

# Original Research Article

## **Adoption of Good Agricultural Practices (GAP) in Muskmelon Production: Constraints and Opportunities in Sagaing Region, Myanmar**

### **Abstract**

Good Agricultural Practices (GAP) in Myanmar has not yet successfully implemented all around the country, but some farmers and large farm owners now start adopting GAP for fruits production. This study goal was to assess GAP adoption in muskmelon production in Chaung Oo Township, Myanmar. This study used mainly qualitative method and quantitative methods which have helped as a supplement for data analysis. A total of 105 surveys including individual interviews, key informant interviews and focus group discussion, were analyzed by using semi structured interview guide and questionnaires during the period of July to September, 2018. (This para is not required, redundant, may be taken to Introduction)

This study revealed that muskmelon farmers' understanding and awareness on GAP was at a good level but the adoption rate on GAP was still weak. ~~In examining~~ GAP adoption rate for muskmelon production, are highest in highly adopting group ~~followed 10 to 13 guidelines~~, moderate in moderately adopting group ~~followed 6 to 9 guidelines~~ and least in ~~less adopting group followed only 3 to 5 guidelines out of 16 GAP guidelines which are recommended by the Department of Agriculture~~. The adoption of recommended GAP guidelines on muskmelon production was observed positively related with education level of the respondents, farm size, market condition, and extension services for GAP. The difficulty of some GAP guidelines and market condition for GAP products influenced farmers' perception on the adoption of GAP and the change of farmers' GAP understanding in the study area. ~~But, t~~ This study also highlighted that highly adopting group and moderately adopting group got higher price than less adopting group.

**Keywords:** Adoption, Good Agricultural Practices (GAP), Muskmelon, Constraints, Opportunities, Myanmar

### **1. Introduction**

Muskmelon has both domestic and export market, and so, growing area of muskmelon has been increasing in Myanmar. According to Myanmar Fruit, Flower and

Vegetable Producers and Exporter Association (MFVP, 2018), muskmelon is second largest export fruit of Myanmar from 2012 to 2018. Ministry of Commerce (MOC, 2016) reported that Myanmar was the biggest exporter in ASEAN of melons with the export 26,380 tons of muskmelons valued at \$5.3 million and 171,483 tons of watermelons valued at \$18.4 million were exported to China, India, Thailand, Korea, Singapore, Malaysia and Japan.

These days environmental and human' health has been growing related with modern agriculture than before. (requires to modify the language) In a study done by (Oo, 2016) mentioned that farmers' crop production practices have been required to make sure food safety for consumers and workers health. Several countries around the world have adopted Good Agricultural Practices (GAP) standard to ensure safe and high quality products.

Good Agricultural Practices are "practices that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products"(Poisot et al., 2004). According to the study of (Amekawa, 2010) Global GAP standards are broadly accepted by international markets such as EU and USA markets. Several Southeast Asian Countries(ASEAN) have introduced public standards of good GAP intended at increasing the supply of better quality and safe food by promoting more sustainable crop production (Premier and Ledger, 2006).

Good Agricultural Practices (GAP) in Myanmar has been introduced by Ministry of Agriculture, Livestock and Irrigation since 2016(DOA, 2016). The government based on quality and safety standards to position itself in competitive ASEAN markets. The government has provided the extensive training for the farmers and large farm owners to be aware GAP in Sagaing Region, Mandalay Region, Yangon Region and Shan State. According to the current situation, GAP has not yet successfully implemented all around the country, but some farmers and large farm owners are now adopting GAP for fruits production. Totally 52 mango growers and 5 groups of tomato growers were certified GAP in 2016 and 2017. In 2018, number of GAP certified growers are increasing up to 111 growers for 7 crops. There are no previous studies that related with Myanmar GAP for muskmelon production and the influence of some on factors muskmelon farmers decision to adopt GAP.

This study has been conducted to assess GAP adoption in muskmelon production in ChaungOo Township, Sagaing Region, Myanmar. Specifically, the study aimed: to understand stakeholders' perceptions on GAP, to explore the role of various organizations and muskmelon farmers coping with how GAP operated in the study area and to examine factors influencing for GAP muskmelon production.

## **2. Literature Review (This should be part of introduction without giving any titles, should be merged and very crisps).**

### **Decision Making of Improved Production Technology Adoption**

(Rogers, E. M., 2003) defined the adoption process as, the mental process an individual passes from the first hearing of about an innovation or technology to a final adoption. According to (Feder, G., et al., 1985) adoption may be defined as, the integration of an innovation into farmers' normal farming activities over an extended period of time. Adoption process consists of five stages; awareness, interest, evaluation, trial and adoption but the adoption process does not follow these sequences in practice (Rogers, E. M., 2003). The adoption rate will be different with different personal characteristics of the individual (Rogers, E. M., 2003). Adoption depends on a range of personal, social, cultural and economic factors, as well as on characteristics of the innovation itself. Farm technology means agricultural knowledge and skills applied by the farmers to turn their resources into outputs. Technology adoption means the decision to acquire and use a new or improved invention or innovation (Ogada, M. J., et al., 2009).

### **Demands for GAP Products**

According to (Nielsen, 2013), 50 % of consumers around the world are willing to pay higher prices for sustainable food. With the expanding globalization trade, the market demand for quality and safe food become increased. To respond to the increased demand, every country tries to participate in the global market and adopts suitable agricultural methods to upgrade the quality and safety of food. That demand is also an attributed consequence of a better awareness of, and greater access to, information on quality and safe food.

After getting ASEAN free trade agreements (2010), the competitiveness for agricultural exports within ASEAN countries have been growing to trade with GAP certificate. In spite of the rapid integration of developing countries into the world horticultural markets, not all producers and exporters could complete demands from markets related with standards and certification compliance (Krause, H., et al., 2016). EurepGAP-certified Turkish producers have been started to sell their tomatoes at a higher price, having 2.8 times higher per unit area as a net income compared to non-certified ones (Bayramoglu, Z., et al., 2010).

## Impact of Pesticide Use on Human Health

Especially the workers for agricultural farms in many third world countries are illiterate and cannot read pesticides' labels, lack trainings on the safe-usage methods of pesticides and to wear protective clothing, and are unaware on safe storage and proper disposal of residuals (Selvarajah, A. and Thiruchelvam, S., 2007). Inadequate or non-existent storage facilities, poor living surroundings and water supplies polluted with pesticides also affect families' health. In USA, the main environmental and economic sufferers due to the usage of pesticides in public health were 1.1 billion dollars annually (Peshin, R., 2014). According to (Patil, D.A. and Katti, R.J., 2012) research in India, skin troubles are the general health problem related to pesticide use in Shirol region, itching (97.43%), eye-irritation (82.05%), and vision harms were also very common among the respondents. (Pingali, P.L. and Roger, P.A., 1995) reported that farmers' average health cost for pesticides exposing was approximately 40% higher than that for the unexposed farmers.

## Pesticide Utilization in Asia and Myanmar

Pesticides are widely used throughout the world. For increasing the world population and food production, the utilization of high-yielding crop varieties, fertilizer application, irrigation and pesticide application becomes a predominant factor to recent global changes in agriculture. According to (Govindarajan, B. and Prabakaran, V., 2015), the worldwide consumption of pesticides has reached 2.6 million metric tons, 85% is used in agriculture. In Asia, the use of pesticides in agriculture has spread rapidly with an estimated compound growth rate of 4.4% annually since the 1950s (Islam, M.S., et al., 2017). In comparison of pesticide utilization in developed and developing countries of Asia, many developing countries utilized more pesticide in agriculture than developed countries especially in 2009 and 2010 (Kyaw, E.M.T., 2014).

## Environmental Awareness of the Farmers

Environmental awareness is defined as an understanding of natural systems with human social system (Baruah, B.K., et al., 2011). Therefore environmental awareness is one of the challenging issues of environmental protection, sustainability and better achievements in productivity. In Myanmar, the trainings for the farmers on pesticides awareness and soil and nutrient management awareness have been conducted, yet the numbers of participants are just a tiny portion of the farmers in the whole country because the rapid development of agro-chemicals trades and private companies is accelerating the potential to use more chemicals by the farmers due to their advertisement and persuasion.

## Farmers awareness and understanding GAP in Asian Countries

The standards implemented and stakeholders' view is likely to influence social argue and the acceptance of standards and labels so it can highly relate to their understanding and acceptance of standards (Putten, M.C.V., et al., 2006 and 2010). For the new technologies adoption mainly knowledge-intensive technologies, the farmers' knowledge was important (Athipanyakul, T., 2012 and Krasuaythong, T., 2008). The result of (Krasuaythong, T., 2008) was consistent with other studies, which stated that farmers with more knowledge will increase the probability of technology adoption (Athipanyakul, T., 2012 and Praneetvatakul, S., et al., 2007). According to the study of (Buckley, R. and Caple, J., 2007), in promoting the standard procedure for the farmers, which could support the farmers' perceptions of the GAP standards, Thai farmers' conventional farming methods adoption was the challenge for GAP extension services. The GAP extension services limitations and unfavorable market conditions did not encourage the farmers to participate in the GAP theme (Pongvinyoo, P., et al., 2014). The success of collaboration between government and private sectors might encourage the farmers to be aware of the standard which encourages comprehensive implementation. (Srisopaporn, S. et al., 2015) mentioned that frequent contacts with government agencies have a significant impact positively.

## Challenges of GAP

Agriculture is very important in balancing the food security and global population growth rate. At the same time, worldwide agriculture has already been responsible for the conversion of 70% of grassland, 50% of savanna, 45% of temperate deciduous forest, and 27% of tropical forest biome (Foley, A.D., et al., 2011). This represents 38% of Earth's terrestrial surface with the soils most suitable for agriculture already under cultivation. For the reduced opportunity for further land use change, good agricultural land is lost every year to houses building and infrastructures to provide accommodation the growth of the world population and urbanization.

Under such circumstances, the implementation of GAP is truly required for food production in sustainable ways. In doing so, there might be some challenges, financial and technical, on the pathway of GAP implementation. In order to overcome these challenges, international cooperation is one of the important factors controlling the success of GAP implementation.

## Factor Affecting on Adoption of New Technology

Different author and institutions conducted a number of empirical studies on the adoption of agricultural innovation throughout the world. (Loevinsohn, M., et al., 2013) Stated that farmers' decisions to adopt new technology are based by the dynamic interaction between characteristics of the technology itself and the array of circumstances and conditions.

### Farm size

Farm size is an essential factor on the adoption of new technology because agricultural activities take place on it. Numerous studies have reported a positive relation between farm size and agricultural technology adoption ( Madhin, E.Z.G. and Haggblade, S., 2001 and Uaiene, R.N., et al., 2009). Farmers with large farm size were more likely to adopt an improved technology (Mariano, M.J., et al., 2012 and Krishna, V.V. and Qaim, M., 2007). The study of (Uaiene, R.N., et al., 2009) also reported that farmers with large farm size were probably to adopt a new technology as they can afford to give part of their land for trying new technology than other farmer with small farm size. According to (Bac, H. V., et al., 2017) and (Feder, G., et al. 1985), larger farmlands would spread the risk for farmers when applying new production practices.

For instance a study by a group of researchers (Waller, B.E., et al., 1998; Wabbi, J.B., 2002 and Samiee, A., et al., 2009) mentioned that farm size did not influence Integrated Pest Management (IPM) adoption implying that IPM dissemination may take place regardless of farmers' cultivation scale.

### Educational Level

Education is an effective variable for farmers' environmental awareness who are basically educated and it was an important tool governing the adoption of farmer (Senanayake, S.S. and Rathnayaka, R.M.S.D., 2015). Farmers' education background affected their choice of suitable pesticide use methods. Schooling year is positively affected to farmers' GAP perception (Pongvinyoo, P., et al., 2014).

Farmers' education has no significant effect on the initial-stage decision (conversion decision) about whether or not to adopt VietGAP production, because the knowledge acquired by farmers through formal education is fundamental and not relevant to the technical knowledge of farming (Bac, H.V., et al., 2017).

## **Farming Experience**

Farm characteristics are one of important factors in farmers' adoption decisions. (Bac, H.V., et al., 2017) mentioned that in VietGAP tea production, highly aged farmers would prefer conventional farming for tea farms' possessing. (Marine, S.C., et al., 2016) reported that cultivation practices and food safety perspectives for growers' knowledge and on-farm performance of GAP did not differ across production years.

## **Market Condition for GAP products**

(Pongvinyoo, P., et al., 2014) found that the market conditions were not favorable the farmers to adopt GAP procedures because GAP certification cannot be directly used as marketing tools from the dealers side. (Bac, H.V., et al., 2017) mentioned that the price of fresh tea would not be very encouraging for farmers to apply VietGAP standards to tea production.

## **Extension Services for GAP**

Extension services were overworked and had many responsibilities with budget and time limitations (Pongvinyoo, P., et al., 2014). (Amekawa, Y., 2010) found that causes of farmers' low GAP understanding of GAP were due to the practical GAP inspection process and extension services limitation and it led to low practical implementation in the past in Thailand.

### **3. Research Methodology**

The study was carried out in Chaung Oo Township, Sagaing Region where is the main cultivated area of muskmelon production in Myanmar (MFVP, 2019).The study involved 59 respondents, 4 focus groups discussion, 5 government officials from the Department of Agriculture which are mainly responsible for GAP certification, 3 GAP trainers from Myanmar Melon Producer and Exporter Association (MMPEA) under Myanmar Fruit, Flower and Vegetable Producer and Exporter Association (MFVP).

Both qualitative and quantitative research design were used in this study. The study employed mainly qualitative method of data collection and analysis. Both primary and secondary data were used in this study. Primary data such as muskmelon production practices, farmers' demographic characteristics, muskmelon growing area and psychological perceptions related to GAP practices were collected using semi-structured interview guide and questionnaires. The data were analyzed using a thematic approach. Content analysis was also used to present data as verbatim so as to determine the presence of certain words or concepts within texts or sets of texts. Being a qualitative study, quantitative data was used to derive descriptive statistics such as frequencies and percentages.

## **4. Results & Discussion (No sub-headings, rather to be merged and discussed)**

### **4.1. Stakeholders' Perceptions on GAP**

#### **4.1.1. Government Official's Perceptions on GAP**

GAP officials at council level indicated that they think GAP is an important initiative and that they will continue to support it fully in order to bring positive thinking for the success of the initiative. The findings revealed that Myanmar government is focusing on food safety and citizens' health (DOA, 2016) so GAP become one of the government's trends to produce high quality and safe products. From healthy point of view, these days most of the people prefer safe foods thus some GAP crops are getting higher price even in international and domestic markets as well. Public health service can be improved by focusing on GAP as a national development strategy. GAP has positive effects on social and economic welfare for human being.

The respondents mentioned that GAP brought a big change in the whole value chain from producer to customers and it is a good practice for long term agriculture.

#### **4.1.2. Private Organization's Perceptions on GAP**

GAP trainers from MMPEA perceived farmers were willing to follow GAP if the price for Muskmelon would increase so that they would be able to make profits. MMPEA, therefore, thinks that market creation is a key for GAP implementation and need to link up with countries like Singapore, Thailand where muskmelon markets are well established. They believe by making good trade relations; it can stimulate farmers' interest on GAP and may help the country to produce more Muskmelons. Farmers' willingness is one of the basic needs to implement GAP so farmers' interest in GAP is first priority to get targeted modern agriculture and to produce export quality products.

#### **4.1.3. Farmers' Perceptions on GAP**

The findings showed that most of the farmers mentioned that GAP was a necessary practice for farmers to maintain sustainable agriculture and to minimize harm from over dosage use of pesticides because some GAP guidelines help human' health by controlling the ways and usage of pesticides and fertilizers. According to GAP certificate holder perception, GAP is man-kind and honorable but products can get higher price by following it even without GAP certificate. GAP follower rate can be increased by growing GAP demonstration farms in order to improve other farmers' interest. As for the farmers who applied for GAP certificate (not yet given), although China fruit-distributors is still buying Myanmar muskmelons without any certificate, muskmelon markets should be extended by government to other countries with GAP certificate because Myanmar government already known that which countries are willing to buy muskmelon. From some farmers point of view who did not apply for GAP certificates market demand for GAP products played a virtual role in farmers' adoption on GAP. GAP guidelines are not too difficult to follow all as some of them are similar with normal practices that they used before.

## **4.2. Stakeholders' Involvement in GAP**

### **4.2.1. Government' GAP Activities**

Three main GAP activities of Ministry of Agriculture, Livestock and Irrigation were drawing GAP guidelines, delivering GAP training and GAP certification to farmers whose farm was conforming to all GAP guidelines. Myanmar GAP book was prepared based on ASEAN GAP book and discussion results with GAP officials from the government, responsible persons from NGO, MFVP and farmers. GAP training were arranged in the study area and also in other parts of the country. When the farmers apply for GAP certificates, GAP inspection would have been done in their farms by GAP inspector team. If the farmer's farm was conforming to all GAP guidelines, local government would give out GAP certificate.

### **4.2.2. Private sector GAP Activities**

According to this study, the main activity of MMPEA was to connect farmers and government as a linkage especially for GAP and muskmelon production. MMPEA's GAP training were in the villages. MMPEA arranged GAP training in 8 townships including the study area since 2015. By emphasizing these training, it helped in the GAP development and in GAP market creation. It therefore, was trying to create GAP zone in the study area and then they had plan to discuss with government officials, muskmelon dealers from China-Myanmar border trade and some organizations about GAP market.

### **4.2.3. Muskmelon Farmers' GAP Activities**

As for farmers involvement in GAP process were different farmer by farmer. They said different points of views. GAP certificate holder said that farmers' GAP activity might be different because it depends on how many times farmers have attended GAP training, their interest on GAP and their experience. Among them, some farmers applied for GAP certificate but only one farmer got GAP certificate because that farmer seriously follow GAP guidelines. This means only one farmer could follow well GAP guidelines so far. In addition, most farmers' GAP activities were still weak. The further findings of this study revealed that most of the farmers did not try assuredly to follow GAP guidelines. They just followed on what they remembered from training.

#### 4.2.4. Constraints Faced by GAP Instructors

GAP instructors mentioned the constraints they faced about GAP training. The study revealed that GAP guidelines were not difficult to follow but they just needed to make it familiar with the farmers. The government could not support many training because of budget limitation and capacity building to get a number of sufficient GAP instructors all the whole country. Most farmers showed lower interest on GAP training. The farmers interested in GAP market than following GAP practices. Thus the GAP trainers organized the farmers to emphasize the benefits of GAP and to understand what advantages of GAP they would get if they grow muskmelon with GAP. This study revealed that some GAP guidelines were still difficult to follow well because of both the government and private organization could not support personal protective equipments(PPE) suit for spraying and guaranty seeds. Although there were mentioned that guaranty seed shall use in the GAP guidelines, muskmelon seeds without Myanmar language instruction were used by the farmers. Moreover, most of muskmelon dealers bought only the products that they old to the farmers.

#### 4.2.5. Constraints Faced by Farmers to Follow GAP

There also had some constraints for farmers to follow GAP. Soil and water analysis were main constraints for the farmers. It could cost and take time moreover some farmers did not get the results of soil and water analysis on time. If the farmers would follow GAP, they need to take care in every stage of muskmelon production than normal practice in which the farmers were not taking care anything. Mostly the workers did not obey the farmers although the farmers teach about GAP. Some farmers were hoping GAP market by producing muskmelon with GAP but most of them still complained about GAP market without following well GAP. In addition, some guidelines (guideline no. 5 and 14) related to follow GAP together with farmers and workers and unfavorable market condition for GAP products were another constraints for farmers.

**Table 1: Respondents' GAP Adoption in Each Recommended Practice out of 16 Practices (GAP) in Muskmelon (N=59)**

No.	16 Practices in GAP Guidelines	Wholly Followed		Partially Followed		Non-Followed	
		No.	%	No.	%	No.	%

1.	Do not use the field with heavy metal and chemical contaminants	10	16.95	4	6.78	45	76.27
2.	Use the clean water or analyze the water quality	9	15.25	2	3.39	48	81.36
*3.	Use certified seeds from authorized source and seed treatment method	-	-	59	100	-	-
4.	Use the recommended fertilizers and properly composted manure and keep record for them	47	79.66	12	20.34	-	-
*5.	Use the registered agro-chemical products and train the labors about chemical handlings	1	1.69	40	67.80	18	30.51
6.	Well train the labors about crop management practices	58	98.31	1	1.69	-	-
7.	Keep cleaning handling tools, storage materials and containers and keep fertilizers and pesticides separately	46	77.97	13	22.03	-	-
8.	Follow the recommended harvesting and packaging methods	50	84.75	9	15.25	-	-
9.	Use sanitized containers for storage and transportation	58	98.31	1	1.69	-	-
10.	Use the building that designed to prevent access to pests, environmental contaminations, well ventilated and constructed according to national building standards	59	100	-	-	-	-
11.	Restricting animals, including livestock, poultry and pets around the growing areas	57	96.61	2	3.39	-	-
12.	Keep the records related to the Good Agricultural Practices at least a years and use the recommended checklists	12	20.34	23	38.98	24	40.68
13.	Make sure to sign after doing something (fertilizer, chemical, transportation) in order to get recall	22	37.29	22	37.29	15	25.42
*14.	Employers must be well trained in their related works	1	1.69	58	98.31	-	-
15.	Check overall production works and records regularly	23	38.98	20	33.90	16	27.12
16.	Well trained all the labors about personal hygiene and sanitation	1	1.69	53	89.83	5	5.47

**Table 2- Number of GAP Adopters in the Selected Respondents**

Category	Respondents
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<b>Adoption Level</b>		<b>No.</b>	<b>%</b>
Highly Adopting Group	10 and above 10 guidelines	14	23.73
Moderately Adopting Group	6-9 guidelines	38	64.41
Less Adopting Group	5 and less than 5 guidelines	7	11.86
<b>Total</b>		<b>59</b>	<b>100</b>

#### **4.2.6. Farmers' GAP Awareness**

This study also revealed that muskmelon farmers' GAP awareness were good than before. After attending GAP training, GAP was getting one of their topics in the farmer communities. They have noticed how much harmful over dosage use of pesticides and chemical fertilizers to human health and the soil and how important food safety issue because they often saw how many people died and some people were in the hospital because of unhygienic food or products through the televisions, radios and in the GAP training. Most farmers have understood that it was important to maintain their farms because they would still use these farms for their lives. Some farmers made organic compost and used it instead of much fertilizer application. They have known that keeping all records about farming can assist for next growing seasons.

#### **4.3. Factors Affecting the Implementation of GAP**

Large farm owner could afford for soil and water analysis and they are really interested in GAP with their future hope. In this study, there were 35 farmers whose farm size is within 0.4 ha to 3 ha, among them 26 farmers (in percentage is 74.29%) were in moderately adopting group. Besides there were 9 farmers whose farm size is above 9 ha, and within these 9 farmers there were 6 farmers in highly adopting group, then the percentage of highly adopting group for the farm size category of 9 ha + was  $6/9=67\%$ . In addition, there were no farmers in less adopting group in the farm size category of 6.01 to 9 ha and above 9 ha.

According to the survey, only few followers were literate and they attended primary school and middle school. To be more clearly, 16 farmers are graduated, and within these 16 farmers, 10 farmers were in highly adopting group, then the percentage of highly adopting group for this education category of graduate was  $10/16=62.5\%$ . Moreover, there was no farmer in less adopting group in education category of high school and graduated.

There were no special prices for GAP muskmelons. Both the local market price and muse-border trade market price had not influenced the farmers to make a decision to cultivate with GAP guidelines. There was no GAP team for muskmelon in the study area. Moreover, most of extension officials in the study area were not able to train farmers about detailed GAP guidelines and they were mainly oriented towards certain crops such as agro-crops (rice, pea and bean) than to guide GAP and to do GAP training. According to this study, only GAP trainers and inspector team from central government are responsible for the whole Myanmar. Education level, Farm size, market condition for GAP products and extension services were positively related to GAP adoption. (very basic analysis, should be the latest statistical analysis be done)

## 5. Conclusion

The results of this study were confirmed with those of (Dhar et al., 2004; Mariano et al., 2012 and Krishna and Qaim, 2007) farmers with large farm size were more likely to adopt an improved technology. This finding is consistent with (Senanayake and Rathnayaka, 2015). In addition, this study is also consistent with (Myint, 2015; Abdulai and Huffman, 2015; Zhou et al., 2008 and Linn, 2016) that the education level of farmers was mainly affected factor in the adoption process. This study also confirmed with (Bac et al., 2017) and (Pongvinyoo et al., 2014) the market conditions were not engage to follow GAP. This result is also consistent with (Linn, 2016) the more access to extension officials can increase more adoption of hybrid rice because they distribute and teach new technology to the farmer.

In examining the adoption of GAP muskmelon production technology, muskmelon farmers in Chaung Oo Township have not much followed yet on GAP. According to this study, muskmelon farmers' understanding and awareness on GAP were at a good level but the adoption rate on GAP was still weak. However, highly adopting group followed 10 to above 10 guidelines, moderately adopting group follows 6 to 9 guidelines and less adopting group followed 5 and less than 5 guidelines. The result revealed that the adoption of recommended GAP guidelines on muskmelon production was positively related to the education level of the respondents, farm size, market condition and extension services for GAP. This study showed that some farmers who were in highly adopting group and moderately adopting group got higher price than other farmers who did not adopt GAP and were in less adopting group. The difficulty

of some GAP guidelines and market demands for GAP products influenced farmers' perceptions on the adoption of GAP and the changes of farmers' GAP understanding.

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