Producers' Perceptions of Public Good Agricultural Practices and their Pesticide Use: the Case of MyGAP for Durian Farming in Pahang, Malaysia

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ABSTRACT

There have been growing interests in the rise of public Good Agricultural Practices (GAP) standards in Southeast Asia that have been implemented by the governments in the region. This paper examines the local implementation of Malaysian public GAP standard called 'MyGAP' with a focus on producers' perceptions of their participation as well as their on-farm practices for safety assurance. For this objective, producers' perceptions of the benefits and shortcomings of the scheme and their pesticide use practices are examined by comparing the cases of MyGAP certified and uncertified durian farms in the state of Pahang, Malaysia. The research found that the certified farmers see the usefulness of the MyGAP program mainly in the minimum securement of opportunities for exporting their produce, and that overall, certified farms are using significantly less pesticides than those of uncertified farms.

Keywords: MyGAP; public GAP standard; food safety; pesticide use; durian farming; Malaysia

INTRODUCTION

In recent years, the implementation of GlobalGAP and some other private food safety standards has raised the critical question of how to balance out the imperative of safety and quality assurance in the production and consumption of food, and the participation in global value chains of small-scale farmers in the Global South (Amekawa 2013a). For small-scale farmers in developing countries, GlobalGAP requirements for food safety could be too high to meet (Amekawa 2009). It is mainly due to costly investments in valuable inputs like switching to approved pesticides and building long-term structures such as farm toilet and pesticide storage unit (Okello and Swinton 2007). Since the early 2000s, several development aid organizations have reported the tendency of small-scale farms in developing countries to be dropped off or excluded from global value chains (e.g., Asfaw 2007; Mungai 2004; Graffham *et al*. 2007). Around 2010, a series of studies started to examine the impact of GlobalGAP certification on the access to export markets and associated economic conditions of producers in developing countries. Many of them identified the socio-economic attributes or characteristics of GlobalGAP certified farms (in most cases through comparison with the case of uncertified farms); and demonstrated the socioeconomic advantage of GlobalGAP certified farms over uncertified farms (e.g., Asfaw *et al*. 2010; Colen *et al*. 2012; Henson *et al*. 2011; Holzapfel and Wollni 2014; Kersting and Wollni 2012; Kleemann *et al*. 2014; Tallontire *et al*. 2013).

Apart from the conspicuous trend of private global food safety standardization led by GlobalGAP, there is a public stream of food safety standardization in Southeast Asia that seems to garner academic attention (e.g., Amekawa 2009, 2010, 2013a, 2013b; Banzon *et al*. 2013a, 2013b; Islam *et al*. 2012; Mankeb *et al*. 2014; Nicetic *et al*. 2010; Pongvinyoo and Yamao 2014; Pongvinyoo *et al*. 2014; Schreinemachers *et al*. 2012, Srisopaporna 2015). Since the early 2000s, several countries of the Association of South-East Asian Nations (ASEAN) have introduced national public GAP standards with the objective of improving the safety and quality of agricultural produce. This is largely a response to the rapidly increasing levels of agricultural pesticide use in the region, as well as the increasing concerns of foreign and domestic consumers about food safety (Schreinemachers *et al*. 2012). It is imperative that the actual working of public GAP standards in Southeast Asia be studied in light of the original purpose of food safety assurance as well as the broader goals related to the welfare of producers and environmental protection. This is said with special regard to the timing when the regional common GAP standard called 'AseanGAP' is to take effect in 2015, with which each national public GAP standard in the ASEAN region is planned to benchmark.

This paper examines the implementation of Malaysian public GAP standard called 'MyGAP' with a focus on producers' perceptions of their participation in the scheme as well as their practices for safety assurance. The latter is examined by comparing the pesticide use and handling between MyGAP certified and uncertified durian farms in Raub District and Bentong District in the Pahang State of Malaysia. Based on the farm-level case study, it considers what characteristics MyGAP would have in the ASEAN regional context of food safety standardization. The paper is organized as follows: The second section introduces the main features and problems of public GAP standards in Southeast Asia. The third section provides an overview of the MyGAP program. The fourth section discusses research context and methods. The fifth section presents research findings. The sixth and last section provides conclusions.

PUBLIC GAP STANDARDS IN SOUTHEAST ASIA

Table 1 shows the basic information of national public GAP standards in 6 Southeast Asian countries that are currently under implementation, as shown along with GlobalGAP and AseanGAP. While sharing the goal of food safety assurance, public GAP standards in Asean countries encompass varying levels of grower adoption and differing ways of policy implementation. Thailand has the largest public GAP program in terms of the amount of certification. As of August 2015, as many as about 119,000 farms (mostly small-scale), received a Q-GAP certification (Q refers to 'quality'). The crude scale of certification even surpasses GlobalGAP which has wielded a strong influence over global food safety standardization. Compared with the number of certifications of over 220,000 in 2012, however, it has rapidly declined since 2013 when the country introduced the new code of practice (the version TAS 9001-2013), which has made it more difficult for applicant farms to get a Q-GAP certification. The amount of certified farms in the other listed ASEAN countries is much lesser due to different levels of stringency in compliance for certification. By way of illustrating the gap in the level of stringency in compliance, MyGAP requires 95-100% of compliance for 106 control points out of the total of 163 control points (Department of Agriculture, Malaysia 2005); in comparison, out of the total of 116 control points, Q-GAP requires 100% of compliance for 23 control points and 60% of compliance for 41 control points, along with 54 recommended points (Department of Agriculture, Thailand 2013).

Table 1. Adoption of national public GAP standards in selected countries in Southeast Asia as shown with the cases of GlobalGAP and AseanGAP

Country/region	Program	Year of Inception	Number of Certified Farms (year)	Responsible Agency
Europe	GlobalGAP	1999	112,576 (2011)	EurepEuro-Retailers Produce Working Group
Malaysia	MyGAP	2002	313 (2013)	Department of Agriculture
Thailand	Q-GAP	2004	≒220,000 (2012) ≒119,000 (2015)	Ministry of Agriculture and Cooperative
Singapore	SingaporeGAP-VF	2004	7 (2013)	Agri-Food & Veterinary Authority
The Philippines	PhilGAP	2005	15 (2013)	Department of Agriculture
Viet Nam	VietGAP	2008	575 (2013)	Ministry of Agriculture and Rural Development
Brunei	BruneiGAP	2013	1 (2014)	Ministry of Industry and Primary Resources
Asean region	AseanGAP	2015 (planned)	T.B.D.	Asean Secretariat

Source: created through reference to the GAP protocol and direct contact to the agency in charge in Southeast.

In accordance with the significantly limited level of required compliance in Q-GAP, empirical findings suggest that the quality of food safety assurance is compromised. For instance, Schreinemachers *et al.* (2012) compared 45 Q-GAP certified and 245 uncertified farms for a total of 9 vegetable and fruit crops in a watershed of Chiang Mai Province, Northern Thailand, only to find that there are no significant statistical differences between the 2 farmer groups in terms of the amount of pesticides used, methods of pest control adopted, and pesticide handling. Amekawa (2013b) found that 34 of the 64 Q-GAP certified pomelo growers from 2 communities of Chaiyaphum province, Northeast Thailand, showed a lack of understanding of the concept of GAP. In addition, most of those who noted a reduction of their pesticide use around the period of their certification attributed it to the growth stage of pomelo rather than the positive effect of Q-GAP certification.

In view of the current situation where research on public GAP standards lags far behind research on private GAP standards, it is necessary to do further empirical studies on public GAP programs in Southeast Asia; especially with regard to the current practices of food safety and quality assurance in food production. Malaysian MyGAP provides an interesting case in point. The GAP standard has produced the second largest amount of public GAP certification in Southeast Asia even though it is regarded to embrace the relatively strict criteria of standard certification. The reality of the compliance of certified farms with MyGAP standard needs to be examined empirically, however, with regard to its implementation of food safety and quality assurance. As regards producers' pesticide use practices, it is hypothesized in this study that unlike the extant research findings related to Q-GAP, MyGAP certified farms would have significantly better results than those of uncertified farms due to its much higher standard of compliance for certification than those of Q-GAP.

MYGAP IN MALAYSIA

In 2002 the Malaysian government established a public GAP certification scheme for fresh fruits and vegetables called SALM (*Skim Akreditasi Ladang Malaysia*[1)]) or Malaysian Farm Accreditation Scheme) (Islam *et al.*, 2012; Salleh and Osman, 2007; van der Valk and van der Roest, 2009) – the original GAP scheme for MyGAP, along with other GAP schemes for fishery and livestock[2)], SALM was aimed at creating vibrancy within the domestic commercial fresh fruits and vegetables (FFV) sector by promoting "agricultural practices that are environment-friendly, sensitive to workers' welfare and yield quality products that are safe for consumption"

[1] The Malay denotation of the scheme was later changed to "Skim Amalan Ladang Baik Malaysia," carrying the same acronym SALM but with the different meaning of 'Malaysian Farm Certification Scheme for Good Agricultural Practice Scheme' (Othman 2006). The change was deemed necessary because it was realized that "the DoA was in no position to accredit farms complying with the conditions set by the department" (Salleh & Osman 2007: 46).

[2] There were 2 other GAP schemes that were established concomitantly: Malaysian Aquaculture Farm Certification Scheme (SPLAM) by the Department of Fisheries Malaysia and Good Animal Husbandry Scheme (SALT) by the Veterinary Service Department (Othman 2006).

(Robert and Menon, 2007:31). While the Department of Agriculture (DoA) serves as the secretariat for MyGAP, it works in collaboration with various state agencies. Major decisions are made by a steering committee called the National Farm Accreditation Committee (NFAC), which comprises the representatives from various government and government-related agencies (van der Valk and van der Roest, 2009). The Department of Standard Malaysia (DSM) and any agency licensed by the DSM are the agencies that accredit the farms for good agricultural practices (Salleh and Osman, 2007).

In 2005, SALM-certified farms were entitled to use the 'Malaysia Best' logo with their products, which provides them more marketing advantages (Robert and Menon, 2007). In August 2013 the Ministry of Agriculture and Agro-based Industry launched MyGAP (Malaysian Good Agricultural Practices) as the rebranding exercise of the 3 existing GAP schemes established in 2002. Hence, MyGAP emerged as a comprehensive certification scheme for the agricultural, aquaculture, and livestock sectors (Ministry of Agriculture and Agro-based Industry Malaysia, 2014).

The participation of farms in the MyGAP scheme is voluntary. Any individual farm growing crops of relevance to the economy at large and complying with the initial requirements for land tenure, the location of the farm, and water sanitation can apply for it. Upon application registration, the farm is required to conform to a series of requirements meted out for MyGAP certification (Salleh and Osman, 2007). The MyGAP certification for agriculture consists of 16 categorical items, each of which comprises specific rules or conditions based on the Malaysian Standard MS 1784: 2005 – Crop Commodities – Good Agricultural Practice (GAP) (Othman, 2006). The DoA sends to the applicant farm a team of auditors who are normally local DoA officers on the daily basis yet could be officers from the DoA Malaysia from Putrajaya once in 2 years, in order to check if the applicant farm complies with a set of required control points (interview with DoA officers at DoA Raub on 10 December, 2013). Record keeping is one of the most important elements for farm verification. Every farm activity should be recorded for the sake of traceability for the produce or the farm worker (Salleh and Osman, 2007).

Once the results of the verification of farm practices are submitted to NFAC, the produce and the water from the farm are collected and analysed for pesticide residues and heavy metals. The samples are taken 3 times over the production season. The 3 samples must not exceed the defined maximum residue levels (MRL). If any of the samples contain residues above the MRL, then another 3 separate samples will be collected. Confirming that no residues exceed the set MRLs, the MyGAP Committee approves MyGAP certification for the applicant farms. A certification will last for 2 years. Before the end of the term, the farm can reapply for recertification. For these farms, only 1 sample will be required for residue analyses instead of 3 (Salleh and Osman, 2007). The government bears the cost of inspection and residue analysis, providing publicity for promotion (van der Valk and van der Roest, 2009).

RESEARCH CONTEXTS AND METHODS

According to the DoA Malaysia, of the total national certifications of 313 in 2013, durian comprised the second largest number of certifications after rice. Since our focus for this study was FFV, we chose durian for the target crop for this research. As of July 2013 there were 21 certified durian farms in Pahang State, out of which 19 were interviewed[3)]. The certified farms were contacted for interview with assistance by local DoA officers and using the local official DoA directory of MyGAP certifications for durian in Raub District and Bentong District. For the purpose of comparison, 57 uncertified durian farmers were also interviewed so that the number of interviewed uncertified farms could triple that of interviewed certified farms. Reflecting the regional pattern of durian production in the state of Pahang, the majority of farms interviewed were located in Raub District, the most prosperous durian production district in Malaysia. In addition, 1 certified and 3 uncertified farms were located in Bentong District (Fig. 1).

[3] Two certified farms were excluded from this research as they were the DoA experimental farms operating on the public basis.

Fig. 1. Map of Pahang State, Peninsular Malaysia

Source: Ramam *et al.* (2007)

Raub comprises 7 *mukim* (territorial divisions), namely Batu Talam, Sega, Semantan Ulu, Dong, Ulu Dong, Gali, and Tras, in the total area of 2,269km². All the areas of the district are dominated by Chinese population except for 2 villages such as Kampung Jeru and Sungai Pasu, where the majority of the population including durian farmers is Malay. The main crops grown in this area include rice, durian, cocoa, oil palm, and natural rubber.

Certified farms were identified in 6 areas including Sungai Klau, Sungai Ruan, Sungai Chetang, Pekan Cheroe, Tras, and Raub Trade Center. Uncertified farms were identified in these areas for interview. With no available official residential information of uncertified farms along with the limited available span of data collection, however, it was not possible to implement a systematic random sampling. Instead, with the help of local DoA officers, the data collectors relied on several local producer groups for snowball sampling in addition to sporadic farm visits. To avoid a sampling bias, only farms with the size of durian orchard between 1 and 10 ha were called for interview. Another criterion for the selection was to focus on those uncertified farms who had never applied for MyGAP at the time of the research. The interviews were conducted by Chinese and Malay speaking research assistants in January and July 2013.

The survey questionnaire form was organized into 7 sections: 1. Basic farm characteristics; 2. Economic and financial aspects of the farm; 3. Perceptions of MyGAP policy and certification; 4. Training and processes for obtaining certification (for certified farms only); 5. Experiences of audit (for certified farms only); 6. Pest and crop management; and 7. Pesticide use and handling. The majority of certified farms comprise a farm manager who is the owner of the farm and 1 or 2 employed workers for on-farm practices, while most of the uncertified farms were run by a farm manager and 1 or no farm worker. Most of the workers are migrant Indonesians, followed by migrant Burmese and local Malaysians. The farm manger was interviewed on 1 ~ 5 sections (the manager of the uncertified farm was focused on 1 ~ 3 sections only), whereas the worker was interviewed on 1, 6, and 7 sections of the questionnaire. In interviewing individual farmers, notes were taken on the structured question form and all the interviews were tape-recorded. The length of an interview was around 60 minutes. Part of the obtained data was structured into the database file and used mainly for quantitative analysis. Data collectors also recorded any conspicuous qualitative information in the form of a descriptive summary, at times with direct quotes of the interviewees' remarks as translated into English.

RESULTS

Farmers' adoption of MyGAP

The total land size of certified farms is nearly 90% larger than that of uncertified farms. One certified farm holds a predominantly large farmland of 42.1 ha (out of which 14.5 ha is used for durian farming), while the land size of the rest of certified farms is 14 ha or less. Excluding the farm with 42.1 ha of land, the average size of certified farms shrinks to 5.4 ha. The total durian farm size of certified farms is nearly 60% larger than that of uncertified farms, with the number of employed workers of certified farms being 40% more than the latter (Table 2). This gap in the durian orchard size may be related to the general incentive of export farming for the adoption of MyGAP since agricultural export generally requires more economic scale than domestically-oriented transactions (Johnston and Mellor, 1966). The average number of employed workers on certified farms appears nearly 3 times larger (3.3 versus 1.2, for certified and uncertified farms, respectively). However, if a certified farm with 30 employed workers (who work on the planting of not only durians but also several other crops) is excluded, the number declines to 1.7. Seventy-nine percent of certified farm managers have secondary education or higher while 57% of uncertified farm managers had primary education or less. Such an observed superiority in the educational background of certified farms over uncertified farms seems to conform to the observations in some literature of good agricultural practices (e.g., Asfaw *et al*., 2010; Kersting and Wollni, 2013; Pongvinyoo *et al*., 2014).

Table 2. Background of respondent farms

	Certified	Uncertified
Total number of studied farms	19	57
Farms in Raub	18	54
Farms in Bentong	1	3
Chinese (farm manager)	19	55
Malay (farm manager)	0	2
Male (farm manager)	17	52
Female (farm manager)	2	5
Average number of employed farm workers	3.3	1.2
Total farm land size (ha)	7.4	3.9
Total durian farm land size (ha)	5.7	3.7
Average monthly salary to workers (US$)[a]	346	308
Average total farm expenditure of 2012 (US$)[a]	17,862	6,172
The number of farms whose data of durian produce of 2012 is available	18	47
Average farm durian produce of 2012 (ton)	25.2[b]	17.4[b]
Average durian produce per hectare (ton/ha)	4.4[b]	3.9[b]

[a]1USD was approximately 3.2 Malaysian Ringgit (MYR) at the time of the research.
[b]The results refer only to the farms whose data of annual durian produce are available.

On the issue of why individual farms have decided to participate in the MyGAP program, the majority of certified farm managers (77%) responded that they had decided to apply for MyGAP certification because they expected that once they obtain the certification, they will be eligible to export their produce to overseas markets. This result comes as no surprise because in many cases DoA extension officers tell farmers that MyGAP certification is a minimum requirement for the export of their durian produce. For most durian farm managers, the farm gate price of durian is their utmost concern since durian sales are their main (or only) source of income. Their main goal is to be able to export durians in order to improve their economic conditions. They claimed that it is difficult to negotiate on the prices, however, as middlemen are positioned to play much more powerful roles in controlling farm gate prices by maximizing their profits through selling produce to the market at much higher prices. Apart from economic motives, only 5 farm managers (26%) considered the improvements in food quality assurance as a reason for their participation in the MyGAP scheme. In this regard, a significant gap in the expectations of farmers and local DoA officers was observed. Farmers claimed that economic expectations for MyGAP must be their primary concern of their participation in the food safety program as they make a living based on farming. However, DoA officers seemed to undervalue this point. They complained that farmers do not understand the main objective of the policy which is food quality assurance through conducting good agricultural practices, and that they rather insist solely on economic interests instead.

The primary reason why uncertified farm managers had not applied for MyGAP at the time of research is that they had little or no knowledge about it. Thirty-seven uncertified farm managers (74%) responded that they had never heard about it and thus had no clues for applying for it. Of the 20 uncertified farm managers with some knowledge of MyGAP, 8 managers (40%) pointed to the lack of tangible benefits from MyGAP certification as the reason why they had not applied for the program[4)]. Even though getting a GAP certification has become the necessary condition for farmers to export their produce, simply holding it does not guarantee their feasibility to do so in the sense that other conditions need to be met. Fruit quality (*e.g.*, flavour, size, appearance, *etc*.) is the main consideration of middlemen in sending farmers' produce to the export market.

Farmers' understanding of the basic GAP concept

A critical issue in GAP is related to the extent to which certified farm managers do understand the basic concept and purposes of GAP. The 19 certified farm managers interviewed correctly pointed to food safety as the main goal of the MyGAP policy. This result is in contrast to the findings of Amekawa (2013b) on Q-GAP, where over half of the interviewed 64 certified pomelo farmers failed to identify the policy objective. This discrepancy may be largely due to the contextual difference between the countries in terms of the farm recruitment process for public GAP certification. In Thailand, the officially targeted clusters of small-scale farmers who belong to a producer group are collectively promoted for registration and provided education and training for the GAP program. Although the decisions to participate are still at the hands of the individuals, the opportunities for them to get access to information and resources could be significantly larger than those without a membership of any producer group. This approach seems to solicit a situation where there are farmers, especially old and less educated, who participate in the program rather passively, failing to understand or remember what they have been involved in (Amekawa, 2013b). By contrast, in Malaysia where the number of small-scale farms nationwide is much less and the proportion of those who belong to a producer group is also much less than in Thailand, the farm recruitment process is largely individually-based, and as such, there is not much organizational mechanism for group-led certification. Due to the fact that decisions to participate in the MyGAP program rely significantly on individual farmers, they tend to learn as much as they could, try to comprehend the fundamental concept, and embrace its significance.

[4] In addition, 6 farms (30%) have not applied for MyGAP because they did not know sufficiently about it, and 4 farms (20%) attributed their lack of application to the relatively small size of their durian orchard for export.

Perceived benefits and shortcomings

Perceptions of certified producers about the benefits and shortcomings of MyGAP certification on their farm operation may affect their decisions about reapplication in the next round. Based on the questionnaire response, 10 farm managers (53%) said there are no benefits from obtaining MyGAP certification, followed by 4 managers (21%) who pointed to the acquired export opportunities as a merit of gaining MyGAP certification. Those farms who used to sell durians to overseas markets before GAP certification was officially required for export tend to undervalue the export opportunities acquired through certification. However, those who began to seek exporting of durians after the certification requirements were put in place seem more likely to appreciate a GAP certification as beneficial for their economic goals.

A more specific question on the perceived economic advantages of MyGAP certification was asked to all the interviewed certified farm managers; it was as to whether they consider themselves to have become economically more advantaged, remained the same, or less advantaged after obtaining certification. Sixteen certified farm managers (86%) said their economic status had remained the same. Eight of them attributed the view to the farm gate price exhibiting no changes after they received certification. There were only 3 managers (16%) who pointed to increased economic advantages. They considered the advantages to be related to the export opportunities opened for them via gaining MyGAP certification.

It is interesting to note that the perceived shortcomings of participation in the MyGAP program involved, among others, the burden of complying with certification requirements pointed out by 6 farm managers (32%), followed by 5 managers (26%) who referred to complex management procedures as such. These results appear to be consistent with the results on the question of the most difficult thing to do in attempting to obtain MyGAP certification. Five farm managers (26%) pointed to the difficulty in complying with the requirements for pesticide control and/or passing pesticide residue sample analysis. While seemingly not very significant, this result may suggest an important distinction from Amekawa's (2013b) study of Q-GAP, which found that Q-GAP certified farmers felt virtually no pressure to change their pesticide practices due to its limited levels of required stringency in compliance. MyGAP regulations, on the other hand, would have some measureable effects on changing their behaviours related to pesticide use and control. Another 5 managers referred to the difficulty in following tedious documentation requirements in application and record keeping. A few even confessed regrets in having applied for MyGAP because of the allegedly complicated application procedures required relative to the tangible benefits they have obtained from certification.

DoA support for compliance

Regardless of whether durian producers have applied for MyGAP based on their self-determination or encouragement by others, they need external training to gain an understanding of compliance requirements and acquire necessary skills. Fourteen certified (74%) and 4 uncertified farms (7%) received some kind of training provided by the DoA. With regard to training on the use and handling of pesticides, 9 certified (47%) and 6 uncertified farm managers (11%) responded that they had received training through the DoA. These results indicate that over half of certified farm managers have received neither pesticide training nor have about a quarter of them had any MyGAP training through the DoA. Although the DoA is the main enforcer of MyGAP regulations related to pesticide use, many farm managers were self-reliant on how to abide by the rules and regulations related to certification and pesticide use.

Farmers must know which pesticides are legal and which are not, given that illegal pesticides are readily available at the local market. All the legal pesticides are registered under the Pesticide Act, a law in Malaysia which was first introduced in 1974 and later amended over time to control pesticide use. Eighteen certified (95%) and 44 uncertified farm managers (77%) responded that they are aware of the types of pesticides officially registered under the Pesticide Act. The majority of them (certified 80% and uncertified 53%) referred to agrochemical suppliers as the major source of such knowledge, reflecting the lack of training they have received through the public sector. Farm managers were also asked whether they sought out any advice on

pesticide use from relevant authorities. Of the 13 certified (68%) and 31 uncertified farm managers (57%) who answered that they did, 12 certified (93%) and all the uncertified managers (100%) replied that pesticide suppliers are the main agents they seek advice from. Only 1 certified farm manager and none of the uncertified managers sought advice from the DoA.

Record keeping is a requirement of compliance for MyGAP certification. In the case of GlobalGAP, farms applying for certification are most likely to fail if record keeping has not been practiced properly even when all the other requirements have been met. This is not the case with MyGAP where record keeping comprises only part of many compliance criteria upon which the decisions of the DoA for certification are to be made. Asked about their daily record keeping habits, 11 certified farm managers (58%) said they always keep records while there are 3 managers (16%) who said they never do it. As expected, the majority of uncertified farm managers (77%) never keep record and there are only 7 uncertified managers (12%) who said they always maintain some form of record keeping. While there is limited evidence available, this situation of record keeping of MyGAP certified farms is much better than the case of Amekawa's (2013b) study of Q-GAP, where most of the interviewed 64 certified pomelo farmers ceased to keep records after receiving certification. Farmers' awareness of the importance of record keeping may be significantly different between Malaysia and Thailand. Many Thai farmers certified based on group solicitation may not readily understand what the Q-GAP policy is all about whereas most Malaysian farmers certified on the individual basis may understand the basic principles and requirements of MyGAP well.

Pesticide use

Pesticide use and handling practices comprise an important component of MyGAP as a food safety standard. In the MyGAP code of practice, about 30% of control points are directly relevant to synthetic pesticides. In case those of indirect relevance are included, more or less 50% of control points become relevant, with the control category of Crop Protection comprising the majority of 44 control points related to the use of synthetic pesticides (The Department of Agriculture, Malaysia, 2005).

In the area under study, there are 3 kinds of synthetic pesticides that durian farmers were using: insecticide, fungicide, and herbicide. Not all of the interviewed farms used the 3 kinds altogether but around 40% of farms used either 1 or 2 kinds of synthetic pesticides (Table 3).

Table 3. Pesticide use of respondent farms

Type of pesticide used	Certified (19 farms)		Uncertified (57 farms)	
Insecticide				
The number of farms whose data are available	17	(84%)	48	(84%)
The number of farms who use insecticide	17	(100%[d])	45	(94%[d])
Annual amount of active ingredients (a.i.) per hectare (kg/ha)	1.01[b]		4.04	
Fungicide				
The number of farms whose data are available	15	(79%)	54	(95%)
The number of farms who use fungicide	4	(27%[d])	10	(19%[d])
Annual amount of a.i. per hectare (kg/ha)	0.23[c]		0.25	
Herbicide				
The number of farms whose data are available	14	(74%)	49	(86%)
The number of farms who use herbicide	13	(93%[d])	32	(65%[d])
Annual amount of a.i. per hectare (kg/ha)	0.69[b]		7.26	
All the Pesticides *(Insecticide + Fungicide + Herbicide)*				
The number of farms whose data are available	11	(58%)	36	(70%)
The number of farms who use at least one type of pesticide	9	(82%[d])	34	(94%[d])
Annual amount of a.i. per hectare (kg/ha)	1.42[a]		11.37	

[a] $p < 0.01$, [b] $p < 0.05$, [c] $p < 0.10$; *NS* not significant at 0.01.

[d]The percentage refers to the number of farms who use a particular pesticide in question divided by the number of farms whose data are available.

To test whether MyGAP helps reduce the amount of pesticide use, comparisons of certified and uncertified farms were made in terms of the annual quantity of active chemical ingredients contained in and used for each of the 3 pesticide types, respectively[5]. Of the farms who provided available information, uncertified farms were found to use 4.0 times more insecticide than certified farms ($p < 0.05$). As for synthetic herbicide use, of the farms who provided available information, uncertified farms were using 11 times more than certified farms ($p < 0.05$). Synthetic fungicide tended to be applied to the trees with fungal infections as needed. Of the farms who provided available information, the average amount of fungicide used by uncertified farms was much less than the case of insecticide and herbicide, with certified farms showing a slightly smaller amount of use than uncertified farms. The seemingly tiny difference in the use of fungicide is indeed statistically significant ($p < 0.1$).

Despite the incompleteness of the obtained data, in the comparison of the 11 certified farms and the 36 uncertified farms whose data are available for all the 3 pesticide types, uncertified farms are found to use nearly 4.0 times more aggregated amount of pesticides than certified farms ($p < 0.01$). Despite with the limitations in the sample size for this study, these findings appear to be distinctive from the aforementioned study by Schreinemachers *et al*. (2012), which identified no statistically significant differences ($p > 0.1$) in synthetic pesticide use between Q-GAP certified and uncertified FFV growers in Chiang Mai Province in Thailand.

While certified farms, overall, are found to use significantly less synthetic pesticides than uncertified farms, the former seems to be more convinced of the safety in pesticide use than the latter. All of them expressed the belief that, if properly managed, pesticides are harmless to pesticide applicators, consumers, and the environment. Uncertified farms appear to be more doubtful. Twelve of them (21%) mentioned that, even if properly managed, some levels of harm are unavoidable to pesticide applicators. Nine uncertified farms (16%) expressed the possibility of any harm to consumers even in conducting appropriate pesticide management, and 4 uncertified farms (7%) pointed to such a risk with respect to the environment, respectively.

Non-synthetic, alternative pest management practices could be employed as part of an integrated pest management strategy for the reduction of pesticide use and associated social and environmental costs. There are 6 certified (32%) and 6 uncertified farmers (11%) who use one or more pest management methods other than synthetic pesticides, with a statistically significant difference ($p < 0.05$) (Table 4). Special mention needs to be made of alternative weed management methods. While there are 16 certified farmers (84%) who use synthetic herbicide with a much smaller average amount than uncertified farms, there is only 1 farmer who relies on an alternative weed management method: mechanical weed cutter. On the part of uncertified farmers, there is only 1 farmer who substitutes herbicide use by a non-synthetic method: the manual removal of weeds. This evidence suggests that, while using little or no herbicide, the majority of certified farmers let weeds grow on their own without caring much about the potential adverse ecological consequences such as weed-tree competition over soil nutrients. Many certified durian farmers responded that they are not concerned about weed growth very much since they consider that its negative effects on tree and fruit growth are negligible in the case of durian farming in the region. Further, some explained that many farms are just too large for the amount of labor required for manual or mechanical weeding methods, given that weeds regularly grow in weeks after cutting them. Such methods are considered less efficient than the power of herbicide leading to the elimination of weeds for several months to come.

[5] In these cases, the farms who do not use any kind of pesticides were included in the analysis with a 'zero' value given to the amount of a pesticide used in terms of active chemical ingredients. The active ingredients identified in the use on surveyed farms include: Abamectin, Beta-cyfluthrin, Carbaryl, Chlorpyrifos, Cypermethrin, Deltamethrin, Diafenthiuron, Dimethoate, Fenthion, Imidacloprid, Lambda-cyhalothrin, Malathion, Monocrotophos, and White Oil for insecticide; Benomyl, Difenoconazole, Fosetyl-aluminium, Maneb, Metalaxyl-m, Methomyl, Metiram, Propineb, and Triforine for fungicide; Diuron, Glufosinate-ammonium, Glyphosate isopropylamine, Paraquat dichloride, and Phosphorus acid for herbicide.

Table 4. Alternative pest management by respondent farms

	Certified (19 farms)		Uncertified (57 farms)	
The number of farms who adopt alternative pest management	6[a]	(32%)	6	(11%)
The number of certified farms who use:				
Rodent trap	2		0	
Biological control (birds)	2		0	
Cutting weeds	1		0	
Burning litters	1		0	
Shot gun	0		1	
Wire fence	0		1	
Mesh wire trap	0		1	
Cats catching rats	0		1	
Smoke release to scare pests	0		1	
Biological control (lizards)	0		1	

[a] $p < 0.01$, [b] $p < 0.05$, [c] $p < 0.10$; *NS* not significant at 0.01.

Pesticide handling

Pesticide handling practices of certified and uncertified farms were examined comparatively in terms of selected items covered and not covered in MyGAP guidelines (Table 5). Of the 7 items covered in MyGAP guidelines, all of them present no statistically significant differences ($p > 0.1$) except for item 7 on the possession of a pesticide storage ($p < 0.01$). It should be noted that there is one farm who does not have a storage that specialises in the housing of pesticides even though the farm has been MyGAP certified. With regard to the 7 items that are not covered in MyGAP guidelines, 4 items showed a statistically significant difference (items 9 and 10 for $p < 0.05$ and items 11 and 12 for $p < 0.01$), with all of them in favour of certified farms. In item 8 (the observance of pesticide labels for pre-harvest intervals), the ratio of farms following the practice appears low for both certified and uncertified farms. The results turn out to be misleading because the majority of farms follow their own rules for pre-harvest intervals. Three certified (16%) and 3 uncertified farms (5%) mentioned, however, that they use pesticides as needed while not following any pre-harvest intervals.

Table 5. Pesticide handling of respondent farms

	Certified (19 farms)		Uncertified (57 farms)		t-test
Items covered in MyGAP guidelines					
1. Change clothes after spraying pesticides	18	(95%)	50	(88%)	NS
2. Wear long-sleeved shirt for spraying	18	(95%)	50	(88%)	NS
3. Wear long-sleeved pant for spraying	19	(100%)	55	(96%)	NS
4. Wear mask for spraying	19	(100%)	56	(98%)	NS
5. Take care of wind direction while spraying	18	(95%)	49	(86%)	NS
6. Follow product label to decide on the dosage	10	(53%)	33	(58%)	NS
7. Have a pesticide storage that does not store other things but pesticides	18[a]	(95%)	40	(77%)	
Iterms not covered in MyGAP guidelines					
8. Strictly follow the pre-harvest intervals as prescribed on pesticide labels	5	(26%)	21	(37%)	NS
9. Smoke while spraying pesticides	0[b]	(0%)	4	(7%)	
10. Eat anything while spraying pesticides	0[b]	(0%)	4	(7%)	
11. Drink anything while spraying pesticides	0[a]	(0%)	14	(25%)	
12. Take shower within one hour after spraying	17	(89%)	44	(77%)	NS
13. Change clothes after spraying and as soon as arriving at home	19[a]	(100%)	45	(79%)	
14. Wash clothes used during spraying together with clothes not used for spraying	10	(53%)	25	(44%)	NS

[a] $p < 0.01$, [b]$p < 0.05$, [c]$p < 0.10$; *NS* not significant at 0.01.

Overall, pesticide handling practices of certified farms are better than uncertified farms with 5 of the total 14 items exhibiting a statistically significant difference ($p < 0.05$ or $p < 0.01$). Although a direct comparison may not be appropriate, it should be noted that in the aforementioned Schreinemachers *et al.*'s study (2012), no significant differences in pesticide handling were found between certified and uncertified farms for 7 items[6].

CONCLUSIONS

This study on Malaysia's MyGAP standard has investigated the relationship of safety assurance and farm participation by examining the perceptions of relevant durian farmers and their pesticide use practices in the state of Pahang, Peninsular Malaysia. It was found that the 19 certified farm managers who were interviewed understand the fundamental rationale of MyGAP. The result is clearly different from the finding of Amekawa (2013b) that over half of the interviewed 64 certified pomelo farms did not show an understanding of the food safety goal of Q-GAP. This difference would be related to, among others, the institutional dissimilarity between the 2 programs: the application of small-scale farms for Q-GAP is largely group-led, giving advantage to the farms affiliated with a producer association. The majority of FFV farms in Malaysia are independent from producer groups and their applications for MyGAP tend to be individually-based, thus likely to invite the applications of farms who are sufficiently conscious of the basic intent of the program.

The majority of certified farm managers decided to apply for the MyGAP program because they wished to either maintain or newly open their durian export opportunities through obtaining MyGAP certification, given that a certification is the officially required condition for the exportability of their produce. Farm managers who

[6] The 7 items in Schreinemachers *et al.* (2012) include: 1. Use pesticides in a preventive way (regular spraying); 2. Follow product labeling to decide on dosage to use; 3. Take temperature or radiation into account when spraying; 4. Take wind speed and/or direction into account when spraying; 5. Cover mouth when spraying; 6. Cover arms and legs when spraying; and 7. Take a shower and wash clothes after spraying (p. 524).

used to export durians before a GAP certification became the official prerequisite for export rather take for granted the export opportunities acquired through a MyGAP certification and thus perceive a certification as not very beneficial. Those who began to seek durian export after the certification requirements were put into effect tend to see a certification as more beneficial for their economic objectives.

Regarding pesticide use practices, certified farms are found to use significantly smaller annual amount of pesticides for each kind (insecticide, fungicide, and herbicide) as well as for all the 3 kinds combined. This finding is in contrast to Schreinemachers *et al.*'s (2012) study of Thailand's Q-GAP, which found no statistically significant differences in the annual amount of pesticide use between certified and uncertified FFV farms in Northern Thailand. However, this is within the scope of our expectations as it was hypothesized that MyGAP certified farms would exhibit significantly better results than uncertified farms due to its much higher level of compliance required for certification than the case of Q-GAP. Coupled with the small sample size and limited available data obtained in this study, however, the obtained results should not take an outright acceptance. More studies of MyGAP and other public GAP standards that are implemented in ASEAN countries are definitely needed to gain national- and ASEAN regional-level insights into the official balancing act between food quality assurance and small-scale farm participation.

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