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The Implementation of Good Agricultural Practice among Rice Farmers in Eastern Region of Bangkok, Thailand

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Good Agricultural Practice (GAP) for rice in Thailand is an important measure in order to promote and encourage the quality of rice standard. Recently, the government launched GAP to produce and encourage farmers to implement GAP in their farming. Ladkrabang district located in the eastern region of Bangkok is the third largest rice production area of Bangkok, Thailand. The implementation of GAP in this area accounted for only one-fourth of the total rice farmers. Therefore, the objectives of this study were 1) to investigate farmers' implementation on GAP for rice production in eastern region of Bangkok, and 2) to identify factors influencing farmer's implementation of GAP. The data were collected using semi-structured questionnaires. Purposive sampling was employed to select 230 sample farmers covering five sub-districts of Ladkrabang, Bangkok, Thailand from July to August 2016 for the cropping year 2015-2016. Descriptive statistics -- mean and standard deviation -- were used to analyze farmers' socio-economic characteristics. In addition, binary logistic regression was employed to identify factors influencing GAP implementation. The results of binary logistic analysis indicated that the level of education, farmer-owned lands, and membership of farming organizations significantly influenced on GAP implementation for rice production. The results provided information to relate organizationand to encourage the farmers for improving their rice farming practices in accordance with the GAP for better quality of rice production.

Keywords: Rice farmer. GAP, Good Agricultural Practice, Ladkrabang, Eastern Region of Bangkok

Introduction

The production of rice farming is vital. Good Agricultural Practice (GAP) for rice in Thailand is significantly important for promoting and supporting quality standards. According to the FAO (2003), The GAP applies recommendations and available knowledge to address environmental, economic, and social sustainability for on-farm production and post-production processes resulting in safe and healthy food and non-food agricultural products.

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In Thailand, Good Agricultural Practice (GAP) for rice standard was established from Ministry of Agriculture and Cooperatives, using as a guideline for farmers in their rice cultivation and postharvest practices for food safety at a farm level.

To participate in the Rice GAP program, farmers must have their rice plots registered; after that, on these plots, they have to follow a set of practices listed in the detailed GAP guidelines as presented in Table 1 (Srisopaporn *et al.*, 2015).

Table 1. Inspections for Thailand GAP Rice

	Items	Inspections
1	Water sources	Inspect the surroundings. If there is any risk, verify the water quality.
2	Plantation areas	Inspect the surroundings. If there is any risk, verify the soil quality.
3	Application of pesticides	- Check the record of pesticide application. - Inspect the storage of the pesticides. - If evidence or situation is in doubt of misapplication of pesticide, the produce shall be analyzed for pesticide residues.
4	Quality management in pre-harvest production	- Review the certified document or The record of seed source. - Review the record of soil preparation and off type plant elimination. - Random sampling for off type rice plant in rice field. - In case of any doubts, analyze the paddy for admixing grain. - Review the record for plant damages by pest survey and control. - Review the record of pesticide application. - Visual examination of for weedy rice plant in rice field. - Visual examination of produce for defected grain by disease and insect.
5	Harvesting and post-harvest practices	- Review data record for harvesting and threshing practices. - If necessary, inspect the practices during harvesting and threshing or visual examination of the harvested produce. -If any doubt occurring, take a random sampling of the paddy to test for milling quality. - Review record for harvesting and threshing practices. - Review record of drying. - If any doubt, take a random sampling of paddy to test for moisture and/or milling quality.
6	Transportation, storage and produce collection.	- Review record of packing, transportation and storage. - Inspect equipments, containers, storage and rice collecting room. - Inspect practices for grain storage and collecting handling. - Inspect labeling in storage.
7	Recording and record keeping	- Review the records. - Review code or sign or mark or record of produce source

Source: Thai Agricultural Standard (2008)

There were several recent studies that focused on the adoption and participationof GAP in many countries. For example, in Thailand (Khaengkhan and Khumsoonthon, 2016), based on learning and acceptance using GAP for rice production indicated that if farmers have the knowledge and understanding in details. Srisopaporn *et al.* (2015) found several differences between non-adopters and first-time adopters; the study indicated better pest and nutrient management from Ayutthaya province. Janthong and Sakkatat (2015) studied farmer's adoption on quality management system of rice (GAP) in Wiset Chai Chan district, Angthong Province. Saosama *et al.* (2012) studied factors affecting the adoption of good quality Hom Mali rice production adhering to Good Agricultural Practice of farmers in Borabue district Maha Sarakham province.

From previous research, there still be the lacks of the study in GAP for rice farming in urban areas such as the eastern region of Bangkok. Accordingly, this study focused on rice farmers in the eastern region of Bangkok. However, only few studies investigate the reason of rice farmers to participate in GAP implementation.

Therefore, the objectives of this study were to i) investigate farmers' implementation on GAP for rice productions in the eastern region of Bangkok as well as to identify factors influencing farmer's implementation of GAP, and ii) to provide information for related organizations to encourage farmers to improve their rice farming practices in accordance with the GAP for better rice production quality.

Materials and methods

The study area

The study carried out in five sub-districts: Klongsongtonnon, Klongsamprawet, Lumplathio, Thapyao, and Khumthong of Ladkrabang district representing the eastern region of Bangkok, Thailand (Figure 1).

The eastern region of Bangkok is situated in the central part of Thailand and located between 13°43′24″N, 100°47′3″E. Ladkrabang, as the area of this study, occupies is the third largest rice production in Bangkok and it was announced as one of the five strategic areas for the rice production of Bangkok, Thailand (Bangkok Agricultural Extension Office, 2014).

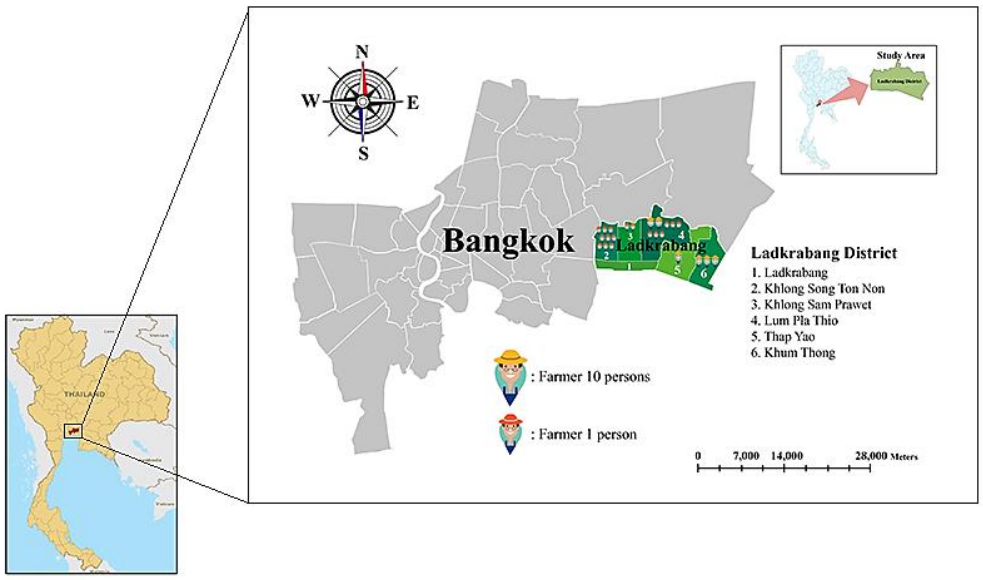

Figure 1. Location map of the study area, Ladkrabang in eastern region of Bangkok, Thailand

Sampling and Sample Size

The purposive sampling technique was employed to select farmers' household that registered with the Department of Agricultural Extension (DOAE) in the cropping year 2015-2016 in Ladkrabang district, Bangkok. As a result, the total number of rice farmers for the survey was 230. The survey was carried out using semi-structured questionnaires from July to August 2016.

Data Analysis

Collected primary data was employed to identify factors influencing GAP implementation and variables. Descriptive statistics including frequency distribution, percentages, means, and standard deviations were used to achieve the first objective, while binary logistic regression was used to analyse to achieve the seoncd objective.

Empirical model

In this study, Binary Logistic Regression (BLR) was employed to investigate the influence of socio-economic variables in the implementation on GAP for rice production, since the dependent variable is binary (i.e. 1

represents GAP implementation for rice production and 0 is for non-GAP implementation). Eight predictor independent variables were regressed against the binary dependent variables of implementation GAP for rice production.

With reference to the theoretical model from Agresti (1996), the model used in the study is specified as below.

$$\text{Ln}\,(P_x/(1-P_x)) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i}$$

Where,

P = Rice farmers implemented GAP for rice production (1 = yes, 0 =no)
1-P = Rice farmers did not implement GAP for rice production
X_1 = Age of the respondents
X_2 = Level of education of the respondents
X_3 = Labor hire
X_4 = Farmer-owned lands
X_5 = Membership of farming organizations
X_6 = Farming experience in years
X_7 = Farm size
X_8 = Participation in agricultural training programs

As per the regression rule, diagnostic tests were carried out to check the heteroscedasticity and multicollinearity problem in the data. Variation inflation factor (VIF) test was carried out to check multicollinearity among variable. Since the VIF value for the dependent variables remained below 10, suggesting no problem of multicollinearity (Khanal and Maharjan, 2013).

To measure the level of awareness, seven GAP criteria based on Thai Agricultural Standard for Good Agricultural Practices for rice were selected which were further divided into sub-criteria within each criterion applicable to rice production system.

Results and Discussion

This section is divided into three parts: socio-economic characteristics of the respondents, the implementation of GAP for rice production of the respondents and factors influencing farmer's implementation of GAP. The detail is as follows:

Socio-economic characteristics of the respondents

The socio-economic characteristics of the respondents are demonstrated in Table 2 comprising of gender, age, level of education, membership of

farming organizations, labor hire, farmer-owned lands, the number of farming experience, farm size in a hectare, and participation in agricultural training programs per year as follows:

The gender of the respondents

Most of the respondents were male (75.22%) who involved in rice production in the study area because the majority of male respondents were the head of households. This finding corresponded to the finding of Saosama *et al.* (2012) that farmers who participated in the jasmine rice good quality rice production project were mostly male.

The age of the respondents

A large proportion of respondent's ages were during 51-65 years old, (53.91%), indicated that old age participants might pose a problem in agriculture because most of agricultural work was physically demanding (Unal, 2008). The median age of the respondents was 54.73 years, which is consistent with the average age of Thai rice farmers.

Level of education of the respondents

Education is an important factor in farm production. Education fastens understanding and adoption of improved technology which in turn increases food production. The result of education level indicated that greater percentage (76.96%) of the rice farmers had maximum education in primary school levels, whilst the least (1.74%) obtained bachelor's degree. This finding implied that most respondents had a low level of education.

Membership of farming organizations

The result exposed that of the total sample, 80.87 percent were members of Bank for Agriculture and Agricultural Cooperative, a secured rural development bank with modern managerial technology and integrated financial services focusing on the uplift of farmers' quality of life (BAAC, 2016).

Labour hire

The result demonstrated that greater proportion of the total respondents (86.96%) hired labor for rice production, since insufficiency of family labor.

Farmer-owned lands

The majority of farmers (82.61%) rented lands for rice production meaning they did not have the ownership of lands.

Farming Experience (years)

The number of farming experience of the respondents was more than 20 years (64.78%); the mean of farming experience was 31.60 years. This may imply that farmers who run their farm for a long time developed their knowledge and skill that might influence and strengthen their perception (Farouque, 2007) also pointed out that experience has evolved from being practical for a long time.

Farm size in hectare

With regard to farm size, based on the category of farm size from Koirala *et al.* (2016) divided into three categories: small (smaller than 1.00 ha), medium (1.00-2.00 ha) and large (larger than 2.00 ha). Of the study areas, 88.00% of respondents occupied large lands with average farm size at 4.91 ha; in the other words, most of respondents were large-scale farmers.

Participation in agricultural training programs (per year)

Approximately 80.87 percent of the respondents indicated that they attended agricultural training programs held by agricultural extension staff ranging from 1 to 5 times per year, or 4.20 times per year on average. This finding was similar to that in Phayakkhaphum Phisai District, Maha Sarakham Province that farmers contacted with agricultural extension staff to encourage the agriculture shares at 4.67 times (Plianpichit, 2011).

Table 2. Socio-economic characteristics of respondents (n = 230)

Characteristics	Frequency	%	Mean	S.D.
Gender				
Male	173	75.22		
Female	57	24.78		
Total	230	100.00		
Age				
21-35	13	5.65		
36-50	57	24.78		
51-65	124	53.91		

Characteristics	Frequency	%	Mean	S.D.
>65	36	15.66		
Total	230	100.00	54.73	11.56
Level of education				
Lower primary	6	2.61		
Primary school	177	76.96		
Junior high school	28	12.17		
Senior high school	15	6.52		
Bechelor's	4	1.74		
Total	230	100.00		
Membership of farming organizations				
Agricultural cooperative	20	8.70		
Leader group	18	7.82		
Farmer group	4	1.74		
Farm women group	2	0.87		
Bank for agriculture and Agricultural Cooperatives	186	80.87		
Total	230	100.00		
Labour hire				
Yes	200	86.96		
No	30	13.04		
Total	230	100.00		
Farmer-owned lands				
Yes	40	17.39		
No	190	82.61		
Total	230	100.00		
Farming experience				
<10 years	29	12.61		
10-20 years	52	22.61		
>20 years	149	64.78		
Total	230	100.00	31.60	17.33
Farm size				
Small (<1.00 ha)	6	2.43		
Medium (1.00-2.00 ha)	22	9.57		
Large (>2.00 ha)	202	88.00		
Total	230	100.00	4.91	2.78
Participation in agricultural training programs (per year)				
1-5 times	186	80.87		
6-10 times	35	15.22		
>10 times	9	3.91		
Total	230	100.00	4.20	2.92

Source: Survey data analysis, 2016

Implementation rice production of respondents:

Provisions concerning requirements and inspections of rice based on Thai Agricultural Standard for GAP have opted which were further divided into sub-criteria within each criterion applicable to rice production system. There are seven main requirements. An example of GAP certified rice paddy farmers in the study area is shown in Figure 2. Farmers insist that GAP for rice production helps farmers to be self-reliant and prevent them from using chemicals.

Figure 2. Example of GAP certified rice paddy farmers in the study area

Entries in Table 3 shows seven items related to the practice level of GAP for rice production in this study. The findings revealed that most of the farmers lacked of "water source" (14%) in item 1. However most of them (95.22%) implemented the "application of pesticides" in item 3.

Table 3. The practice level of GAP for rice production of respondents

No	GAP items	Implement		Not implement	
		Frequency	%	Frequency	%
1	Water sources	32	14.00	198	86.00
2	Plantation areas	37	16.00	193	84.00
3	Application of pesticides	219	95.22	11	4.78
4	Quality management in pre-harvest production	209	90.87	21	9.13
5	Harvesting and post-harvest practices	55	23.91	175	76.09
6	Transportation, storages and produce collection	101	43.91	129	56.09
7	Recording and record keeping	106	46.09	124	53.91

Source: Survey data analysis, 2016

Thai Agricultural Standard (2008) recommended especally “water sources”because water is necessary for rice plantation and has a vital effect to rice yield. Rice should be grown from hazardous-free contamination for instance wastewater from industrial activities in order to improve the quality of rice production. In fact, farmers used water from natural water sources. There may be contaminated from hazardous or prohibited substances. This requirement has not been implemented in rice production.

The requirements of the "application of pesticide" that do not use the hazardous substances which are prohibited for agricultural use. Most of the farmers are aware of this requirement because chemicals are harmful to farmers themselves. Hazardous substances should be applied properly and appropriately, such as application of hazardous substances must follow an instruction specified on an official label authorized by the Department of Agriculture, Ministry of Agriculture and Cooperatives, for example putting on protective clothing to cover their body, of keeping hazardous substances in safety places.

Factors influencing farmer's implementation of GAP

The results from binary logistic regression model revealed factors influencing farmer's implementation of GAP for rice production as presented in table 3. The fit of the data was statistically significant at ($P<0.001$), while the Nagelkerke R^2 was computed as an estimated proxy to R^2 in regression which, according to Norušis (2004), measured proportion of the variation in the response can be explained by the model. In this study, Nagelkerke R^2 of 0.130 was obtained which indicated that most of variations were explained by the model with an overall prediction percentage of 13.00.

The estimated parameter of the model were evaluated at 1% and 5% levels of significance. Three out of the eight independent variables included in the model were significant. This finding included the level of education of the respondents (X_2) which was significant at 1% level, farmer-owned farmlands (X_4) which was significant at 5% level of probability, and membership of farming organizations (X_5) which was statistically beyond 1% level of significance as presented in Table 4.

Table 4. Binary logistic regression analysis of GAP implementation for rice production

Variable	B	S.E.	Wald	df	Sig.	Exp (B)
(X_1) Age of the respondents (years)	-0.308	0.375	0.674	1	0.412	0.735
(X_2) Level of education of the respondents	1.058	0.406	6.784	1	0.009***	2.881
($X3$) Labour hire	-0.634	0.419	2.287	1	0.130	0.531
(X_4) Farmer-owned lands	0.791	0.374	4.472	1	0.034**	2.205
(X_5) Membership of farming organizations	0.999	0.355	7.920	1	0.005***	0.368
(X_6) Farming experience	-0.232	0.353	0.430	1	0.512	0.793
(X_7) Farm size	-0.041	0.299	0.019	1	0.890	0.960
(X_8) Participation in agricultural training programs	0.352	0.266	1.752	1	0.186	1.422
Constant	0.083	0.542	0.023	1	0.879	1.086
-2 Log likelihood	281.940	(P<0.001)				
Cox & Snell R^2	0.096					
Nagelkerke R^2	0.130					

***Significant at p = 0.01, **Significant at p = 0.05
Source: Survey data analysis, 2016.

Among all explanatory variables, level of education of the respondents, farmer-owned lands and membership of farming organizations were significantly related to the GAP implementation of rice production. The level of education would make it easier for households to comprehend negative externalities and passive user values of natural resources. The positive significant coefficient of the level of education indicated its positive influence on GAP implementation in rice production. Similarly, Usman and Dodo (2014) discovered a significant positive relationship between years of formal education and agricultural insurance in their farm. Rice farmers who possessed formal education were expected to give importance to the insurance of agricultural activities and GAP for rice farming to be able to apply for insurance or receive welfare from government agencies. Consequently, GAP certified rice is the development of agricultural commodity and food which is safe and in accordance with standards and reduce the risk of activities from the production of rice as well. According to Falola *et al.* (2014), education significantly enhanced farmer's ability to make accurate and meaningful management decisions; it could also enhance adoption and the use of improved technologies.

Farmer-owned lands

Farmers in the area do not have their own lands, they have to increase productivity of rice farming. Hence, the GAP is the standard of rice production

that can help solve the problem. This finding was consistent with the study of Pandit *et al.* (2017), that landholding was positively correlated with adoption of GAP criterion. As a result, landsholding was significantly associated with the adoption of gap indicating that farmers who owned small lands had more adoption of GAP than those who occupied big lands. Moreover, Singh and Yadav (2014) reported that landholding significantly associated with the level of knowledge and GAP adoption of the farmers of recommended rice production technology. While Saosama *et al.* (2012) dicovered that landownership was one of the factors affecting the adoption of good quality Hom Mali Rice production adhering to Good Agricultural Practice of farmers in Borabue District of Maha Sarakham Province.

Membership of farming organizations

Membership of farming organizations presented a significant and positive effect of (0.005) coefficient, indicating that farmers who were members of agricultural organizations can accquire knowledge from agricultural extension staff, and understand GAP for rice production (Najaroon, 2012). Likewise, Khaengkhan and Khumsoonthon (2016) suggested that grouping of productions can assist farmers to get higher standards. This result may be due to group learning process, learning of management and outcomes, changing of ideas, and solving problems. Moreover, GAP certificate is one of the agricultural extension variables that showed a positive impact on efficiency, reflecting the knowledge that farmers have adopted via agricultural extension activities from agricultural extension staff (Taraka *et al.*, 2012).

Conclusion

Good Agriculture Practices (GAP) for rice production can enable farmers to produce rice under the GAP quality management system by controlling the production system, as well as providing safe and quality products. The benefit from GAP implementation can go to both manufacturers and consumers. The objectives of this study were to investigate farmers' implementation on GAP for rice production in eastern region of Bangkok and identify factors influencing farmer's implementation of GAP.

The findings revealed that most of the farmers lacked of “water source” and most of them implemented the “application of pesticides”. Moreover, tt is crucial to promote and encourage farmers to use appropriate agricultural technologies for farmers' production, such as the presence of non-contaminated water sources, providing knowledge about wastewater treatment for using in

production, and the use of agricultural hazardous substances as suggested by the Department of Agriculture. Staff involving in GAP should encourage farmers to participate in training programs by coordinating agencies together with local rice experts. The finding of binary logistic regression demonstrated that the value of Nagelkerke R^2 (.130) indicated that socio-economic factors could explain GAP implementation for rice productions in this area by 13.00%.

The study exposed that some socio-economic variables had significant influence on GAP implementation for rice productions; therefore, policy makers and planners should aware of farmers' socio-economic variables in the planning and implementation of GAP in order to improve rice productions. Furthermore, the results from this study provided information for relevant organizations to encourage farmers to improve their rice farming practices in accordance with the GAP for a better quality of rice production.

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