et al., 2009).

Support policies, especially in donor supports, are one of the most important factors of Global-GAP adoption. Although compliance with Global-GAP standards helps farmers produce safe of products and work condition, the costs of Global-GAP certification are very high. Therefore, the government and donors provided farmers good conditions such as financial certification, training of workers, input supply, and auditing to apply with Global-GAP to meet the requirements of supermarkets and other coordinated supply chains. It is expected that support policies have a positive impact on the decision of farmers to comply with Global-GAP standards.

Another variable could be mentioned here is the size of farm, Muriithi (2008 ) had shown that the cost of production and the gross income would be parallel with the width of the farm. It was a clear example in Kenya that product price is much higher for small-scale Global-GAP-compliant farmers than big-scale ones. It is because the cost for Global-GAP certification awarding seems to be quite high compared to profit from the small size of the farm. Then, they have no motivation to adopt Global-GAP standards. It is possible for small producers to overcome this issue only if they take part in group certification which is able to reduce individual cost of compliance.

Gender is believed an important factor in the horticultural industry as well. The industry is mainly associated with women and children since it is labor intensive hence inclusion of this labor intensive, with women frequently comprising the majority of their workers (Dolan and

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Sutherland, 2002) . It was therefore expected that the female-headed household had the high probability of complying with the standards than the female households.

The ability to adopt new technologies in agriculture production also depends on the age of farmers. This variable is told to have an effect on willingness to take a risk in investment to Global-GAP compliance.

The number of potential customers also effects on farmers' decision on Global-GAP compliance. Farmers reported that they are not willing to invest to Global-GAP standard unless there is a good market or a guarantee for their production.

The quantity and quality of lime depend on the age of the trees. We introduce this variable, which could be seen as a fixed investment since we suppose a potential effect on Global-GAP adoption. The price of the product is considered as a key factor that contributes to farmers' adoption to comply with Global-GAP. It was expected that growers who get price premiums thanks to their Global-GAP product will be enhance their income.

#### **3.4.2 Backwards selection model result**

A backward selection model was predicted to explore the factors that have an influence on the farmers' decision to comply or not comply with Global-GAP standards. The test of hypothesis was carried out and results shown below.

The results of backward selection model are indicated in table 3.7. The independent variable is a typical binomial response with two categories, 1 if growers comply with the Global-GAP standards and 0 otherwise. The household head of education level, age, gender, the age of tree, buyer, support policies, the product price, and the size of farms are the dependent predictor variables. The results show estimate, standard error, P value.

Table 3.7: Factors influencing on farmers' decision to comply with Global-GAP standard

Parameters	Estimate	Std. Error	Z value	Pr(> z )
Intercept	-76,9	28,9	-2,6	0,007**
Support policy	5,9	2,1	2,7	0,006**
Price of lime	7,7	2,8	2,7	0,007**
Gender	0,6	2,4	-0,3	0,8
Years of plant	-0,5	0,9	-0,6	0,5
Buyers	3,5	1,9	1,9	0,05
The size of farms	0,7	0,5	1,3	0,16
Education levels	1,1	0,4	2,4	0,01*
Age of farmers	-0,1	0,1	-1	0,3

\*\*\* =Significant at 0,001; \*\* =Significant 0,01 level; \* =Significant at 0.05 level,  $\cdot$  =Trend

After the backward selection procedure, support policy, price, selling activities, education level was still the significant predictors whereas the age of household head, gender, the age of lime, and the size of farm did not have significant influence (all P value >0,16).

As expected support policy, the price of the product, education level, and buyers had a positive influence on the compliant decision of the producers to apply GlobalGAP standards. However, the age of household head, gender, the age of lime, and the size of the farm was against the prior expectation, which had negatively influence the decision of the producers.

Results of P value in table 3.7 present that the buyer variable is trending towards GlobalGAP decision. Almost of GlobalGAP lime was sold to exporters because exporters bought GlobalGAP lime with a higher price than brokers bought. The variable was significant at 90% confidence interval that does not fit the null hypothesis. So the hypothesis is rejected Education level, support policy and price of product variable had a positive influence

on the farmers' decision to comply with the GLocalGAP standard. These variables were very significant at 95% confident interval

### 3.5 Development of Global-GAP standard in the following years

The figure 3.8 shows the development of Global-GAP standard in next time and figure 3.9 shows the development of Global-GAP standard with non-compliant farmers next years.

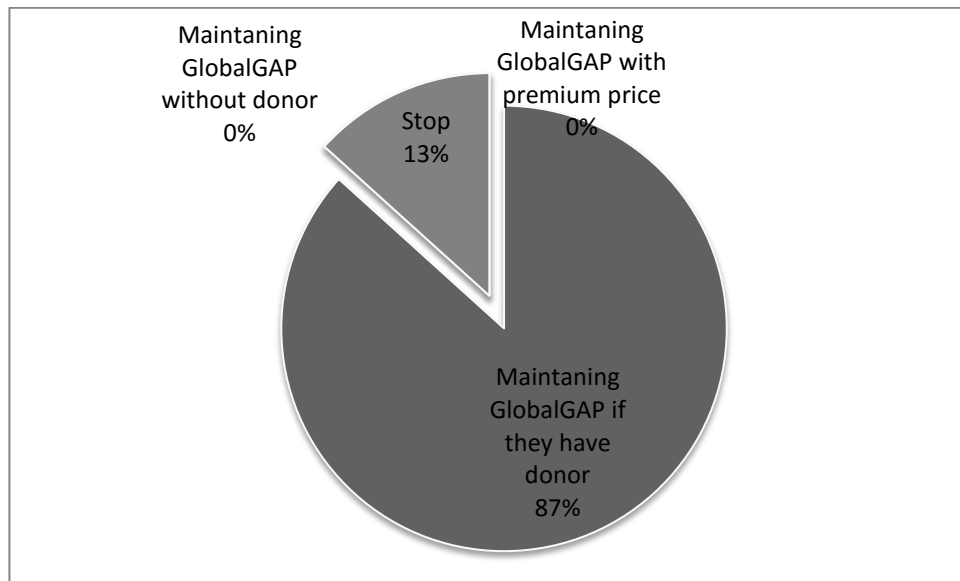


Figure 3,8 The percentage of farmers maintaining Global-GAP certification

As presented in figure 3.8, compliant producers will maintain their Global-GAP certification if donors still maintain support to them. It is reported by approximately 87% of those who had done with GlobalGAP. On contrast, nobody implements Global-GAP production without support. About 13% of total compliant farmers want to stop GlobalGAP production because they said that the price of a product with Global-GAP was not high enough to cover costs of building a store, labors and the managements and controls of GlobalGAP standard are stricter than their own methods

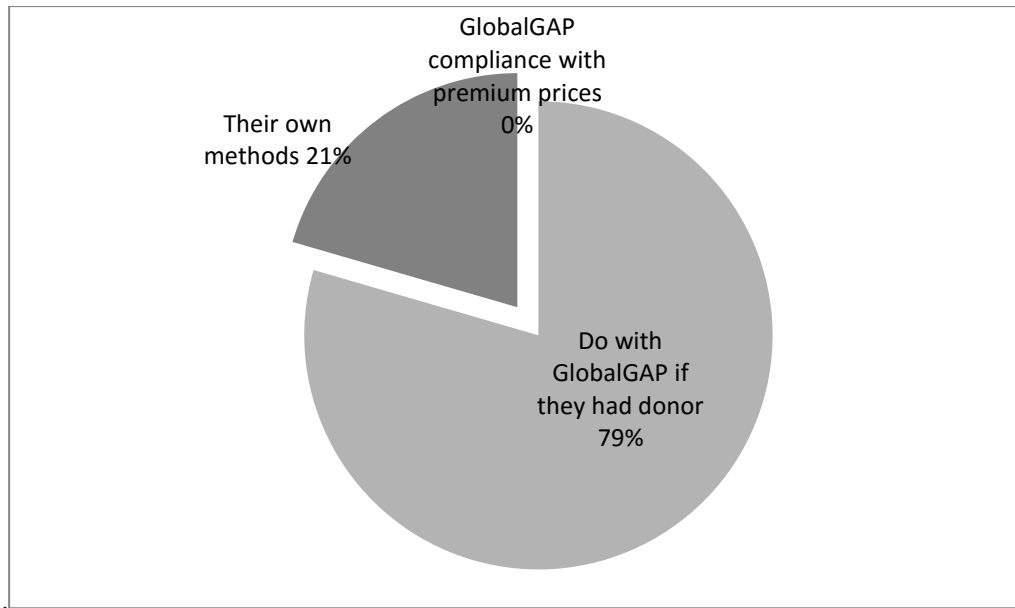


Figure 3.9 The percentage of farmers maintaining Global-GAP certification

As shown in figure 3.9, the development of Global-GAP production with non-compliant farmers in the future is depending on donor support. Among non-compliant farmers, about 79% would like to do with Global-GAP standards if they are supported like finance, training, contract farming, and premium price, 21% would not apply Global-GAP because their customers do not require and 0% would not apply Global-GAP production although they would get a higher price. According to hotel and restaurant owners, they are not sure whether they consume Global-GAP product because of the higher input cost for their services (Uhlig, 2007).

### 3.6 Effects of Global-GAP practice to practical culture

#### 3.6.1 Decrease of amount of fertilizer use

Most of the lime farmers used synthetic fertilizer. However, differences between Global-GAP farm and non- Global-GAP farm are the times and amount of using fertilizer used. From the result of figure 3,1, the lime production under the Global-GAP standard was fertilized less amount of fertilizer than non-compliant ones. The average amount of fertilizer was used in Global-GAP farm about 300 gram per tree while that number is 410 gram per tree in the non-Global-GAP farm.

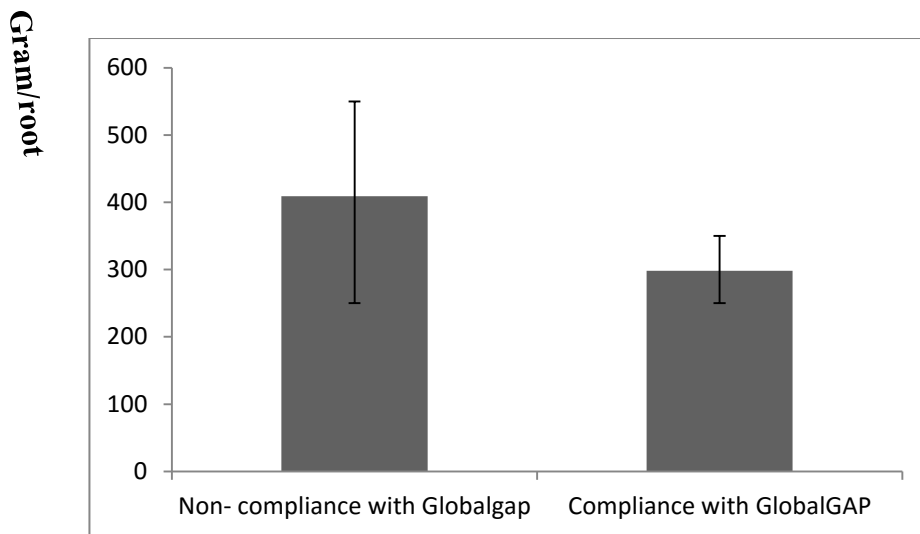


Figure 3.10 The average amount of fertilizer manure for a limes' root between GlobalGAP and non-GlobalGAP lime

Besides, organic fertilizer was applied by approximately 80% of Global-GAP farmers interviewed while it is only 15% for their counterpart without Global-GAP as indicated in figure 3.11. Their purpose of application of organic fertilizer is to improve soil structure and to help the roof of lime grow better. After a long time of production, soil usually turns into compaction, so organic fertilizer can help to improve soil structure and enable soil to be porous.

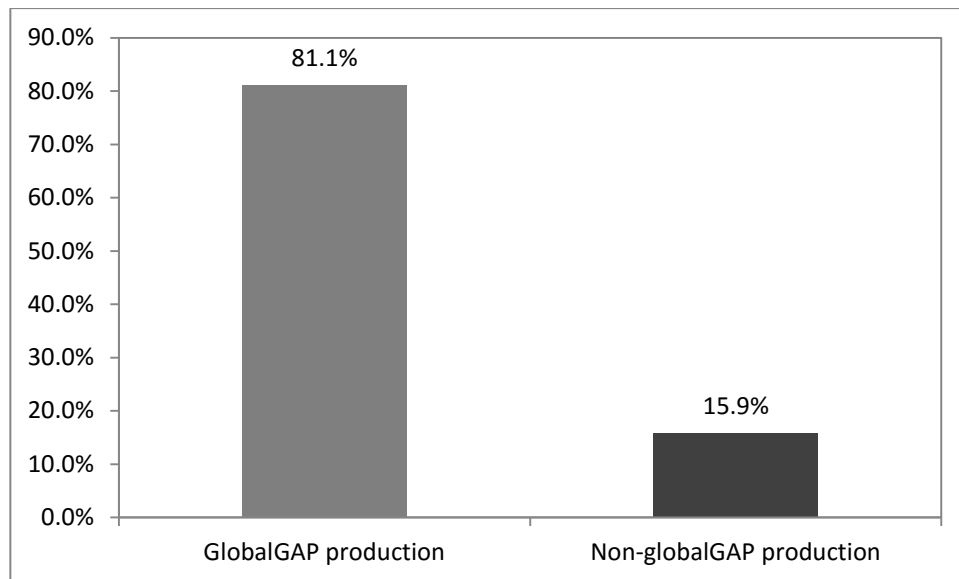


Figure 3.11 The percentage of farmers applying organic fertilizer on GlobalGAP and non-GlobalGAP farm

By applying Global-GAP standard on lime production, the growers expressed that using pesticide and fertilizer appropriately is able to reduce pathogens and pests on their farms. Moreover, many compliant and non-compliant farmers also apply integrated pest management to kill enemies and protect their lime garden and environment without toxic of chemicals, which contribute to the reduction of the damage and widen disease area. For instance, some Global-GAP producers spray biological pesticide to prevent the risk of infestation of spider mites. Many compliant farmers exclude stink bug and borer by their hands or cut down disease branch. Furthermore, producers used herbicide and pesticide in allowed-pesticide list. In addition, time to spray pesticide and the amount of pesticide used are restricted while non-compliant farmers do not have to follow these rules. As a result of figure 3.12, GlobalGAP farmers was sprayed less the times of using pesticide than non-GlobalGAP production about 1,5 times.



Times of  
using  
pesticide

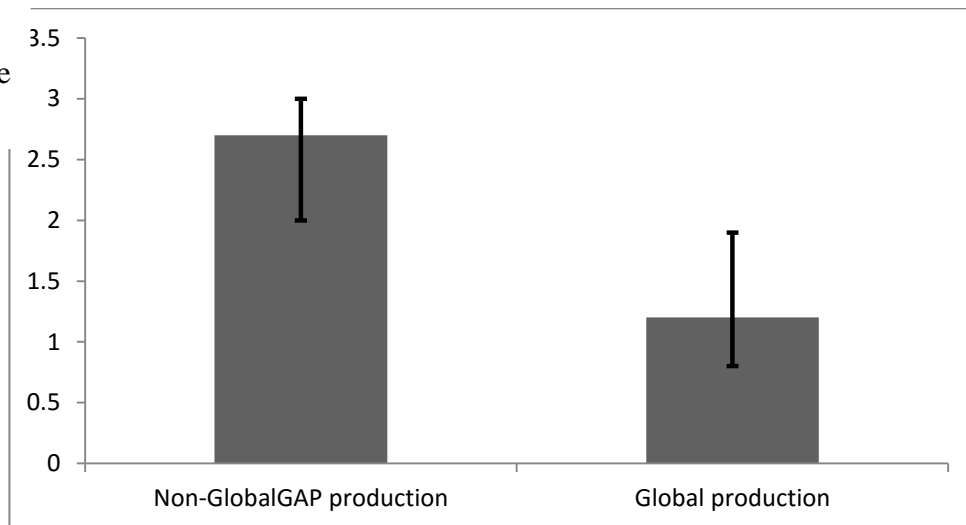


Figure 3.12 The mean times of spraying pesticide from flowering period to adult fruit on GlobalGAP and non-GlobalGAP farm

### 3.6.2 Impacts of the Global-GAP seedless lime production on environmental protection



Figure 3.12 Agricultural waste treatment between Global-GAP garden (left) and non-GlobalGAP garden (right)

Building the area of mixed pesticide and pesticide packages is one of the requirements of applying Global-GAP standard followed by lime production. The production of Global-GAP lime must build them on their farm. In contrast, traditional producers who were less interested in the pesticide residues' poison in the packages to environment usually throw

pesticide package around their farm. This leads to many some negative impacts on environmental nature, soil, resource, animal, human being, sight. For the Global-GAP lime production, the grower often used to wash sprayers first and mix the pesticide then.

Therefore, the environment around is less influenced by pesticide residues. Besides, the packing of pesticides often was put in the separate pit which is built to store them separately. Thanks to this pit, the packages of pesticide are destroyed by fire on the spot.



Figure 3,13: The traditional toilet in non-compliant area (left) and self-decontaminating toilet in compliant house(right)

Besides, the modern toilet was built in the Global-GAP producers' houses to suit the requirements of Global-GAP standard (figure 3.13). This change has positive impacts on environmental protection of the Global-GAP households. On contrast, the non-compliant Global-GAP producer is still using the fish toilet. This can lead to polluted water. In addition, Mekong delta has the complex river system, so it is difficult to manage water sources by using the fish toilet. Therefore, the Global-GAP growers had to stop using the fish toilet and build modern toilet when they join in the Global-GAP standard.

### 3.6.3 Worker health and safety

The Global-GAP lime production needs to build medicine chests, fertilizer, pesticide and a separate area for putting equipment in the Global-GAP producers' houses to meet the

management of Global-GAP system (figure 3.14). Therefore, the health of members of family, worker and sanitation is protected better. Moreover, much equipment such as the hat, face mask, glass, boot, etc., is clean and orderly put separate areas. This meets only the management system of Global-GAP equipment, but also helps farmers manage their production easily presented in figure 3.14. On contrast, some non-Global-GAP farmers kept all pesticide and fertilizers on their houses. This is a serious issue because the health of human and animal is threatened by the toxic smell of chemical content from pesticides and fertilizers. Besides, much equipment such as sprayers, hats, etc., is not put in the order (figure 3.15)



Figure 3.14 The safety equipment for worker protection in Global-GAP production



Figure 3.15 Non- compliant farmers keep fertilizer in their house (up) and fertilizer storage in their farming (down)

In order to have safe products, the product must be protected from production area to customers' hand. The Global-GAP farmers put their lime in some trays, bags to separate them in order to avoid outbreak food while the non-Global-GAP lime is dropped on the floor and the selector who took out some bad lime was smoking while selecting lime. Some of these activities affect to lime's quality in post-harvest stage (figure 3.16).



Figure 3.16 Harvesting activities between compliant (left) and non-compliant production (right)

### 3.7 SWOT analysis of the Global-GAP lime production system in Mekong Delta of Vietnam

The current Global-GAP lime production is evaluated through strengths, weakness, opportunities and threats analysis (SWOT) (table 3.7). The strengths and weaknesses are internal factors that are indicated within lime farming system whereas the opportunities and threats are external elements that have an influence on reduction or increase lime farming system. The farmers were trained knowledge of lime production with high safety and quality before starting participating in the Global-GAP lime production. Besides, support services are available when they need help. The farmers received support from a donor in the implementation of the Global-GAP standards such as the fees of a soil test, certification, training activities, first aid kit, The farmers only paid for building store, modern toilet.

The analysis exposes overviews of the current situation of the Global-GAP lime production in Mekong Delta. Moreover, the thesis focuses on the key issues that are helpful for constraints and possible improvement of the Global-GAP lime system in the future.

Seedless lime is a new tree in the Mekong Delta which brings higher income for many farmers. So many farmers change from rambutan, longan to lime because of its benefits like easiness to grow, easiness to sell thanks to the seedless characteristic. It brings higher income and it is also much cared by the government, which promises a good result for next years of lime farming.

**Table 3.7 SWOT analysis**

<b>Strengths</b>	<b>Weaknesses</b>
<ul style="list-style-type: none"> <li>✓ Knowledge and experience of quality and safety production.</li> <li>✓ Land owned,</li> <li>✓ The tropical weather</li> <li>✓ Lime guaranteed and no seed</li> <li>✓ Low input expenses of lime production</li> </ul>	<ul style="list-style-type: none"> <li>✓ High costs of GlobalGAP compliance</li> <li>✓ Farmers mostly depend on donor support</li> <li>✓ Difficulty in separating lime with Global-GAP compliance</li> <li>✓ The price of Global-GAP lime is not really premium price</li> <li>✓ Transportation by motorbike is influence on the cover of lime quality</li> </ul>
<b>Opportunities</b>	<b>Threats</b>
<ul style="list-style-type: none"> <li>✓ Enhance protection of natural ecosystem</li> <li>✓ Support of some organization to build infrastructure of Global-GAP lime production</li> <li>✓ Practice ecology knowledge through foreign project</li> </ul>	<ul style="list-style-type: none"> <li>✓ Effects of climate change</li> <li>✓ High price of Global-GAP lime to consumer</li> <li>✓ Salinity intrusion in the Mekong Delta</li> </ul>

As presented in table 3, the key strengths of the lime production at Mekong Delta are that the land is owned by the Vietnamese organization, which is a great chance for the farmers. They did not have to buy the land or to rent it. In addition, the weather is suitable for Bearss lime growing.

The weaknesses are that the costs of getting Global-GAP certification are very high, which is a significant challenge for farmers who want to implement Global-GAP standards. In addition, most of the compliant farmers depend on donors. Therefore, the price of Global-

GAP lime was given by donor and exporter, which is not really higher than non-Global-GAP lime's price.

The opportunities for lime growers are that they are not seed, which is a good point for marketing. Bearss lime is not only easy to grow with less input investment, but also brings high income. Therefore, it is paid more attention from the government with many support activities like offering free varieties to the poor, training activities, etc.

The potential threats are that the influence of climate change which one cannot predict. As a case of this year 2016, climate change caused lack of water and salinity intrusion in the Mekong Delta, which is currently a serious problem for all agriculture production in Vietnam.

## **4. DISCUSSION**

### **4.1 Benefits of GlobalGAP production for producers**

Thanks to the GlobalGAP lime production, the producers of Mekong Delta receive many benefits from complying lime production with GlobalGAP standards. From interviewed information, farmers get higher income thanks to applying GlobalGAP standards on their farm. As the case study of GlobalGAP rice production in Mekong Delta of Vietnam showed that income of the GlobalGAP farmers was enhanced about 20-30% or 30-50% (N. T. Nguyen, 2012). Moreover, The GlobalGAP lime production also helps producers reduce the cost of inputs by decreasing the amount of chemical fertilizer and spraying pesticide. In addition, the lime growth with GlobalGAP standards helps farmers enhance their knowledge better. Through training classes, they could practice and manage production system and health protection better. For instance, compliant farmers divided their house into separate parts such as living room, the area of smoking, drinking, and eating. Besides, separating living house and storage of pesticide and fertilizer also contribute to protecting health of their family members far away the smell of these toxic. However, some households still has stored pesticide, fertilizer and equipment together. According to GlobalGAP regulation, they need to be equipped separately. From interviewed compliant farmers, they supposed that they feel more secure about their health when they grow lime under GlobalGAP standards. A report of GRASP project compared differences of GlobalGAP and non-GlobalGAP production is that GlobalGAP farmers are guaranteed their work conditions on the farm. In fact, compliant producers have been trained to make the safe product as well as protect their health and family members thanks to knowledge about handling poisonous products and hazard works (Uhlig, 2007). The customers and producers are enjoyed GlobalGAP lime with secure and high quality.

### **4.2 Challenges of GlobalGAP lime production for both GlobalGAP and non GlobalGAP farmers**

To grow lime under GlobalGAP standards, growers must face many difficulties in the compliance process. Many interviewed compliant and non-compliant farmers said that they really would take the GlobalGAP standards for their farm because consuming of the GlobalGAP lime is guaranteed and it was sold with a higher price than normal lime.



However, the high costs of building facilitate and maintain GlobalGAP certifications are the big problems. Although support donors brought a good opportunity for global market access with initial costs of compliance paid by the donors, GlobalGAP producers had to pay for building a modern toilet, storage of pesticide and fertilizer. GlobalGAP standards required farmers to be annual recurrent costs which are also high. Therefore, most of the compliant farmers said that they could drop out the GlobalGAP groups because they could not pay the high cost of annual maintenance of GlobalGAP certification (figure 3.8). As GlobalGAP farmers, almost non-compliant farmers complained that the costs of compliance GlobalGAP standards are very high. So, support donors have become an important factor for encouraging and funding attempt to apply with GlobalGAP standards. The price of GlobalGAP lime is not really premium price.

In addition, there are some subjective conditions which cause the decision of non-GlobalGAP compliance for non-GlobalGAP farmers. The size of lime production of producers is small – scale and unsystematic in Mekong Delta in general whereas the fruit republic company need the large GlobalGAP lime area to ensure market demand. So the management of GlobalGAP lime growth faces many difficulties by control of complex criteria of GlobalGAP regulations. Moreover, to make sure separateness between GlobalGAP and non-GlobalGAP is also a problem for applying GlobalGAP standard to be suitable for regulation of GlobalGAP standard. The representative of farmers group who want to do with GlobalGAP and Thanh Phuoc cooperative connected with their neighbor garden to join in the group of the GlobalGAP lime production. This helps the management of GlobalGAP production system better. This connection is similar to the control of My Thanh cooperative and some countries around the world such as Kenya and Tanzania. Small-scale farmers are gathered into groups to register and comply with GlobalGAP production. According to Graffham et al, (2007) collecting small-scale farmer together to become large land areas is possible for producing a large product and it also contribute to managing the system of GlobalGAP production easily compared with individual farm management. A study case in Tanzania, the small-scale producers share infrastructure resources, reduces transaction costs and enhance economic efficiencies throughout cooperation of production and market (Mushobozi & Santacoloma, 2010). Thus, the smallholder's cooperation has a positive influence on group areas of the GlobalGAP lime growth in Mekong Delta of Vietnam.

Secondly, practice culture is the second reason of non-GlobalGAP compliance. Lime growth with GlobalGAP standards requires growers have to follow many strict regulations compared to traditional production. The non-compliant farmers supposed that they feel uncomfortable in implement of the rules. Moreover, the lime productivity of GlobalGAP production is not higher than non-GlobalGAP lime production. Additionally, they are not satisfied with the strict classification of exporter request. The rest of GlobalGAP classification is sold low price. For this reason, they sell their whole lime for brokers without classification.

Besides, approach GlobalGAP information of some farmers is also the problem of GlobalGAP compliance. Although GlobalGAP is an entrance ticket for international access, a part of lime production does not hear GlobalGAP standards. Therefore, propaganda activities for GlobalGAP standards by people and means of communications are necessary for the GlobalGAP production.

### **4.3 Changes of GlobalGAP lime production on practice culture**

Throughout the study of the Global-GAP lime production in Mekong Delta of Vietnam, the exploration indicates that lime production with Global-GAP standards impacts positively on changes of culture practice such as applying advanced technologies, the cooperation of small farmers together in lime production, good practice management in a lime production system, working condition improvement, natural environmental protection.

Indeed, the complex requirements of GlobalGAP standard help growers improve their quality and safe lime to meet the demands of customers in both domestic and international markets. On the contrast, the non-compliant farmers cultivated lime by their own methods with the system of normal cultivation technologies which are not standards for soil preparation, varieties of lime, amount and times of fertilizer use and pesticide spraying, harvesting period as well as post-harvest. Therefore, the price of lime Global-GAP is often higher than the price of lime non-Global-GAP.

Moreover, the Global good agricultural practice production also enhances the farmers' awareness in lime cultivation and safe health protection. The farmers said that they got much more knowledge from training classes and practices by Global-GAP compliance. The producers believed that selection of grown soil area in the Global-GAP lime production is

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carefully strict based on soil history. The testing of soil and soil sample can prevent many threats in lime production such as toxins, virus, pests, and diseases. Moreover, the awareness of safe health protection of producers as well as customers was enhanced remarkably by the control of good agricultural practice (Graffham et al, 2007 ). The farmers are very aware of wearing safe clothes such as face mask, hat, boot, and glasses when they were spraying pesticide and manuring fertilizer. They also built reparable storages of chemicals and equipment and their house to protect their health and family members.

In addition, a choice of sprayed pesticides is also strict equipment of Global-GAP production. Its choices must be within the allowed pesticide list. The compliant farmers said that they feel more secure when they bought pesticides from allowed varieties shops of government than unclear varieties shop. On the contrast, the non-compliant farmers do not care for the poisonous effect of pesticide on health human and environment while the compliant producers only spray pesticide when it is really necessary. Indeed, the pesticide is often sprayed when lime growth is in flowering and young fruit period. In these stages, both producers compliant and non-compliant usually visit their garden to observe the growth of flowering and fruit as well as to manage pests and diseases. For the flowering stage, non-compliant producers often spray chemicals and manure nitrogen to get many fruits and increase the size of the fruit. They frequently harvested lime without quarantine time that can cause residue nitrogen and pesticide in the lime. Also, the amount of chemical fertilizer in non-Global-GAP lime production often depends on their own experience while compliant farmers almost follow guide and label. Non-compliant lime was applied much more fertilizer than compliant lime. As a consequence, compliant producers apply pesticide and fertilizer on their lime farm actively according to four criterions of Global-GAP requirements.

Also, another significant change of the Global-GAP lime production is that the process of classified lime is managed strictly after harvesting. The Global-GAP lime was put in the basket to avoid negative impacts around. After bad lime was taken out, they are classified into uniform size (not smallest and biggest). These practical alterations are not applied in the non-compliant farm system. The non-compliant producers often put their lime on the floor without canvas sheet that is not separate between cement and lime. Therefore, it can have a negative effect on lime quality by outside conditions.

#### **4.4 Impacts of the Global good agricultural practice on the environmental protection**

The GlobalGAP lime production has some positive influences for protection natural environment. For insect prevention, compliant GlobalGAP farmers decreased times of spraying pesticide less than the times of non-GlobalGAP sprayed from 2 to 3 times per season (figure 3.12). Farmers with their own experience, they sprayed pesticide when they saw the insect damage on lime. They do not consider the most efficiency of the spraying. Besides, most interviewed non-compliant farmers did not care poison of pesticide, insecticides as well as their health and environment around when they bought pesticide because they mainly concern in the preventable ability of pathogen damage. On the contract, few farmers also applied biological pesticide to protect their health and family members and natural environment. However, they did not know how to use correctly, For instance, they mixed many kinds of pesticides together and they also decided amount pesticide by their own experience. Consequences, lime production with the GlobalGAP standard help farmers reduce amount and times of spraying insecticide as well as a pesticide. The compliant farmers just sprayed when spraying is really necessary to prevent and kill the damage of pests. Furthermore, the GlobalGAP farmers have to follow the allowed pesticide list of government. Besides, the compliant GlobalGAP growers apply biological pesticide on their farm better.

Additionally, the GlobalGAP farmers reduce the amount of synthetic fertilizer, which follows the guide of engineers whereas non-GlobalGAP farmers want to manure by their own experience and label. Applying much fertilizer cause a pressure on soil and soil compaction. Therefore, using suitable fertilizer of the GlobalGAP farmers contribute to protecting environment soil and reduce the cost of input. Moreover, they also apply some organic fertilizers to improve soil structure. As study case of Eastern and Kenya country, they got higher economic value of changes in soil quality thanks to compliance GlobalGAP standards.

## **5. CONCLUSION AND RECOMMENDATIONS**

### **5.1 Conclusion**

The study shows the benefits of GlobalGAP production for farmers evaluated the awareness of the GlobalGAP among the compliant farmers, and also identified the significant factors contributing to the farmers' decision to comply with the standard. Besides, the study explored negative and positive effects of the standard on the face of economic, social and environment in Mekong Delta. Thanks to complying with GlobalGAP production, the growers can approach advanced technologies on their lime garden. In particular, the lime cultivation with GlobalGAP standard helps farmers enhance their lime product with safety and high quality. Besides, the standard also helps the producers increase their knowledge about protection of their health safety as well as the preservation of natural environment throughout using protective equipment (clothes, hat, boot, and face mark), a decrease of the amount of fertilizer and reduction of times of spraying pesticides and insecticides. Moreover, the GlobalGAP lime production also increases their income through the decrease of production input and premium price for certified products. However, most of the compliant farmers mostly depended on donor support because the costs of GlobalGAP certification are very high. They cannot afford GlobalGAP costs. As a result, the GlobalGAP farmers do need potential guarantors, which help them maintain GlobalGAP standard next following years.

### **5.2 Suggestions for further research**

The project focused on the profitability influence of GlobalGAP compliance on some objectives without looking at the possibility of donors, exporting to strict markets, the customers' perception of GlobalGAP product. There is a need to explore the possibility of potential support of donors for small-scale farmers. There is also a need to study the possibility of farmer linking directly to merchants in the importing countries. There is the necessary to explore whether GlobalGAP compliance guarantees market assurance or increase of profit. Finally, it needs a study to analyse the effect of GlobalGAP standards on productivity of lime.

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## 6. APPENDIX

### Survey on compliance with GlobalGAP standard on seedless lime in Mekong, Vietnam



#### HEDMARK UNIVERSITY COLLEGE

Dear respondents,

This survey is a part of my thesis in Hedmark University College, Norway. The aim of this research is to find benefits and costs of applying GlobalGAP standard on seedless lime to fix them timely. Also, better application of such a standard can bring Vietnamese fruits to international markets based on using powerful potential of agricultural production, especially in fruits.

My name is Doan Thi Nhan; your assistance in my thesis would be greatly appreciated.

My email address is: [dtuhan8967@yahoo.com.vn](mailto:dtuhan8967@yahoo.com.vn)

If you have questions concerning this survey, please contact my supervising teacher:

[Hans.endrerud@hihm.no](mailto:Hans.endrerud@hihm.no)

#### I. General information

The interviewee..... Age ..... Gender: male/female

Address: .....

Date of survey:.....

Phone number: .....

Household member:.....

The size of farm:.....

Education:.....

- a. Primary school    b. Secondary school    c. High school    d. University

1. Do you know GlobalGap?

a. Yes

b. No

2. Where did you get information on GlobalGAP?

Exporter

Collector

Other farmers

Farmer meeting

Radio/TV

Government

3. Have you applied GlobalGAP standard in your farm?

a. Yes

b. No

4. (*If yes*) why did you comply with GlobalGAP?

Buyers required me to implement it

I wanted to have higher value product

I wanted to decrease the costs of chemical

Buyer offered a purchase guarantee for certificated produce

Buyer offered higher price for certificated produce

I wanted to find buyers easier

It is good for my family's & worker's health

Management practice easier

Policies support

5. (*If yes*) who support standard implementation at your farm?

a. Nobody

b. Exporter

c. Brokers

d. Cooperative

e. Government

6. Were you certificated?

a. Individually

b. Group

7. (*If no*) why didn't/don't you adopt GlobalGAP?

The investment costs were too high

I didn't understand many standard requirements

Record keeping was too difficult

Buyer didn't require it

There was not enough support available

There is no price premium for certificate produce

8. Which organization license GlobalGap certification

.....

**II. Status of farm**

1. What type of soil?

a. Alluvial soil

b. Sandy yellow clay

c. Others:.....

2. Are the soil sample analyzed?

a. Yes

b. No

3. Are the following analysis regularly conducted at your farm?

a. Pesticide residue analysis

b. Soil analyses

c. Irrigation water analysis

4. How often is the analysis conducted:.....

5. Who pays for the analysis costs?

a. Myself

b. Exporter

c. Collector

6. What kind of water use do you irrigation for your farm?

a. Underground water

b. Well water

c. River

7. Which year did you start with GlobalGAP

.....

8. Years of experience in growing seedless lime?.....

9. What kind of varieties

a. Grafted

b. Root extract

10. Where did you buy varieties?

a. Cooperative

b. Shop

c. Myself

d. Given from government

10. Age of seedless lime?.....

11. Total yield/year:.....

12. Have you raised livestock?

a. Yes

b. No

13. What did/do you treat livestock's waste?

a. Biogas

b. Release to river/well

c. Raise fish

14. What kind of fertilizers do you use?

a. Chemical fertilizer

b. Organic fertilizer

c. Microbiological fertilizer

15. Which do you care when you buy pesticide?

a. Toxic

b. Price

c. Efficient

16. How does the mixer determine the amount of pesticide/fertilizer used for mixing chemical (using fertilizer)?

a. Follow the labels

b. From own experience

c. Instruction by technical staff from government

d. Instruction by technical staff from company

17. Do you have fertilizer storage?

a. Yes

b. Storage with pesticide

c. Storage along with pesticide and tools

d. Keeping my house

18. Do you built it to comply with GlobalGap?

a. Yes



b. Family's health

19. How many time did you spraying pesticide in flowering stage?

.....

20. Amount of fertilizer /plant :.....(gram)

21. How often do you manure fertilizer?

a. One month

b. 1,5 month

c. 2 months

d. More than 2 months

22. Is there time interval when you spray chemical?

a. Yes

b. No

23. Do you have a place to wash hands next to where you store your chemical?

a. Yes

b. No

24. (If no) Where can you/worker wash your (their) hands after handling chemical

25. Do you have a first aid kit at your house?

a. Yes

b. No

26. Is there a toilet accessible for the farm workers at your farm or your house?

a. Yes

b. No

27. Do you apply IPM at your farm?

a. Yes

b. No

28. (If yes) What the IPM techniques do you apply at your farm?

a. Pruning off branches

b. Use insect traps

c. Use of biocides

29. How do you treat waste?

a. I throw every where

b. I collect to burn

c. I collect and classify

30. Do you use safety clothing when spraying pesticide?

Boot

Gloves

Safety clothing

Mask

Hat

Glasses

All

31. Mode of selling product?

a. Exporter

b. Collector

c. Local market

32. Do you keep records?

a. Yes

b. No

33. Do you keep records about?

Growing and harvesting calendar

Chemical & fertilizer stocks

Chemical application records

Fertilizer application records

Sales records

Yield

All

34. Have you ever been trained GlobalGAP standard?

a. Yes

b. No

35. How often have you joined training class?

a. From 2 months

b. Sometimes

36. Have you ever been trained how to grow seedless lime?

a. Yes

b. No

37. How is your awareness of GlobalGAP requirements

Site management

Worker health, safety

Risk assessment

Traceability

Soil map

Waste and population management

Technical service

Environmental protection

Irrigation

Certification

Fertilizer use

Record keeping

Crop protection

Training

38. Do you plan for your farm in the future?

a. I will not comply with GlobalGAP

b. Will continue to grow with GlobalGAP

c. Want to implement GlobalGAP

d. Stop implementing GlobalGAP

**THANK YOU VERY MUCH!**