

Assessing Malaysian Farmers' Capability, Acceptability, and Practicality toward a Rice Good Agricultural Practices Model

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ABSTRACT

Sustainability and self sufficiency are the essential goals of rice production in Malaysia. The objectives of this study were to develop a rice good agricultural practices (GAP) model and to assess farmers' capability, acceptability, and practicality toward the rice GAP model. A sample of 70 rice cultivators in Mukim Bagan Serai, Kerian District, in the state of Perak, Northern Peninsular Malaysia was selected through a multistage sampling technique determined by the method of Arkin (1974). An interviewing schedule on rice GAP production containing 22 questions of knowledge, 40 statements of attitude, and 35 queries of practice was used for data collection. The results revealed that all respondents had the capability to understand more than 50 percent of rice GAP principles. The majority of respondents had a positive to extremely positive attitude towards rice GAP. They also practiced rice GAP at the average to good level. However, there were some items that farmers could not understand, agree on, or practice that need to be supported by concerned agencies. Therefore, this investigation found that there is greater potential for implementation agencies to establish and promote a rice GAP program with regard to integrated land, water, crop, pest, and harvest management, to promote sustainability and self sufficiency in Malaysia's rice production.

Keywords: rice GAP, Malaysia rice production, knowledge, attitude, practice

บทคัดย่อ

ความยั่งยืนและพึ่งตนเองได้ คือ เป้าหมายสำคัญของการผลิตข้าวในมาเลเซีย วัตถุประสงค์ของการศึกษารังนี้ เพื่อการพัฒนาแบบจำลองระบบ

เกษตรดีที่เหมาะสม และประเมินความสามารถ การยอมรับ และการปฏิบัติของเกษตรกร ตามแบบจำลองระบบเกษตรดีที่เหมาะสมในการผลิตข้าว กลุ่มตัวอย่าง คือ เกษตรกรผู้ปลูกข้าวในพื้นที่ตำบล Mukim Bagan Serai, อำเภอ Kerian, จังหวัด Perak

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ในตอนหนึ่งของประเทศไทย เนื่องจากได้รับการคัดเลือกคุณตัวอย่างแบบหลายขั้นตอน โดยกำหนดขนาดตัวอย่าง ด้วยวิธีของ Arkin (1974) การเก็บรวบรวมข้อมูลเกี่ยวกับการผลิตข้าวอย่างยั่งยืน ใช้แบบสัมภาษณ์ ซึ่งเนื้อหาประกอบด้วย ด้านความรู้ 22 ประเด็น ด้านทักษะ 40 ประเด็น และด้านการปฏิบัติ 35 ประเด็น ผลการศึกษา พบว่า เกษตรกรทั้งหมดมีความสามารถเข้าใจหลักการของระบบเกษตรดีที่เหมาะสม มากกว่า 50 เปอร์เซ็นต์ เกษตรกรส่วนใหญ่มีทักษะดี ถึงค่อนข้างมากกับระบบเกษตรดีที่เหมาะสมของ การผลิตข้าว และมีการปฏิบัติในเรื่องดังกล่าวอยู่ในระดับปานกลางถึงดี อย่างไรก็ตาม พบว่า มีบางประเด็นที่เกษตรกรไม่เข้าใจ ไม่เห็นด้วย และไม่ได้ปฏิบัติเกี่ยวกับเรื่องนี้ ซึ่งหน่วยงานที่เกี่ยวข้องควรให้การสนับสนุน ทั้งนี้ จากผลการศึกษานี้ ชี้ให้เห็นว่า มีความเป็นไปได้สูงในการดำเนินการส่งเสริมการผลิตข้าวตามระบบเกษตรดีที่เหมาะสม โดยคำนึงถึงการจัดการดิน น้ำ พืช และศัตรูพืช และการจัดการการเก็บเกี่ยว เพื่อที่จะให้การส่งเสริมการผลิตข้าวในมาเลเซีย มีความยั่งยืนและพึ่งตนเองได้

คำสำคัญ: เกษตรดีที่เหมาะสมของข้าว การผลิตข้าวของมาเลเซีย ความรู้ ทักษะ การปฏิบัติ

INTRODUCTION

Sustainability and self sufficiency are the essential goals of rice production in Malaysia. At present, Malaysia's self sufficiency level of rice is 73 percent. From the viewpoint of major agricultural policy in Malaysia, Haron (2009) pointed out that in the context of sustainable rice production, the challenges are to feed the growing population and to increase the income of farmers. Many articles in the literature have indicated that rice production in Malaysia is neither economic nor sustainable due to high costs and low productivity; thus, the industry is highly subsidized by the government (Mohd Salim, 2010). In 2008/09, Malaysia's rice productivity was

3.57 t/ha per year, which was slightly higher than Thailand (2.75) and India (3.37), but lower than the world average (4.25) and Asia generally (4.30), Vietnam and Indonesia (4.88), while being very low compared to Japan (6.78), the USA (7.68), and Australia (11.33 t/ha) (International Rice Research Institute [IRRI], 2010).

Malaysia's cultivated area has remained relatively constant at less than 0.7 million ha since 1980s. The land area for rice has also remained rather constant, while productivity has increased from 2.1 in 1961 to 3.7 t/ha in 2010 (IRRI, 2010; Department of Agriculture [DOA], 2011). The rice yield per capita has declined each year from 174.6 kg in 1974 to 86.0 kg in 2010. Therefore, Malaysia needs to increase by at least 106 kg the rice per capita using any means if the country is to become 100 percent self-sufficient by 2015 (Teh, 2010). Otherwise, Malaysia will have to depend on imported rice amounts of around 700,000 to 1 million t/year.

Rice research conducted in Malaysia has concentrated on higher yield and productivity based on basic crop science, plant breeding, and agronomic practices. There are limited studies that have examined rice from the viewpoint of the social sciences such as community empowerment and extension aspects (Johari, 2011). In terms of human behavior such as knowledge, attitude, and practice (KAP), the current literature is strictly limited. Furthermore, improved science and technology itself will never be successful without the participation of farmers who must understand, accept and practice it. Social rice research findings, particularly in aspects of farmers' KAP are important for policy makers and implementation agencies. It is very useful for planning an appropriate strategy to boost rice production towards farmers, public and private participation approaches. Therefore, this study has been conducted based on the following objectives:

1. To develop a rice good agricultural practices (GAP) model based on comprehensive study of the literature, key informants, and an in-depth case study.

2. To measure the level of farmers' capability, acceptability, and practicality toward the rice GAP model.

LITERATURE REVIEW

Good agricultural practice

The concept of good agricultural practices (GAP) has evolved in recent years due to rapid changes and globalization in the food economy. In addition, there has been amplified commitment of stakeholders regarding food production and security, food safety and quality, and agricultural and environmental sustainability. Global agriculture in the new millennium has been faced with three main challenges: (1) to improve food security, rural livelihood, and income, (2) to satisfy the increasing and diversified demand for safe food and other products, and (3) to conserve natural resources (Food and Agriculture Organization [FAO], 2003). It is believed that all these challenges can be tackled by GAP approaches with concrete contributions to the environmental, economic, and social sustainability of farm production.

Malaysia rice GAP

Malaysian rice GAP was introduced on a massive scale in 2001 to implement the "Check Rice" planting system that had been developed and practiced in Australia. The program was named "10 Tons Paddy Project" (Xinhuanet, 2002). According to the Department of Agriculture (DOA, 2008), the project aimed to boost paddy production by up to 10 t/ha and improve rice quality. The system involved more efficient management, scheduled planting and proper monitoring as well as the promotion of technology to farmers. The major goal of this project was to promote GAP in rice production towards efficient inputs. Based on relevant research and technical papers found in Malaysia as detailed by the Malaysia Agriculture Research and Development Institute and the Department of Agriculture (Malaysia Agriculture Research and

Development Institute [MARDI] & Department of Agriculture [DOA], 2008), the Malaysia Agriculture Research Institute (MARDI, 2008) and the Department of Agriculture (DOA, 2006), the focus of technological changes was based on local conditions and chiefly focused on higher yield production technology for farmers to achieve a national target of 5.5 t/ha by 2010 (Ministry of Agriculture and Agro-base Industry Malaysia [MOA], 2008).

Farmer's knowledge, attitude, and practice

The assessment of farmers' KAP is important to understand the level of farmer's performance towards technology promotion. The information from this study can benefit policy making and implementation agencies to improve their plans and strategies for future development programs. According to Escalada and Heong (1997), understanding farmers' practices is important in designing appropriate improvements in GAP. Particularly in pest management, it is crucial to understand why the farmers do the things they do. Referring to FAO (1997), a KAP survey has been used to understand and assess farmers' local indigenous knowledge, values, and belief systems and how they affect their farming practices.

In terms of farmer's KAP towards GAP assessment, Joshi, Matchoc, Bahatan, and Dela Pena (2000) indicated that the method was employed to assess farmers' KAP of rice crop and pest management in three municipalities of the Ifugao Rice Terraces in the Philippines. In Myanmar, Brown et al. (2008) employed the same survey to examine the importance of rodents, farmers' perception towards the causes of yield losses, and their beliefs towards rodent management. The latest similar study was conducted by Stuart, Colin, Grant, and Joshi (2011) in the coastal lowland agro-ecosystems of the Sierra Madre Biodiversity Corridor, Luzon, the Philippines.

In Malaysia, Johari (2011) employed the survey to examine the attitude, knowledge, and

competency factors that may affect the adoption of precision agricultural practice in rice farming in Sawah Sempadan, in the state of Selangor. In another case, Daqi (2010) employed an identical method to collect information related to pesticides used in the Anhui province, southern China. All findings indicated that the useful information gained from the farmers' KAP surveys provided direction to the policy makers and implementation agencies to draw up appropriate policies and strategies toward good agricultural practice.

RESEARCH METHODOLOGY

There were two stages of data collection and analysis in this study. First, the rice GAP model was developed. Data were collected through the literature review, from key informant interviews with rice experts, progressive farmers, rice millers, and officers involved from relevant agencies, followed by in-depth case studies in the nearest rice research station and progressive farmers' plots.

Second, farmers' KAP levels toward the rice GAP model were assessed. The 70 studied samples of rice cultivators in Mukim Bagan Serai, Kerian District, in the state of Perak, Northern Peninsular Malaysia was determined by Arkin (1974) through a multistage sampling technique. The interviewing schedule was developed based on the requirements of each management item in the rice GAP model. The validated questionnaire surveyed each the farmer's personal background followed by 22 questions of knowledge, 40 statements of attitude, and 35 queries of practice. The format of the knowledge questions was multiple choice answers. In addition, five levels of a Likert's scale were used for attitude assessment, while 'Yes' or 'No' replies were employed for the closed-format questions. All interviews and assessments were personally conducted by the researcher from May to October 2010.

Descriptive statistics (arithmetic mean, range, percentage, and standard deviation) were used to

analyze the data. The percentile rank and the T-score formula from the Centre for Teaching, Learning and Technology (Centre for Teaching, Learning and Technology [CTLT], 2011) were also used to determine the capability of farmers towards rice GAP.

RESULTS AND DISCUSSION

Rice GAP model

The rice GAP model in this investigation is the innovation that gathered and upgraded from intensive studies by literature review, key informant interview with rice expertise, progressive farmers, rice millers, officers from relevant agencies followed by in-depth cases study in the nearest rice research station and progressive farmers plot as shown in Figure 1. The model consisted of four main components of rice production technology: integrated land and water management, integrated rice crop management, integrated rice pest management, and integrated harvest management. These concerned sub-items are urgent required from all respondents that they hope to promote as cultivation techniques for rice cultivators in the research site and also in the whole country for sustainable farming.

Knowledge of farmers towards rice GAP

In general, as shown in Figure 2, the findings revealed that most respondents (more than 50%) had capability in terms of correct rice GAP knowledge. The highest corrected knowledge was in integrated harvest management (65.7%), while the lowest was in integrated rice pest management (52.0%). These results indicated that the farmers were knowledgeable in almost all the general items in the rice GAP model. However, looking closely into subcategories, the results indicated that the farmers lacked knowledge in particular on fallow and soil fertility management, planting technique, crop density, and appropriate timing of replanting after seeding.

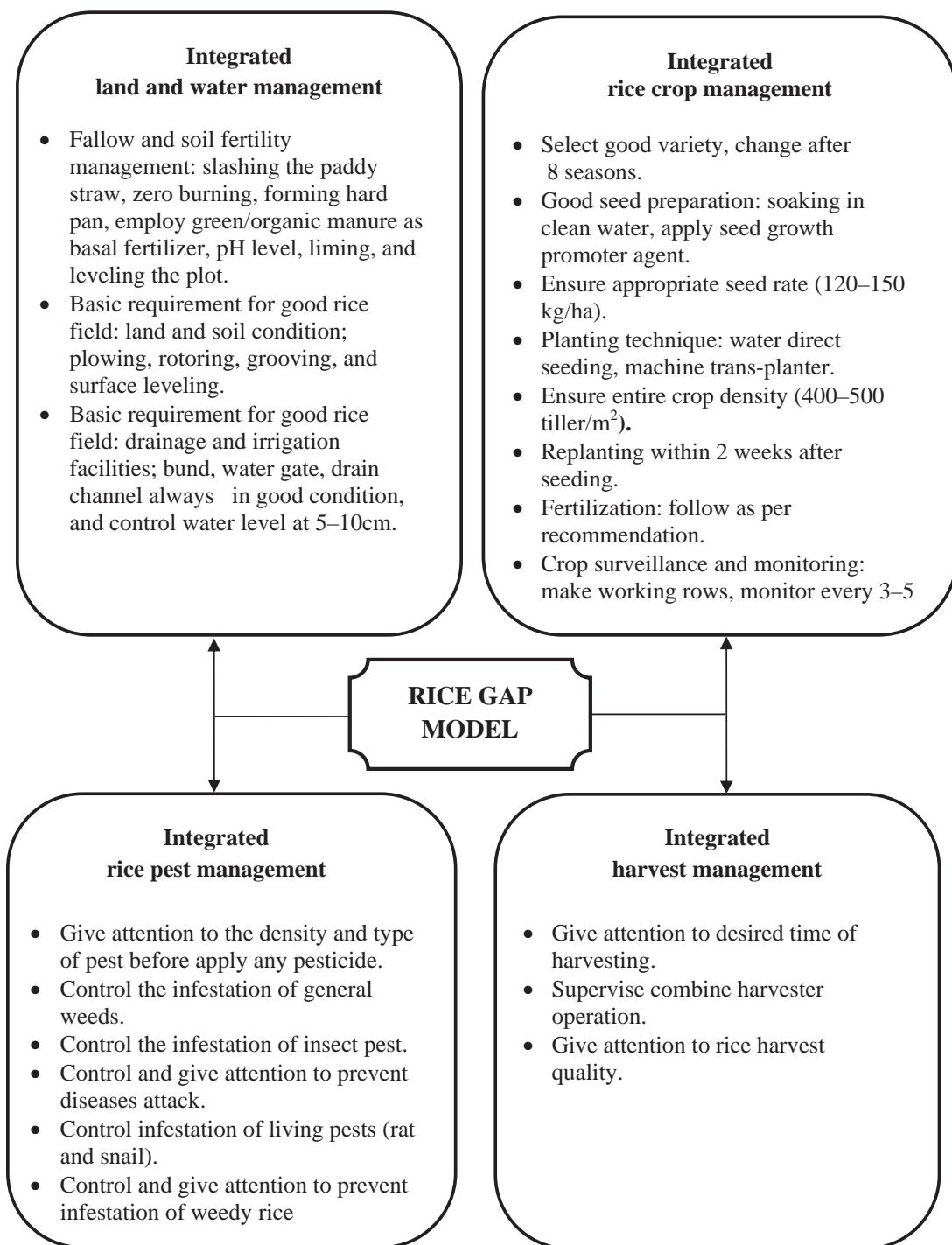


Figure 1 Rice good agricultural practices (GAP) model

The findings also revealed that many farmers still lacked knowledge in terms of integrated pest management, particularly in insect pest and pathogen management. Farmers could not provide answers to questions related to those aspects because they were confused between current practice and that proposed by the GAP model. For example, farmers failed to know that zero burning is the best practice for soil improvement and is also friendly environment. Second, the farmers also did not know that water seeding and transplanting methods are the best practices to eradicate weedy rice. Third, they were not sure of the best crop density for higher yield and the best time for replanting after seeding (in fact, it is considered to be within two weeks, to ensure balanced growth). Finally, for items related to insect pest and pathogen management, the farmers also could not answer well because it seems to be difficult for them to understand the complexity of insect and pathogen interactions and their management.

Regarding the level of farmer's knowledge, Table 1 shows that nearly 80 percent of the respondents' capability was at the moderate (41.4%) and high (37.1%) levels. The result revealed that the majority of farmers here had high capability to understand the concepts and principles of rice GAP. As a result, there is potential for implementation agencies to promote this model due to many farmers

already knowing and understanding the basic principles of rice GAP.

Attitude of farmers towards rice GAP

As presented in Figure 3, most respondents had a positive ($n = 50, 71.4\%$) to extremely positive attitude ($n = 20, 28.6\%$) towards the rice GAP model. The respondents had an extremely positive attitude towards the general principle of efficiency input used and harvest and quality management with average scores of 4.24 and 4.22 percent, respectively. The findings indicated that most respondents tend to have a positive attitude toward all proposed items in rice GAP. Thus, the proposed rice GAP model may have greater potential to be accepted by farmers.

Even though in the general category, all respondent tended to have a good attitude towards rice GAP model, in a few subcategories, there were items where farmers tend to disagreeing. These items were related to practice fallow and fertility management such as zero burning of straw, decomposition, planting legumes for green manure, and practicing water saving techniques. The reasons why many disagreed were because those practices differed from their current practices. Some of them also did not know or had never practiced these activities before. Therefore, the extension agencies should apply more effort to encourage farmers to understand and believe in the benefits of all the

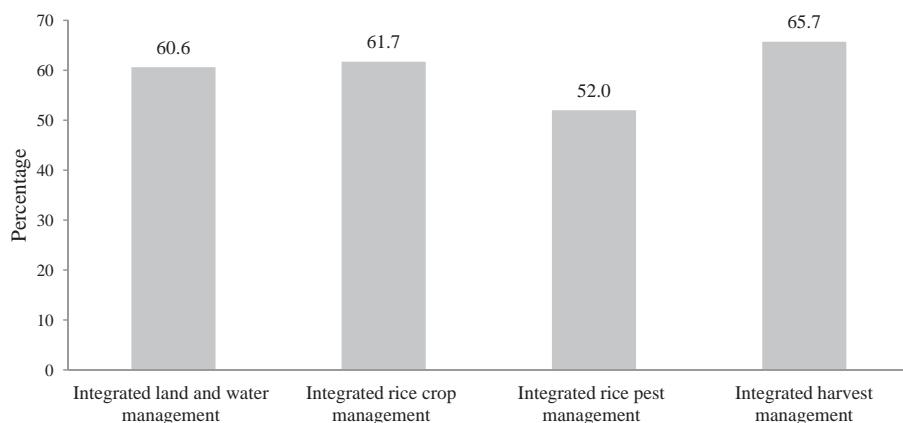
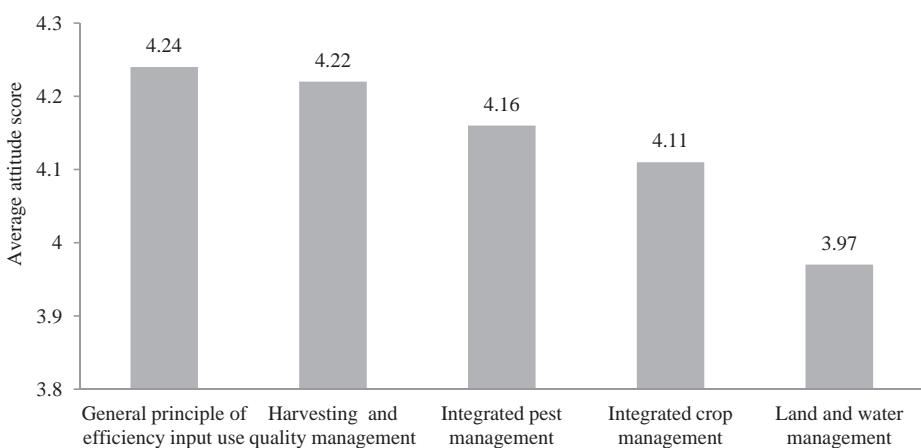


Figure 2 Distribution of corrected knowledge capability toward rice good agricultural practices

**Figure 3** Average attitude score toward rice GAP

Note: Average score 4.21–5.00 = extremely positive attitude; 3.41–4.20 = positive attitude; 2.61–3.40 = average attitude; 1.81–2.60 = negative attitude; and 1.00–1.80 = extremely negative attitude.

Table 1 Level of farmer knowledge in rice good agricultural practices (GAP)

Score	Frequency	Cumulative frequency	Percentile	Percentile rank	T-Score	Level*
19	1	70	96.15	69.71	69.66	High (37.1%)
18	3	69	88.46	68.14	66.30	
17	5	66	80.77	64.57	62.93	
16	8	61	73.08	58.71	59.56	
15	9	53	65.38	50.43	56.20	
14	9	44	57.69	41.43	52.83	
13	6	35	50.00	33.29	49.46	Moderate
12	8	29	42.31	26.71	46.09	(41.4%)
11	6	21	34.62	19.29	42.73	
10	6	15	26.92	13.29	39.36	
9	6	9	19.23	7.29	35.99	Low
7	2	3	11.54	2.43	29.26	(21.5%)
6	1	1	3.85	0.71	25.89	

* Steps to calculate level of farmers' knowledge in rice GAP are (1) determine the range in the score using the maximum–minimum of the T-score ($69.66 - 25.89 = 43.77$); (2) classify into three levels by calculating the interval score ($43.77 \div 3 = 14.59$); (3) low level = minimum of T-score + interval score ($25.89 + 14.59 = 40.48$); (4) moderate level = ($40.48 + 14.59 = 55.07$); (5) high level = ($55.07 + 14.59 = 69.66$)

particular items proposed in the rice GAP model, particularly for items that relate to land and water management.

Farmers practice towards rice GAP

As presented in Figure 4, most respondents practiced rice GAP at a score of average (28.6%) to good (65.7%). Thus, it can be assumed that a majority of the farmers have good skills to perform all the proposed practice items in rice GAP. In general, the results also revealed that most of the farmers practiced more than 50 percent of the proposed tasks and indicated that the majority of farmers have been practicing more than half of the proposed tasks in the rice GAP model. On the contrary, there were some activities in which farmers were reluctant to be involved.

Comparison between farmers' knowledge and practice towards rice GAP

As presented in Table 2, the results of the comparison between farmers' knowledge and practice towards rice GAP can be expressed by three conditions. First, the condition where the farmers absolutely did not know and had never practice it.

The items were: 1) to practice good fallow and soil fertility management including to practice zero burning of paddy straw, decomposition, and applying green manure; 2) to practice good integrated rice crop management including to employ the water direct seeding or transplanting method for eradicating weedy rice, to know the population of tillers and replanting the areas that have not grown within two weeks after seeding to ensure balanced growth; and 3) to practice well integrated pest management, particularly to give attention to checking the density and type of pest before the application of any pesticide.

The second condition covered farmers who actually knew the terms and their importance but they never practiced it. The items were to undertake proper land leveling, check the seed germination rate, apply the fertilizer according to the recommendations, and construct a working row for crop surveillance and better aeration.

The third condition was for farmers who actually did not know about the terms but always practiced them anyway. For example, with pathogen management they prevented diseases by applying fungicide.

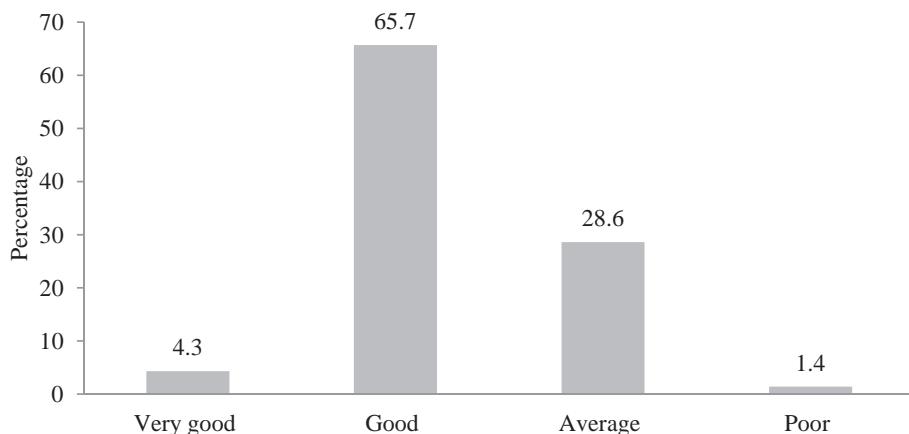


Figure 4 Classification of farmers' practice in rice GAP

Note: Practice characteristics score range (%): Very good = above 80.00; Good = 60.00–80.00; Average = 40.00–59.99; Poor = below 40.00

CONCLUSION AND RECOMMENDATIONS

Based on the findings, the farmers have high capability, acceptability, and practicality towards the rice GAP model. Thus, there is greater potential for concerned agencies to promote the rice GAP program as a model for gearing sustainability and the target of self sufficiency in rice production for Malaysia.

In order to promote the rice GAP program to achieve sustainability and self sufficiency target, the concerned agencies should give attention to in-depth research of local conditions, training and the persuasion of farmers to continue to follow and practice each of the proposed items in the rice GAP model. In particular, items that farmers do not know

about, agree on, or practice are: the zero burning technique, land leveling, green manure, following the seed recommendations and checking seed germination rates, applying fertilizers according to the recommendations, replanting within an appropriate time after seeding, and making working rows. The farmers should be encouraged through hands-on training programs, demonstration plots, and the provision of more incentives to develop motivation and self esteem. In addition, to address and promote the principles of integrated pest management, in particular to improve farmers' understanding of insect, pest and pathogen management, the proposals in the "Rice Doctor" program promoted by the International Rice Research Institute (IRRI, 2009) should be elaborated on and launched as a mentor-mentee program in the rice bowl community of Malaysia.

Table 2 Comparison between farmers' correct knowledge and practice toward rice good agricultural practices

Item	Knowledge score	Practice score
Integrated land and water management		
Fallow and soil fertility management.	✗	✗
Zero burning of paddy straw.	✗	✗
Applying green manure.	✗	✗
Land preparation: leveling the plot.	✓	✗
Integrated rice crop management		
Planting technique: water direct seeding and transplanting.	✗	✗
Crop density: count the number of tiller per square meter.	✗	✗
Replanting: replanting in two weeks after seeding.	✗	✗
Seed preparation: checking seed germination rate.	✓	✗
Seed rate: following the recommended seed rate.	✓	✗
Nutrient management: apply fertilizer according to the recommendation.	✓	✗
Working row: making working row for crop surveillance.	✓	✗
Integrated rice pest management		
Insect pest management: giving attention to check the density and type of pest before pesticide application.	✗	✗
Pathogen management: giving attention to prevent diseases attack.	✗	✓

Note: ✓ refers to either correct knowledge or correct practice score is more than 50%; ✗ refers to either correct knowledge or correct practice score is less than 50%

To achieve success under the recommended actions, the orientation of the rice policy and its implementation should focus more on human capital development, particularly with regard to the young generation. The results of continuous research and development in rice community empowerment and rice GAP technology toward increasing stakeholders' participation also need to be implemented.

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