

Knowledge and Implementation of Good Agricultural Practices among Farmers in Kuala Terengganu, Malaysia

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Abstract Agricultural activities are one of the most important economic generating activities for the people of Kuala Terengganu. However, good agricultural practices that are introduced by the government are less implemented among farmers, despite the expected improvements in the quality of production, economic development, environmental and social well-being. The study was conducted to assess the level of knowledge and practice of farmers that have Malaysian Good Agricultural Practices (MyGAP) certificate. In this study, a total of 30 farmers from 33 who have obtained MyGAP certificates were interviewed by using closed-ended questionnaires. The participants were selected based on the recommendation by Kuala Terengganu Agriculture Officer. The results of this study show that these MyGAP certificate holders did have knowledge and managed to apply the GAP in their farms. This finding is important because with a good knowledge of GAP, the farmers can continuously apply GAP. This finding may be a result of the role played by the extension officer as well as the nature of the farmers themselves. Nevertheless, improvements need to be made from time to time so that the production of agricultural products will be at the optimum level in terms of quality and quantity.

Keywords Sustainable Agriculture, GAP, Food Safety, Pesticide Usage

1. Introduction

Over the years, perhaps due to a lack of knowledge, information and skills, farmers in Malaysia still practice conventional farming systems where the sustainability aspects in agriculture are not taken seriously nor given any emphasis. Farmers tend to focus on how to increase their returns and profits, in addition to the state of the nation's economic level, capital constraints, and other issues. The use of chemical fertilizers and pesticides in conventional agriculture is proven to increase agricultural yields. However, without proper control, this practice will have a negative impact on the environment and human health in the long term. Currently, it is estimated that 2 million tons of pesticides have been used worldwide [1] and it is estimated to continue to increase to 3.5 million tons in 2020 [2]. This situation occurs because of a lack of awareness of the negative effects of chemicals and pesticide used in the long term to the environment, including the impact of the agricultural activities itself on biodiversity and ecological diversity. Chemical waste from agricultural operations can cause environmental damage, including soil and water pollution, and is harmful to human health.

The National Agrofood Policy 2021-2030 (NAP 2.0) focuses on a future food system that is sustainable, nutritious, guarantees food safety and has the potential to increase the income of food producers along the food chain. One of the NAP 2.0 strategies is to ensure that agricultural practices can be improved by maintaining biodiversity and avoiding pollution and damage to the environment [3]. Food safety is very important because of its impact on human health, contributing to growth in domestic trade as well as increasing the competitiveness of Malaysian agricultural products in the international market. Food safety hazards from foodborne diseases due to biological, chemical or physical contamination factors may occur at any level of the food chain. Therefore, it is very important to ensure that aspects of food quality and safety start at the farm level. The implementation of MyGAP is one of the latest initiatives by the Malaysian government to ensure that farmers can guarantee the production of food supply that is not only productive, but of good quality and safe. It is also to control and reduce dangers and risks during the production, harvesting and post-harvest processing of crops. Each element of MyGAP needs to be evaluated and validated in terms of documentation, activities, and actual practices on the farm. These elements are divided into mandatory (100% compliance), non-mandatory and encouraged [4].

The farmers' knowledge of the correct practices as defined in MyGAP is vital because this knowledge greatly influences the way they think, make decisions and act. The formation of farmers' knowledge is a complex process and is in part closely related to their area or location [5]. For example, farm workers in North Carolina, USA wear personal protective equipment (PPE) when using pesticides [6]. This implicit knowledge develops in the context and specific characteristics of an area where it is influenced by various sources and shaped by the culture and economy of the area [7].

Nowadays, more consumers are concerned about the safety and cleanliness of plant products, such as the vegetables or fruits that they purchase. The food export and import industry also places great emphasis on food safety, especially in terms of quality, safety, and hygiene. Good Agricultural Practices (GAP) is an implementation that can ensure the safe level of quality, safety, and cleanliness of plant and animal products [8]. In addition, similar GAP certification schemes are also used by many countries, such as GLOBAL GAP in European countries, New Zealand GAP, Japan GAP, Thai GAP, Korean GAP and Indo GAP [9].

The need for such certification schemes is obvious, in light of past experience with lapses in food safety around the world. For example, chili produced in Thailand was restricted from entering European countries due to pesticide contamination [10]. In Malaysia, prohibited pesticide compounds that violated the Food Regulations (1985) were detected in water samples in Cameron Highlands, while in Australia, rock melons were found to

be contaminated with the *Listeria* bacteria that led to several fatalities.

Apart from being able to guarantee the safety of consumers and the environment, crops from farms with GAP status are also found to be more preferred by consumers. Amekawa et al. [11] conducted a study on durian growers in Malaysia and concluded that the application of MyGAP among the growers is largely for export requirements and better profits.

Farmers who register for Malaysian Good Agricultural Practices (MyGAP) certification need to practice the elements outlined therein, which include proper storage, record activities, crop selection, use of insecticides, worker health, post-harvest handling, soil fertilization, packaging, traceability and farm waste management and pollution reduction. This study aims to assess the level of knowledge and practice of farmers that already have MyGAP certificate in the Kuala Terengganu area regarding the Malaysian Good Agricultural Practices. A good knowledge of MyGAP can indicate that the farmers do understand the importance and effect of MyGAP on crop production and are able to continuously apply the GAP system in their farms.

2. Materials and Methods

2.1. Locale of the Study

Kuala Terengganu is the state capital of Terengganu. The city is located at the estuary of the Terengganu River and is known as the Water Coastal Heritage City. The district of Kuala Terengganu, which is the capital of Terengganu state covers an area of 605 km² and has the highest population with 237,000 people compared to other districts. Most of the residents in Kuala Terengganu are Malays and Muslim. Agriculture is one of the most important economic activities in the Kuala Terengganu district. A total of 648 people work as farmers and most of these farmers are involved in the production of fruits and leafy vegetables. This area was selected as it is the capital of Terengganu state and next to Universiti Malaysia Terengganu (UMT). This grant funded by UMT was purposely to transfer the knowledge to the community around UMT. Part of the focus of this grant is for sustainable cities and communities and for good health and well-being. Thus, the researchers took the initiative to organize the MyGAP workshop for the farmers that already have MyGAP certificates to increase their knowledge about MyGAP and will continuously apply the good agriculture practices in their farm.

2.2. Population of the Study

Data of registered farmers in Kuala Terengganu were obtained from the Department of Agriculture. A total of 30 respondents were involved as suggested by the Agriculture Officer and this number represents 91% of the total

respondents with MyGAP certificate. The selected respondents were also asked for their consent and well explained to understand their contribution to this study.

2.3. Data Collection and Analysis

In order to obtain information about the knowledge and application of MyGAP among farmers in the Kuala Terengganu district, a quantitative study using a questionnaire was conducted. The respondents were randomly selected from a list of MyGAP farmers based on the records provided by the Department of Agriculture. The questionnaire was conducted face-to-face, where the selected farmers would answer questions based on the questionnaire that had been prepared and the researchers gave them relevant information to make it easier for the respondents to fill out the question-and-answer form.

The questionnaire includes 3 parts, which are the socio-demographic information of the participants that include the gender, age, level of education, ownership status of cultivated agricultural land, types of crops grown, and courses related to agriculture that they have attended. The second part of the questionnaire is about the participants' general knowledge about MyGAP. The question in this part is a basic and general knowledge about MyGAP that has already been explained by extension agents from the Agriculture Department before they applied for the MyGAP certificate. The third part covers questions about farm practices, fertilizer use, and pesticide use in MyGAP certified farms. The questions in this research instrument have been developed based on the Official MyGAP application form. Parts 2 and 3 are True and False questions about MyGAP. The statement for each question was built to have a solid answer.

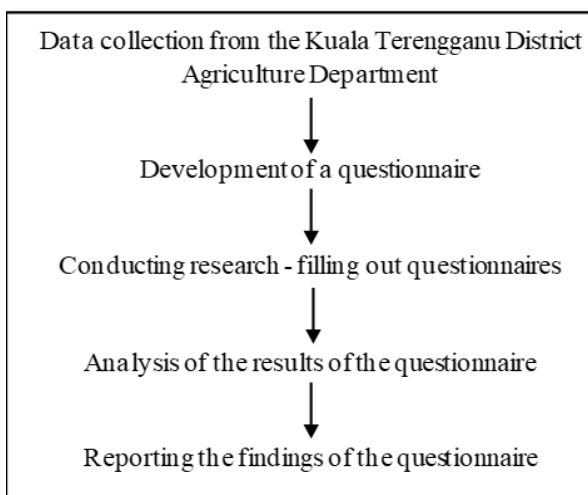


Figure 1. Study Method Flow Chart

Figure 1 shows the flow chart of the research method that was carried out. All the data that were collected from the questionnaire were analyzed to obtain the total percentages

using Microsoft Excel software to see the extent of the knowledge among farmers in the Kuala Terengganu district about MyGAP.

3. Results

3.1. Socio-Demographic Information

Demographic analysis from each participant in Table 1 shows that the majority of the participants are male (86.7%) with an age range of 50 years old and above (56.7%). Among the participants, most of them possess a secondary education level (53.3%) while only a small percentage of the participants had never gone to school (6.7%). Although the participants have different levels of education, most of them grow leafy vegetables (90%) as their main source of income on leased land (63.3%). It was also found that 73.3% of the respondents had attended training related to agriculture.

Table 1. Demographic Profile of the 30 Study Participants

Demographic profile	Frequency (%)
Sex	
Male	26 (86.70)
Female	4 (13.30)
Age (years)	
20-29	5 (16.70)
30-39	7 (23.30)
40-49	1 (3.30)
50 and above	17 (56.70)
Education level	
Did not go to school	2 (6.70)
Primary school	4 (13.30)
Secondary school	16 (53.30)
Diploma/degree	8 (26.70)
Type of crops	
Leafy	27 (90.00)
Fruits	3 (10.00)
Land ownership status	
Lease land	19 (63.30)
Own land	11 (36.70)
Have joined any course related to agriculture	
Yes	22 (73.30)
No	8 (26.70)

3.2. General Knowledge about MyGAP

Table 2 shows the level of knowledge of the participants about MyGAP in general. Of the 13 questions asked in the questionnaire for this section, 6 of them were answered correctly by all participants (100%), namely questions

about the government body that provides MyGAP certification, the purpose and benefits of MyGAP, farm site inspections and auditing by the officials involved, and chemical analysis. 97% of them also know that only permitted pesticide can be used on the farm. Meanwhile, twenty people out of the 30 participants (67%) knew that both self-owned and leased cultivated land can be used to apply for a MyGAP certification while the remaining 33% thought that only self-owned land could be used. In addition, only one (3%) participant knew that a farm with a MyGAP certificate does not reflect the halal status of the cultivated crops. This is the only question that gets the lowest correct answer.

Table 2. Level of General Knowledge on MyGAP among the Participants

General Knowledge on MyGAP	Percentage of Correct Responses (%)
Government body that certifies MyGAP	100
Benefits of MyGAP	100
Objectives of MyGAP	100
Who can apply for MyGAP	90
Rules on land ownership	67
Marketing of farm yield	90
MyGAP performance obligations and costs	80
Benefits of MyGAP on productivity	87
Permitted use of pesticides	97
Farm inspections	100
Auditing process	100
Halal and MyGAP relevance	3
Analysis of pesticides, heavy metals, and microbiology	100

This misconception in general knowledge about MyGAP may be one of the factors that hinders farmers from applying for the MyGAP certification. It is also possible that this general knowledge is known through relatives or close friends and not from authorized sources. Our finding

is aligned with Joshi et al. [12] who found that the level of education among banana farmers in Nepal significantly affects the level of GAP knowledge. In their study, initial training, number of years cultivating banana crops, and male gender were found to increase the level of knowledge about GAP.

3.3. Knowledge and Practice of MyGAP

Based on Table 3, it was found that there is a slight difference between the knowledge possessed by farmers and the actual practices carried out on their respective farms. For farm records keeping on average the level of knowledge of the respondents is 97%, though only 77% update farm records correctly. This may happen due to the farmers encountering difficulty in recording every transaction and activity on their farm because most of the farmers are over 50 years of age. Although knowledge of the farmers involved in this study related to crop selection only shows 90% achievement, all of them were able to choose the right type of crop (100%) that is suitable and meets the current market demands. This may be due to the role played by the Agricultural Officer in helping farmers to make the correct crop selections. Choosing the right type of crop is very important to meet the needs of consumers and the local market. In addition, the correct selection of crops also helps to control soil fertility with proper crop rotation practices.

It was found that knowledge about wastewater treatment is slightly low compared to other categories. This is due to the farmers using clean water sources and not sewage water. Farmers' knowledge and practices on the farm regarding the health of workers who collect, and pack produce and regarding the cleanliness of equipment and produce are at the same level, which is 97%. Knowledge and practices related to these aspects need to be improved because they are very important in ensuring the safety of crop products, avoiding cross contamination and at the same time ensuring the health and welfare of workers. In addition, all the participants (100%) understood the management method of damaged crops and have correctly practiced the knowledge.

Table 3. Level of Knowledge and Practice of MyGAP among Participants

Standard Practice for MyGAP Farm	Percentage of Correct Responses on Knowledge (%)	Percentage of Correct Responses on Practices in Farm (%)
Farm record keeping	97	77
Crop selection	90	100
Crop treatment	97	90
Wastewater treatment	87	70
Worker safety and welfare	100	93
Management of damaged crops	100	100
Health concerns on harvesting and packaging workers	97	97

3.4. Participant’s Knowledge and Practices regarding on Fertilizer Application in MyGAP Farms

Table 4 shows the level of participants' knowledge and practices regarding the use of fertilizers in MyGAP farms. It was found that there is a difference between the average knowledge and practices done by farmers regarding the use of fertilizers in their respective fields. The average knowledge of the participants regarding the use of permitted types of fertilizers is 100%. However, 93% of the participants admitted to using permitted fertilizers use practices while the remaining 7% used unauthorized or unregistered fertilizers. This discrepancy occurs because some farmers are only concerned about obtaining better crop yields and are less concerned about the adverse effects of using prohibited types of fertilizers. Excessive use of prohibited fertilizers can have adverse effects on the environment because it can cause the accumulation of heavy metals in the soil and crop systems [13]. In addition, it was found that actual practices of storing fertilizers also need to be improved because there are some participants who store fertilizers together with fresh produce and pesticides, which are 83% and 80%, respectively. This may be due to financial factors and the size of the land where

the participants do not have enough land to provide a separate space for fertilizer storage.

The correct use of pesticides is very important to guarantee the safety of consumers. Table 5 shows the level of knowledge and practices performed by the participants regarding the use of pesticides in MyGAP farms. Based on the table, it was found that 90% of the participants use pesticides that are allowed while 10% of them are still using illegal pesticides that are not registered in Malaysia. Knowledge about the use of permitted pesticides among farmers needs to be improved to reduce the contamination of pesticide residues in harvested crops, environmental pollution and the effects of harmful chemical pesticides on the farmers' health. The use of pesticides is regulated by the Food Regulations 1985 and the Pesticides Act 1974 [12].

Excessive use of pesticides without following guidelines such as the use of prohibited pesticides, not wearing appropriate personal protective equipment when using pesticides, or not disposing of pesticides and the containers properly can cause problems for human health such as cancers and the environment [14-16]. In Thailand, for example, pesticide residues exceeding the maximum limit by 55 times have been detected on Thai vegetables [17].

Table 4. Participants' level of Knowledge and Practices Regarding the Application of Fertilizers in MyGAP Farms

Knowledge of fertilizer application on MyGAP farms	Percentage of Correct Responses on Knowledge (%)	Percentage of Correct Responses on Practices in Farm (%)
Use of permitted fertilizers	100	93
Fertilizer application record	97	90
Fertilizer storage	97	93
Prohibition of storing fertilizers together with fresh produce	90	83
Prohibition of storing fertilizers with pesticides	83	80

Table 5. Participants' Level of Knowledge and Practices Regarding the Application of Pesticides in MyGAP Farms

Knowledge on pesticide usage on MyGAP farm	Percentage of Correct Responses on Knowledge (%)	Percentage of Correct Responses on Practice in Farm (%)
Application of permitted pesticides	90	90
Pesticide application based on label.	100	93
Records of pesticide application	100	87
Use of Personal Protection Equipment when involved with pesticides	100	100
Prohibition period to collect fresh produce	100	100
Requirement to store pesticides in the original packaging	97	100
Pesticide storage area	100	100
Separation of containers for powder and liquid pesticides	93	90
Safety of pesticide storage	100	90
The need to place signs in the poison storage area	100	93
Emergency information	100	80
Disposal of pesticide containers	100	93
Expired pesticide disposal	100	97

In addition, there are a small number of participants who do not practice the correct methods in pesticide management, including storing pesticides in a safe place (10%), the absence of signs in pesticide storage areas (7%), and the absence of emergency information (20%). Meanwhile, although all the participants know about the proper disposal of containers and pesticides, there is still a small percentage of participants (3-7%) who do not practice it. A previous study similarly found that farmers incorrectly disposed pesticides due to a lack of understanding of its importance and what was done was just to meet the requirements during the inspection by authorities. In addition, an inspection session that only involves a one-time visit causes farmers to return to conventional disposal methods after the inspection [18, 19].

General knowledge about MyGAP is important so that farmers know the importance of this certification in agriculture and further make it easier for them to manage farms according to the system that has been set in MyGAP. In addition to knowledge, awareness about the importance of GAP needs to be increased among farmers. Banzon et al. [20] showed that there are farmers who are not interested in obtaining GAP certification because they feel that the crop products produced can be sold at a premium price without the certification. In Thailand it was also found that the level of GAP application among farmers is very low due to the GAP certification process being too complicated for them because they need to learn new methods that are different from the common practices that they have been doing all this while [21]. In addition, one of the challenges of the implementation of GAP is that farmers refuse to make the financial investment for the implementation of the system and the use of technology for a sustainable agricultural system is a challenging and dynamic issue.

Therefore, in addition to exposing farmers to information, consumers also need to know the benefits of GAP in obtaining quality and safe food sources. This increases the consumer's knowledge and expands the demand for GAP-certified products locally and globally [22, 23], and subsequently increases awareness and good practices by farmers. Although consumers are becoming more aware of food safety issues, there is also a problem of a lack of confidence by consumers towards food safety certification systems such as MyGAP due to several factors, such as a lack of confidence in the inspection and monitoring process by the responsible parties [24]. Consumer demand is an important factor that can influence the implementation of a safe food production system in Malaysia. Therefore, the stakeholders need to ensure that the GAP system is implemented effectively to gain the trust of consumers.

Oo and Usami [25] explained about several factors that can influence farmers' perception of GAP, including the influence of gender, education level, income, and the reception of information about agriculture. Farmers need to be exposed to formation related to the importance of MyGAP implementation to increase the positive perception

of this system in Malaysia. The application of GAP in rice cultivation in Myanmar has produced a safe product in a safe environment [25] using this approach. The implementation of farming activities based on GAP principles will also be able to ensure better quality control of farm produce [26] and further help increase farmers' profits as well as strengthen the sustainability of food sources in Malaysia.

4. Conclusions

In conclusion, having knowledge related to MyGAP rules and practices is significantly important to ensure successful MyGAP implementation among farmers. This study has gathered information on the level of knowledge and compliance to MyGAP among selected farmers from the Kuala Terengganu district. Our finding shows that more than 80% of the farmers have knowledge about MyGAP and can practice MyGAP successfully. However, the actual practice of record keeping such as updating information related to the fertilization system and the pesticides usage is still relatively low among the participants. These findings affirm that frequent lectures and training sessions need to be increased and extended to all farmers in Malaysia, especially in rural areas so that they can realize the advantages of MyGAP to the quality and safety of food produced from their farms. In addition, it is suggested to authorities and farmers to work together to develop a user-friendly, digital record keeping that will help farmers update their farm's data on time to comply with MyGAP requirements.

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