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Transitioning to sustainable agriculture products in Thailand

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Abstract

The growth in the health food market is now evident. This is because, after the pandemic, people understood the value of their lives and developed the behavior of consuming organic, healthy food for a healthy life. The research objectives of this study were to study consumer behavior toward organic products; to collect data related to the knowledge of farmers, understanding, and attitudes towards organic farming; to study problems of Thai farmers towards organic farming; to study the organic network and organic product accreditation and to study domestic and international organic markets. This study used two research methodologies: documentary analysis and time series analysis. Durian and mangosteen are important in terms of agricultural export values. Therefore, the two important fruits were chosen in this study. There are also lucrative export products throughout Asia, including China, Japan, the Middle East, and Europe, bringing in a hundred billion baht annually. The result showed that consumers demand agricultural products, which emphasize the consumption of healthy food as organic products. Consumers have focused on their health. Farmers involved in crop cultivation or animal husbandry have changed their farming method to an organic one according to the market demand. Farmers could not switch from conventional to organic agriculture overnight, and they had begun with Good Agricultural Practices (GAP) before transitioning to organic farming. The public and private sectors have promoted and supported doing more organic farming. The market demand for organic products has continuously increased. Time series analysis confirmed an increasing trend in agricultural export value. Therefore, this investigation could help as a guideline for those who want to learn about organic agriculture and wish to change their farms to organic agriculture for sustainable income.

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Introduction

Growth in the healthy food market has recently increased due to changes in consumer behavior. Most people have been more interested in taking care of their health and the environment. Therefore, consuming non-toxic food is one of the popular solutions as they believe that good health begins with consuming clean and safe food (ACFS, 2018), especially agricultural products from organic farming, which are widely recognized as quality products that enhance the quality of life. In contrast to the growth in the healthy food market, organic farming has not been as popular among farmers. They believe that organic farming is difficult to do, takes a long time to get products, and has high production costs with low

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productivity. They also lack knowledge and understanding of organic agricultural laws and regulations. These are the reasons why organic products are challenging to find and expensive (DOA, 2018). If farmers are more supported and organic farming is acknowledged, these problems will be solved, and the quality and standard of agriculture will be enhanced. The farmers will also have a stable career, which will help them get a consistent income (DOAE, 2019).

For this reason, the research was interested in studying organic agriculture in Thailand to get information as a guideline to promote organic farming. The research studied the meaning, history, and principles of organic agriculture, including the principles of organic farming in alignment with various organic farming certification aspects (Green Network, 2018). The demand for plant- or animal-based organic products in domestic and international markets has also been studied (Commerce News Agency, 2018). This research could provide information for consumers or farmers who are interested in living a healthy life. It will also help farmers to find alternatives, gather knowledge, and come up with concepts to decide whether they want to proceed with organic farming (Organic Agriculture, 2018). Organic farming provides chemical-free agricultural products, and the farmers themselves are a group of people who directly benefit from being chemical-free to maintain their better health. The research objectives of this study were to study consumer behavior toward organic products; to collect data related to the knowledge of farmers, understanding, and attitudes towards organic farming; to study problems of Thai farmers towards organic farming; to study the organic network and organic product accreditation and to study domestic and international organic markets.

Method

This study used two research methodologies: documentary analysis and time series analysis. Document analysis is a systematic procedure for reviewing or evaluating documents, identifying relevant categories and finally interpreting the body of documents, including quantitative and qualitative components (Bowen, 2009). In this study, secondary data were used. The whole process was performed under the following criteria;

- Analyzing documents that interpret the meaning of organic agriculture. They describe that agriculture is based on natural principles in agricultural areas without pesticide residues. Organic farms must be avoided chemical contamination to soil, water, and air to maintain biodiversity in the ecosystem
- Analyze documents that show many aspects of organic principles, such as health, ecology, fairness, and caring and
- Analyze documents related to organic production processes that align with various organic certifications and how to get accredited for organic products in every step.

Time series analysis is a statistical methodology appropriate for an important class of longitudinal research designs. A time series analysis can help us to understand the underlying naturalistic process, the pattern of change over time, or evaluate the effects of either a planned or unplanned intervention. In this study, the Box-Jenkins method was used to forecast the export value of durian and mangosteen (Velicer et al., 2003).

Durian and mangosteen are important in terms of agricultural export values. Therefore, the two important fruits were chosen in this study. There are also lucrative export products throughout Asia, including China, Japan, the Middle East, and Europe, bringing in a hundred billion baht annually. The King of Fruits, the durian, is a fragrant, sweet, and high-energy fruit. It also has a lot of critical nutrients in it (Paisan et al., 2020). Mangosteen, on the other hand, is referred to as the "Queen of Fruits" because of its exquisite sweet flavor. It can alleviate the symptoms of heat. It aids the system's regular energy burn. It's a fruit continuously increasing demand domestically and abroad (Warangkana, 2017).

This research selected the monthly export value (Million Baht) of Durian and Mangosteen to show the trend of international organic markets. Data were collected from Jan 2015 to Dec 2020 as shown in Table 1. and Table 2. (Thai Customs, 2022).

Forecasting the future has an important role in the management of agriculture. Univariate time series analysis is used to forecast the production and exports of crops or products (Başer et al., 2018). Box-Jenkins method was prominent in

forecasting the monthly export value of durian and mangosteen. The data consisted of 72 months. The assumptions of the method were verified and corrected. The autocorrelation function (ACF) and partial autocorrelation function (PACF) plots determined the models. In general, at least one model or several models passed the assumption in this step, so the chosen model must have the minimum Akaike information criterion (AIC). MINITAB 16 was used for the analysis, with a statistical significance level of 0.05.

Results

Consumers were aware of the importance of consuming safe food

According to data from 2017, the research team discovered that the organic value market was worth 3 trillion baht, with a 20 percent annual growth rate globally. Consumers were aware of the importance of consuming safe food. Therefore, the demand for organic products has been increasing continuously. Consumers worldwide have changed to taking care of more of their health by choosing chemical-free food, including being aware of the environmental problems. These factors affected the growth of the organic market (Maneechoti and Athinuwat, 2019). In Thailand, the demand for organic products has also increased, as more consumers have the knowledge and desire to live a healthy life. The government sector is more aware of the importance of organic market growth.

Knowledge, understanding, and attitude towards organic farming

To support the understanding of agricultural farming, the Ministry of Commerce (MOC) launched the National Organic Agriculture Development Strategy, implemented from 2017-2021, the succeeding issue after the first issue in 2011. This five-year strategy aims to make Thailand the regional leader in sustainable production, consumption, and commerce of organic agricultural products and services to be widely recognized among international consumers. At present, MOC is in the process of moving forward with the strategy and with a roadmap toward four areas, which are to 1) Facilitate research as well as build and promoting knowledge and innovation about organic agriculture; 2) Develop organic products and services; 3) Develop organic marketing, products, and services, together with organic agricultural certification; and 4) Drive organic agriculture due to the increasing demand in the organic agricultural market.

The MOC aims to push organic market value in Thailand to grow by double-digit rates, or by 20 percent per year, from the current market value of 2,700 million baht, which increased by 10 percent. The current market value consists of the export market value of 1,100 million baht, and the remaining is the domestic market value of 1,600 million baht. Predictably, the demand for organic products will continue to increase steadily. In addition to the operation of the MOC, the Ministry of Agriculture and Cooperatives of Thailand (MOAC) has also worked toward increasing organic productivity and encouraging farmers to do organic agriculture, as well as making them understand that the initial investment will not generate much profit. Still, the benefit will be worthwhile and sustainable after three years.

Farmers' adaptation process to organic agriculture

Supplemental farming support or producers to get involved in organic farming certification, such as GAP, to enhance agriculture standards. A survey by the Department of Agricultural Extension under MOC in 2019 showed that farmers were more interested in standardizing farming. Some products were accredited as GAP, which has led them to continue organic development in the long term (Meunchang, 2015). All the data about agriculture in Thailand from 2016 to 2018, which was collected by the research team, was grouped into nine areas regarding the number of farms accredited as GAP, which shows how farmers paid attention to enhancing the quality of agriculture: Area 1 consists of 9 provinces: Bangkok, Chainat, Nonthaburi, Pathum Thani, Phra Nakhon Si Ayutthaya, Lop Buri, Saraburi, Singburi, and Ang Thong; Area 2 consists of 8 provinces: Kanchanaburi, Nakhon Pathom, Prachuap Khiri Khan, Phetchaburi, Ratchaburi, Samut Songkhram, Samut Sakhon, and Suphan Buri; Area 3 consists of 9 provinces: Chanthaburi, Chachoengsao, Chon Buri, Trat, Nakhon Nayok, Prachin Buri, Rayong, Samut Prakan, and Sa Kaeo; Area 4 consists of 11 provinces: Kalasin, Khon Kaen, Nakhon Phanom, Bueng Kan, Maha Sarakham, Mukdahan, Roi Et, Sakon Nakhon, Nong Khai, Nong Bua Lam Phu, and Udon Thani; Area 5 consists of 7 provinces: Trang, Narathiwat, Pattani, Phatthalung, Yala, Songkhla, and Satun; Area 6 consists of 8 provinces: Chiang Rai, Chiang Mai, Nan, Phayao, Phrae,

Mae Hong Son, Lampang, and Lamphun; Area 7 consists of 8 provinces: Chaiyaphum, Nakhon Ratchasima, Buriram, Yasothon, Sisaket, Surin, Amnat Charoen, and Ubon Ratchathani; Area 8 consists of 7 provinces: Krabi, Chumphon, Nakhon Si Thammarat, Phang Nga, Phuket, Ranong, and Surat Thani; and Area 9 consists of 9 provinces: Kamphaeng Phet, Tak, Nakhon Sawan, Phichit, Uttaradit, Phitsanulok, Phetchabun, Sukhothai, and Uthai Thani that shown the number of farms received the Good Agricultural Practices (GAP) between 2016 – 2018 (DOAE 2019) in Figure 1.

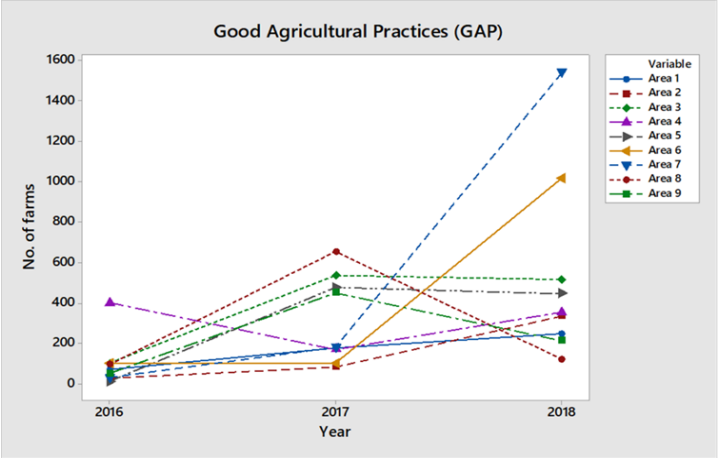


Figure 1. The number of farms that received the Good Agricultural Practices (GAP) between 2016-2018

Figures for the nine areas show that the number of organic agricultural farms accredited by GAP between 2016 – 2018 increased. Therefore, farmers in Thailand have paid more attention to safe farming by reducing the use of chemicals and developing their organic farming for the long term.

GAP accreditation from the Department of Agricultural Extension (DOAE)

The DOAE aims to facilitate and develop farmers' expertise in producing safe and standardized agricultural products. Therefore, it is necessary to upskill farmers in organic agricultural processes to get accredited by GAP to serve the market demand. Farmers need to get accredited by GAP before registering for organic agriculture. According to GAP, due to chemicals accumulating on their farms, they would need to continually reduce or replace them with bio-fertilizer in producing agricultural products.

Key factors driving steady demand for organic products

The following are key factors that naturally drive demand for organic products: 1) Changes in consumer behavior: One-third of global consumers have switched to more organic products. Also, trends toward a healthy lifestyle and environmental conservation increased the demand for environmentally friendly products. Organic products will continue to be a future trend, as seen in the marketing channel change. In the past, organic products were only found in health food stores, farmer's stores, etc., but now organic products have entered the mainstream market, such as the supermarket (Kamolsri, 2017). 2) By exchanging agricultural product protection policies for sanitary and environmental measures, each country began to agree on a free trade zone by reducing taxes and subsidies. These caused each country to become more stringent in non-tax measures, especially in inspecting the number of pesticide residues and the prohibited chemicals used in agricultural products. Therefore, all countries exporting agricultural products adjusted their policies by increasing the production of more organic products. In addition, the government sectors of many countries have incentive measures to motivate farmers to do organic farming. They also supported production, marketing, and consumer behavior research to produce market-demanding organic products. 3) Align organic products in markets to meet the same standards for production, trading, product inspection, and organic product labeling. Although the critical principle in inspecting organic products is to see whether the production process has a chemical, at the same time, each country also has its inspection requirements, so this is one of the main obstacles to expanding the market for organic products. Therefore, the Codex Alimentarius, a collection of international food standards, collaborated with the United Nations (UN), the World Health Organization (WHO), and the International Federation

of Organic Agriculture Movements (IFOAM) to work on standardizing organic products in the world by having the same international standard level. This will help people, especially farmers, to have a clear understanding of organic products.

Trends of organic export products

The trend of organic exports was based on examples of fruits, namely durian and mangosteen. The results are shown in Tables 1. and 2. ; the numbers indicate monthly export values as well as the mean, or average, annual export values for durian and mangosteen between 2015 and 2020. When constructed and considered, a scatterplot of the mean of the two fruits is shown in Figure 2. Both durian and mangosteen show a rapidly increasing trend in the mean export value.

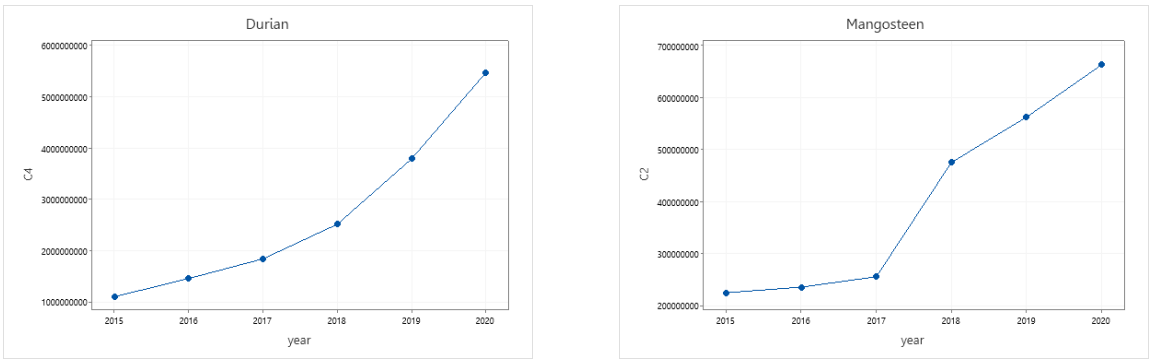
Table 1. Monthly export value of durian from the year 2015- 2020 (Million Baht)

Month	Year					
	2015	**2016**	**2017**	**2018**	**2019**	**2020**
Jan	159.65	299.97	128.54	352.74	668.85	615.78
Feb	210.86	98.67	181.18	415.45	1,580.01	646.23
Mar	401.68	866.77	646.25	1,327.08	3,930.12	6,513.23
Apr	1,575.77	3,199.90	2,484.67	6,823.39	12,809.92	17,332.33
May	2,812.52	2,804.43	7,187.07	4,914.40	4,890.34	15,425.39
Jun	1,818.38	1,664.65	2,572.30	3,764.03	1,796.24	4,581.86
Jul	1,909.85	1,440.50	2,556.10	3,109.49	5,283.52	6,951.34
Aug	2,325.05	2,426.28	3,632.95	5,757.87	9,962.20	3,517.86
Sep	1,206.93	2,697.93	662.04	1,649.42	2,051.51	6,673.76
Oct	338.27	1,522.31	464.99	531.91	684.94	1,779.26
Nov	233.67	309.23	457.56	558.57	375.92	850.98
Dec	253.77	175.12	1,124.79	982.61	1,447.89	743.01
Mean	1,103.87	1,458.81	1,841.54	2,515.58	3,790.12	5,469.25

Table 2. Monthly export value of mangosteen from the year 2015-2020 (Million Baht)

Month	Year					
	2015	**2016**	**2017**	**2018**	**2019**	**2020**
Jan	90.79	98.19	98.74	180.91	231.44	277.19
Feb	74.00	113.43	102.96	127.06	274.91	178.01
Mar	77.72	118.32	249.01	382.82	363.64	541.92
Apr	134.05	174.19	135.84	274.29	369.01	461.80
May	254.63	220.15	192.37	664.08	648.64	492.39
Jun	337.47	257.12	416.00	663.89	340.10	562.87
Jul	393.17	233.78	291.82	602.11	458.00	892.28
Aug	484.96	397.72	517.21	1,007.77	1,571.60	910.25
Sep	326.86	541.13	347.59	761.68	712.53	1,289.05
Oct	199.00	311.90	312.68	410.59	784.05	977.92
Nov	158.10	183.65	216.96	293.30	500.14	761.10
Dec	165.11	175.69	183.74	334.63	493.42	610.47
Mean	224.66	235.44	255.41	475.26	562.29	662.94

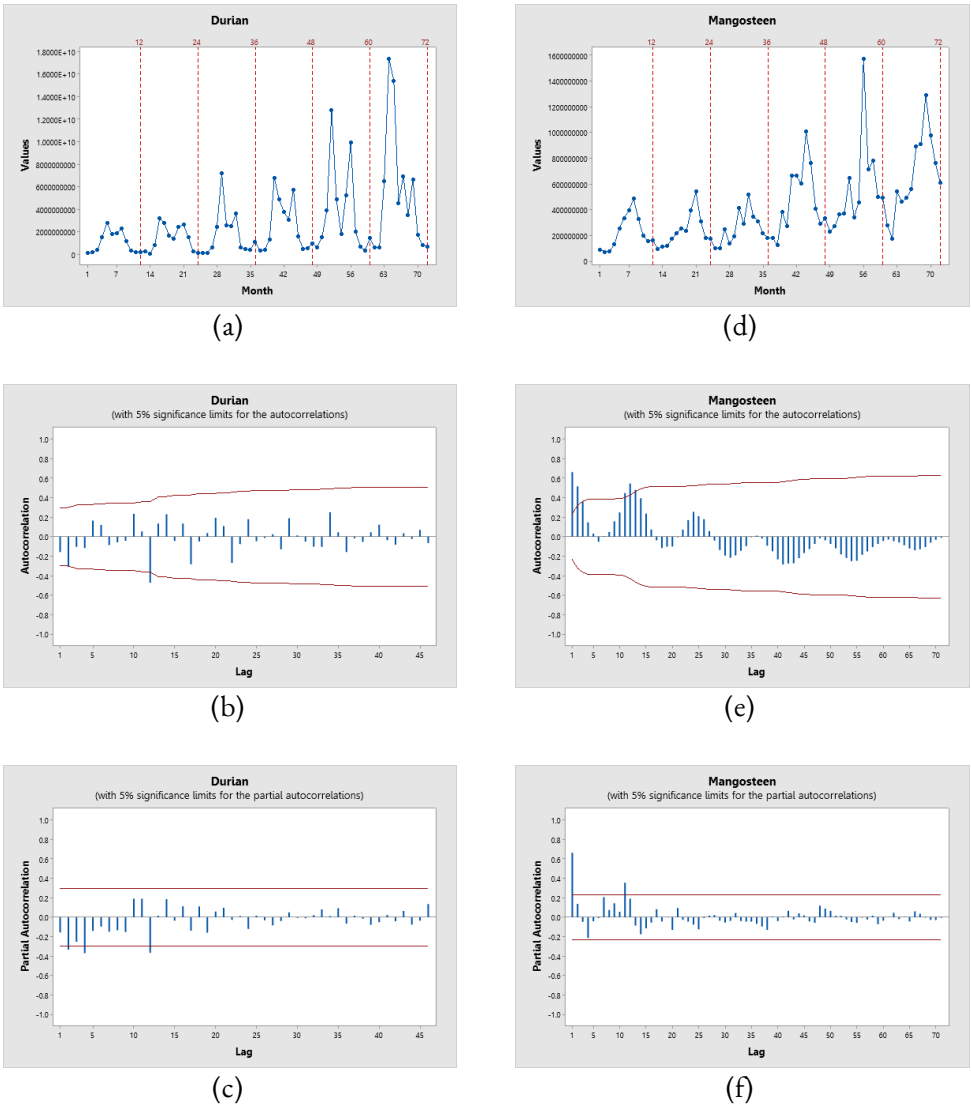
Source: Thai Customs Department (2022)



(a) (b)

Figure 2. Mean of export value of durian (a) and mangosteen (b)

Additionally, using time series analysis, the Box-Jenkins method was used to create models for forecasting the export value of both fruits. Export data, ACF and PACF graphs of durian and mangosteen were shown in Figure 3. The parameters were displayed from ACF and PACF graphs. The results found that there are 3 models for each fruit. These results are shown in Table 3. and Table 4. After that, these models were compared to the AIC values, and the models with the minimum AIC value were selected. The forcasting models for durian and mangosteen were ARIMA(4,2,0)xSARIMA$(0,2,1)_{12}$ and ARIMA(1,2,1)xSARIMA$(0,2,1)_{12}$. These two final models were considered efficient models for durian and mangosteen that could be used for future predictions of the monthly export value.



(a) (d)

(b) (e)

(c) (f)

Figures 3. Export data, ACF and PACF of durian (a), (b), (c) and mangosteen(d), (e), (f).

Table 3. The forecasting model and AIC based on the ACF and PACF of durian

Forecasting model	AIC
ARIMA(0,1,2) x $SARIMA(1,2,0)_{12}$	1.34E+09
ARIMA(1,2,1) x $SARIMA(0,2,1)_{12}$	1.33E+09
ARIMA(4,2,0) x $SARIMA(0,2,1)_{12}$	7.23E+06

Table 4. The forecasting model and AIC based on the ACF and PACF of mangosteen

Forecasting model	AIC
ARIMA(1,2,1) x $SARIMA(0,2,0)_{12}$	7.24E+06
ARIMA(0,2,2) x $SARIMA(1,2,0)_{12}$	6.21E+06
ARIMA(1,2,1) x $SARIMA(0,2,1)_{12}$	5.73E+06

Conclusion and Discussion

Since Thailand is still in the initial stages of organic agriculture development, only a few types of organic products are being produced, and the production process does not require high technology. Thai farmers produce essential agricultural products, such as rice, vegetables, fruits, etc. There are few processed organic products on the market, as organic raw materials are insignificant and lack continuance. It is assumed that organic products are in the market that numbers less than 6,000 tons per year. Organic products cost 15–30% more than conventional agricultural products for small-scale farmers and 5–10% more for large-scale farmers. This caused the organic market to remain limited to those with high incomes. A study by Pilanthana and Prasopchai (2016) about factors affecting consumers' willingness to pay for organic products. Results showed that the samples were very satisfied with the nutritional quality and were certified by an internationally recognized standard. Consumers focus on quality, safety, and acceptability at a higher price on organic products.

Although Thailand has problems with organic products regarding productivity and high prices, organic product export is considered a new business in the future. Thailand can currently export organic products worth 800 million baht a year, which is considered a tiny scale compared to the export of all agricultural products. However, the organic market remains appealing because it is growing at a rate of 20–30% per year. The export trend of Thai organic agricultural products is rice, coffee, vegetables, fruits, spices and herbs. In particular, jasmine rice has a high demand in the European Union (EU) market, but the quantity of products is insufficient to meet the demand. In addition, organic fruits, such as mangosteen, bananas, and durian, and vegetables like asparagus, baby corn, sweet corn, and salad vegetables are also in demand in foreign markets. Included, processed organic agricultural products are also being exported. It can be said that Thailand can grow into organic markets, but if production costs can be reduced, it will even increase its advantage in world market competition. As the study guideline of Pittawat et al. (2019) pointed out, competitive advantage significantly impacts favorably on financial performance in terms of cost reduction for Thai organic farmers.

Furthermore, using the Box-Jenkin method, time series analysis was used to forecast durian and mangosteen export values. This is due to the fact that predicting the future is crucial to managing agriculture. The results of this study show the increasing trend in export values of both durian and mangosteen, as well as the forecast models used to predict future export values. There have been many time series studies using the Box-Jenkin method to forecast production (Başer et al., 2018), electrical load (Chodakowska et al., 2021), export (Iqbal et al., 2005), yield (Suresh and Priya., 2011; Kitworawut and Rungreunganun., 2019) and public health (Rendana and Idris., 2021).

This research shows that organic farming in Thailand is practicable because the private sector has given more support. Still, farmers must be receptive to change, particularly to producing quality and chemical-free agricultural products. The most important thing is to provide a learning source for farmers or those interested in facilitating the knowledge to build both a sustainable career and an income.

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