

## GREEN REVOLUTION'S ROLE AND IMPACT: ORGANIC FARMING POTENTIAL FOR INDONESIAN SUSTAINABLE AGRICULTURE

### *Peran dan Dampak Revolusi Hijau: Potensi Usaha Tani Organik untuk Pertanian Berkelanjutan di Indonesia*

Ashari<sup>1\*</sup>, Juwaidah Sharifuddin<sup>2</sup>, Zainal Abidin Mohammed<sup>2</sup>, Nurul Nadia Ramli<sup>2</sup>, Yong Farmanta<sup>3</sup>

<sup>1</sup>Indonesian Center for Agricultural Socio Economic and Policy Studies  
Jalan Tentara Pelajar No. 3B, Cimanggu Bogor 16111, Jawa Barat, Indonesia

<sup>2</sup>Department of Agribusiness and Bio-Resource Economics,  
Universiti Putra Malaysia, Serdang Selangor 43400

<sup>3</sup>Department of Land Management, Universiti Putra Malaysia, Serdang Selangor 43400  
Corresponding author. E-mail: [ashari.sp@gmail.com](mailto:ashari.sp@gmail.com)

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#### ABSTRAK

Pada 1960-an, Indonesia mengalami kekurangan beras dan termasuk salah satu pengimpor beras terbesar di dunia. Pemerintah saat itu memprioritaskan pemenuhan beras dengan target swasembada dengan berbagai upaya, seperti penerapan teknologi revolusi hijau (RH) melalui penggunaan input pertanian modern. RH terbukti membuat Indonesia mencapai swasembada beras pada tahun 1984. Namun, teknologi tersebut juga telah menyebabkan dampak negatif, terutama kerusakan lingkungan dan petani sangat bergantung pada industri agrokimia. Beberapa kalangan menganggap sistem pertanian organik adalah solusi untuk mengatasi masalah ini. Pertanian organik menawarkan cara terbaik untuk produksi pangan dan penggunaan sumber daya secara berkelanjutan dan ramah lingkungan. Permintaan beras organik diperkirakan akan meningkat di masa mendatang seiring dengan pertumbuhan penduduk dan pendapatan. Adopsi pertanian organik masih sangat lambat. Tantangan utama pertanian padi organik adalah kekhawatiran anjloknya hasil panen ketika melakukan konversi. Permasalahan lainnya adalah kurangnya pengetahuan teknis dan dukungan pemerintah, mahalnya biaya konversi dan kontaminasi bahan kimia dari pertanian konvensional. Diperlukan penelitian yang lebih mendalam tentang faktor-faktor yang memengaruhi petani untuk mengadopsi pertanian organik. Dengan demikian pemerintah dapat merancang strategi dan kebijakan yang tepat untuk mempercepat adopsi pertanian padi organik.

**Kata kunci:** *Indonesia, pertanian berkelanjutan, pertanian organik, revolusi hijau, swasembada beras*

#### ABSTRACT

In 1960s, Indonesia experienced serious rice insufficiency and was one of the largest rice importing countries. The government was encouraged to achieve rice self-sufficiency, i.e. implementing the green revolution (GR) technology through promoting modern agricultural inputs adoption. GR had helped Indonesia to achieve rice self-sufficiency in 1984. However, such technology deals with some problems, e.g. environmental destruction and farmers' dependence on agrochemical industry. Many consider organic farming system is the solution to address this issue as its practice offers the best way toward sustainable food production and resources use. Demand for organic rice is expected to increase in the future along with the population and income growth. However, prospect of organic rice farming is still uncertain as its adoption is very low. The main challenge is farmers' unease on yield reduction. Other crucial problems are lack of technical know-how and government supports as well as increase in costs of land conversion and chemical contaminations from conventional farming. It is necessary to conduct more in-depth studies on the factors influencing farmers' willingness to adopt organic farming. It will be useful for the government to design appropriate strategies and policies to accelerate organic rice farming adoption.

**Key words:** *green revolution, Indonesia, organic farming, rice self-sufficiency, sustainable agriculture*

#### INTRODUCTION

Food fulfillment or sufficiency is one of the most fundamental human rights and the

determinant factor in national security. Records have shown that food shortages could lead to economic, social and political instability and insecurity (Suryana et al. 2009). In Indonesia, the status of rice as a staple food is extremely

important and crucial. Besides being the bread and butter, rice functions as a source of livelihood for most of the people. Rice's economy has contributed significantly to the rapid economic growth of the country (Amang and Sawit 2001). Ikhsan (2001) published that for every 10% increase in the price of rice, it caused a 1% increase in consumers' level of poverty. Timmer (2010) also revealed that a high price of rice had a significant impact on the number of individuals living below the poverty line. A study by Hasan (2013) confirmed that higher prices in rice had caused the poverty headcount ratio to increase tremendously. Owing to the significant role of rice in Indonesia's economy, rice production has permanently remained the top priority in national development.

Pranolo (2001) elaborated that rice was not merely economic importance but also a social, psychological and political commodity. Suryana et al. (2009) proposed some rationales by placing rice as a strategic commodity, i.e., (1) more than 20 million of farmers' families and farm workers depended on rice's businesses; (2) the demand for rice is always on the increase due to population growth; (3) the uncertainty in rice production risk; and (4) rice as the most significant and mainstay of job creation in rural areas. Therefore, the government's policy on rice production has multi-facets, i.e., the fulfillment of growth in demand, improvement of farmer's income and support of national food security.

Historically in the 1960s, Indonesia experienced serious insufficiency in rice. In the years 1961-1964 total import of rice amounted to 4,371,000 tons and this placed Indonesia as one of the largest rice importing countries. Such a situation has compelled the government to prioritize the fulfillment of rice and to achieve self-sufficiency (Timmer 2010). Sayaka (2003) published that the extra effort to enhance food availability was executed at the end of 1960. The government undertook measures by implementing the green revolution (GR) technology, an intensification program through promoting the use of modern agricultural inputs. GR was regarded as the best way to boost rice production and was adopted massively and aggressively nationwide.

The government strongly supported GR through the development of 4.75 million hectares of irrigated rice fields and the rehabilitation of irrigation networks. In addition, the use of high-yielding varieties and the application of chemical inputs were encouraged. Since 1971, the government had also provided

subsidies in fertilizers (Warr and Anshory 2013). The government was committed to providing such subsidy and by the year 2017, it has amounted to Rp. 31.33 trillion (Julianto 2017). An FAO Report (2005) revealed that out of total fertilizers used in Indonesia, 52% was utilized for rice cultivation and the rest (48%) for other diversified crops. The allocation for fertilizers was highly prioritized for an increase in rice production.

Jahroh (2010) claimed that GR had helped Indonesia to achieve rice self-sufficiency in 1984 and was highly praised by FAO for excellent achievement. Rice production and productivity increased sharply from 3.7 million tons (2.5 tons/ha), in 1968 to 8.2 million tons (4.4 tons/ha) respectively. In aggregate, rice production in Indonesia rose 275% from 1966 to 2000.

The role of GR technology as the main contributor to rice self-sufficiency achievement poses no issue. However, the benefits the GR technology have generated some detrimental problems. The Green Revolution technology relies greatly on the application of external inputs, mainly agrochemicals (Sukristiyonubowo et al. 2011). Several critics claimed that the GR technology could trigger environmental deprivation and aggravation in the disparity of income, prejudice in the allocation of assets and worse of all, absolute poverty (IFPRI 2002; Pingali 2012).

This paper aims to look at the role of GR in supporting rice self-sufficiency achievement in Indonesia. It also explores the GR's impact on the environment and the opportunity of organic rice farming as one of the alternative farming to reach the sustainable agricultural development. The constrains will be encountered to realize organic farming development is also discussed widely.

This study utilize the literature review method by exploring the studies related to the GR revolution in Indonesia. It covers both benefit and the negative impact of GR technology. In addition, a number of literature discussing about organic farming and its potential and challenges for sustainable agriculture is also a crucial references to understanding this issue.

## **THE ROLE OF GREEN REVOLUTION TECHNOLOGY ON RICE PRODUCTION**

The massive and aggressive efforts toward GR technology had yielded a significant impact on rice production in Indonesia. The empirical

data show that the performance of the harvested area, productivity and production of rice since the implementation of the technology. It demonstrates a considerable escalation in rice production. The rapid growth can be seen by the impressive increase in yield per hectare. For example, in 1965, the average yield was 1.7708 ton/ha and had increased to 5.3411 ton /ha in 2015 amounting to a 200% increase during a period of 50 years. Consequently, production rose sharply from 12,975,000 tons (1965) to 75,397,841 tons (2015) amounting to 481.10% in the same period. The average growth in yield and production in the span of 50 years (1965 - 2015) was 4.03% and 9.62% per year respectively. Therefore, GR technology has proven to be impressive in contributing to rice self-sufficiency in Indonesia.

The picture of the rice supply and demand in Indonesia, suggests that both the production and demand of rice had increased steadily. Rice production was adequate to satisfy food requirements due to the fact that production always exceeded demand. However in 1985, the total supply was still less than the total demand and subsequently in 1990, started to produce a surplus. The total demand for rice, apart from food, comprised of requirements for seeds, processing, feeds and wastes. Therefore, imports were still required to meet the total demand. The number of imports fluctuated throughout the years, depending on the level of domestic rice production. Generally, in terms of food, domestic production had met consumption requirements.

The GR technology initiatives had facilitated the government to maintain self-sufficiency in rice in Indonesia. Nuryanti (2016) reported that during the period 2001-2014, the value of self-sufficiency rate (SSR) in rice ranged from 0.95 to 1.0. A high level of SSR confirmed that self-sufficiency in rice was still "safe" for Indonesia and the evidence that GR technology in rice production was considerable. However, it also served a warning sign that the use of agrochemical inputs remained dominant in the agriculture sector, especially in rice cultivation.

### **THE IMPACT OF GREEN REVOLUTION TECHNOLOGY**

Globally, GR technology had allowed many countries to fulfill their food requirements sufficiently. The adoption of high yielding variety (HYV) had been one of the key determinants for success. In 2002, the International Food Policy

Research Institute (IFPRI) reported that the adoption of HYV was widely received. In 1970, for instance, nearly 20% of wheat and 30% of rice-growing regions in developing countries were cultivated with HYVs (IFPRI, 2002). In 1990, the regions had expanded drastically to 70 % for the two crops. In the span of 20 years, yields of rice and wheat were almost doubled. The existence of HYVs and irrigation networks had enabled growers to increase productivity.

IFPRI (2002) documented that the worst issue highlighted the impact of GR technology was environmental devastation. The over-use of chemo-synthetic inputs emerged as a negative impact, such as the presence of chemical residues in foods and the destruction of land fertility or productivity due to long-term chemical fertilizers or pesticide applications. Improper application of fertilizers and pesticides had contaminated water, poisoned agricultural employees, and eradicated useful insects or other wildlife. According to Rahman (2015), disorganized and inappropriate use of chemicals had infected soil, water, and air.

With respect to farmers' behavior, the cultural practices used in GR technology had shaped farmers' habits in utilizing agricultural inputs. Farmers were inclined to be highly dependent on the agrochemical industry, mainly fertilizers, and pesticides. It means that GR technology had driven farmers to be less independent in the fulfillment of production inputs. Fertilizer use always increased throughout the years. Fox (1991) and Buresh et al. (2007) reported that the overuse of fertilizers (nitrogen and phosphorous) in paddy fields occurred widely in Indonesia. Empirical evidence demonstrates the increasing use of fertilizers throughout the years. It implies the overuse of fertilizer was getting worse in recent years.

Data released by the Directorate of Fertilizer and Pesticide, Ministry of Agriculture (MoA) (2017) showed that pesticides used in Indonesia had increased from year to year as shown by the positive growth of pesticide products registered to MoA. As the quantity of pesticide products reflects farmers' demand, it indicates that pesticide use increased continuously every year. Subsequently, the growth of demand encouraged companies (producers) to expand pesticide products. It is an alarming concern that due to the continuous use of pesticides, the accumulation of pesticide residues is inevitable and hence degrades the quality of the environment.

Pollution due to pesticide residues in agricultural lands and water could cause serious

problems. Several studies had shown that heavy utilization of pesticides had generated a negative impact on the environment (Pretty and Hine 2005) and human health (Kishi 2005). There had been reports that farmers had experienced symptoms of insecticide intoxication after spraying (Pawukir and Mariyono 2002).

A study by Oberemok et al. (2015) predicted that in 2050 the utilization of pesticides would be 2.7 times higher than in 2000 worldwide. Globally, the situation potentially generates hazardous conditions against humans and the environment. A more recent study by Joko et al. (2017) revealed that in Indonesia, the enhancement of pesticide use occurred not only in the rural environments but also widespread in urban areas.

Another crucial issue concerning the impact of GR technology is the contribution of rice cultivation towards greenhouse gas emissions (Yao et al. 2014; Khosa et al. 2012; van Groenigen et al. 2012). Management practices in the rice production system played a critical role in greenhouse gas emission, especially fertilizer and flooding regimes (Boateng et al. 2017). It suggests that rice cultivation contributed a substantial amount of gas emission. The use of synthetic fertilizers, as well as crop residues, worsened the magnitude of greenhouse gas emission. A study by Sampanpanish (2012) compared the impact of organic and inorganic fertilizers on emission levels of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). The finding showed that chemical fertilizers produced a higher rate of emission than organic ones and therefore the use of organic fertilizers was strongly recommended.

Overuse of fertilizers and pesticides by inappropriate practices in agriculture had also contributed to gas emission and this condition required alternative solutions. The GR paradigm which relied on the use of agrochemical inputs should be changed to more environmentally friendly practices for sustainable agricultural development. Many consider the organic farming system is the solution to address this issue.

### **ORGANIC FARMING FOR SUSTAINABLE AGRICULTURE**

GR technology, which emphasized the use of agrochemical (also called conventional farming) had contributed significantly toward food

sufficiency. However, it had also created other problems related to the environment. The organic farming system, said to be eco-friendly agriculture, was expected to be the best solution in reducing or even eradicating the negative impact of conventional farming. According to Rochayati and Hasnain (2015), organic farming could act as an alternative against the GR paradigm, which had degraded the environment and which had also incurred a high cost of production. Organic farming was also expected to relieve farmers on the dependency on the use of external inputs.

There are various definitions of organic farming provided in the literature. For instance, Mannion (1995) defined organic farming as “a comprehensive approach of agriculture that purposes at reflecting the deep interconnection among farm biota, agricultural production and the environment on the whole”. According to the Codex Alimentarius Commission (1999), organic farming encompasses a comprehensive production management system stressing the use of management practices by prioritizing the utilization of on-farm inputs. It is attained by employing the cultural, biological and mechanical methods as a contrast to synthetic matter use.

Lampkin (1994) described organic agriculture as “a method to agriculture that intends to create integrated, humane, environmentally, and economically sustainable production scheme”. This is undertaken by “maximizing dependence on farm-derive renewable resources and the management of ecological and biological processes and relations”. IFOAM (2014) described organic farming as “a production method that maintains the health of soils, ecology, and community. It depends on ecosystem processes, biodiversity, and cycles tailored to local conditions, instead of the utilization of inputs with harmful impact”. Thus, organic agriculture incorporates science, innovation, and folklore to benefit the environment and encourage equitable relations and a good quality of life for all concerned.

Wallace (2001) briefly defined organic farming as “an integrated system of farming based on ecological principles”. Meanwhile, Rigby and Cáceres (2001) attested that organic farming method should prevent the use of chemical fertilizers and pesticides; instead, relying on organic materials and reprocessing for the supply of nutrients and focus on planting system patterns and biological manners for pest management. Trewavas (2001) concluded that in general, organic farming provides the priority for long-term ecological healthiness as opposed

to conservative agriculture, which only short term benefit-oriented.

In Indonesia, the modern organic agriculture concept and its application is quite a novel. Hence, according to Las et al. (2006), sometimes misconception occurred. They proposed a simpler description of organic agriculture as a method or technique for crop cultivation utilizing organic or natural inputs. The use of agro-chemical (fertilizer and pesticide) was forbidden or at least their uses should be minimized.

With regard to reduction in the use of agrochemical inputs, a term that experts proposed is "Low Input Sustainable Agriculture" (LISA). Such a farming method is intended to optimize management and use of internal production inputs and to reduce the purchase of external inputs such as chemical fertilizers and pesticides. LISA is also designed to lower production costs, prevent surface and groundwater pollution, minimize pesticide residues in food and farmers' total risk while improving long-term and short-term farm profitability (Parr et al., 1990 in Najafabadi et al., 2012).

Another similar term is known as Low External Input Sustainable Agriculture (LEISA). Reijntjes et al. (1992) mentioned that in the LEISA farming system, locally available natural and human resources are used optimally, which are economically reasonable, ecologically reliable, culturally adaptable and socially adjustable. External inputs are still utilized in LEISA, but in reciprocal to the local resources used. Based on a study in Sragen District, Central Java Province (Indonesia), Sukristiyonubuwo et al. (2011) termed the use of low external inputs among paddy farmers as "semi-organic farming".

The organic farming practice is said to offer the best way that enables the production of food and other resources continuously and environmentally friendly. Wheeler (2008) asserted that organic farming had a wider spectrum due to its being commercially viable and regarded as a breakthrough in addressing the problems usually materialized by conventional farming. FAO (1999) considered organic farming as one of the methods to uphold agriculture-based businesses. Meanwhile, Cary and Wilkinson (1997) revealed that organic agriculture in developing countries is frequently deemed as measures to alleviate poverty among small farmers. In the global market, Helga and Lernoud (2015) reported that organic product trades have increased at a favorable

rate over the last decade, and they envisaged that growth would be stable in the coming years, suggesting that organic farming has good potentials to develop in the future.

## THE POTENTIAL AND CHALLENGE OF ORGANIC FARMING DEVELOPMENT

Organic farming gained momentum at the onset of the 21st century. The phenomenon "back to nature" lifestyle emerged. People became more aware of the negative impact of chemo-synthetic inputs. Thus, organic farming could be an alternative farming system matching with new lifestyles. Consumers had preferences to consume organic products, suggesting that there is potential to increase organic product demand. According to Jahroh (2010), the sustainability of organic farming can be viewed from three aspects: economic, social, and environmental. Firstly, in terms of the economic aspect, organic farming is free of external chemo-synthetic inputs usage and reduces production costs. By assuming the organic products secure premium prices, farmers achieve higher profitability. Secondly, the social aspects can be spotted from social relationships, political, cultural, and human development. Farmers who practice organic farming were respectful to nature, environment, and culture. Thirdly, in association with the environmental aspect, organic farming directly ensures the sustainability of the environment. A number of benefits are provided by organic farming such as the provision of ecosystem services, preservation of biodiversity, reduction of resource and energy use, landscape values as well as environmental protection.

### The Potential of Organic Farming

The present-day interest in a healthy lifestyle motivated by the slogan "*back to nature*" has become a trend for many international societies. The lifestyle assumes that most that originate from nature are safe and good for the well-being. People have become more aware that the use of chemical products, such as pesticides in agricultural production, could cause harmful effects to health and the environment. In Indonesia, the organic product became popular since the early 21<sup>st</sup> century. Entering this era, people have become more conscious of the negative effects of agrochemical inputs (Jahroh 2010). The consciousness had driven consumers (especially middle-income) to consume a healthy diet. People tended to buy safer food products for health on the

environmental-friendly rationale. The phenomenon had generated an increase in demand for organic products.

Sukristiyonubuwo et al. (2011) emphasized that the emergence of customers' concern on quality food has driven an increase in demand for organically produced products. On the other hand, awareness to sustain land resources is also on the rise among farmers. Several farmers' associations in a number of rice-producing areas have initiated the practices of organic agriculture. The growth in demand for organic products in urban settings and higher prices of products has given the motivation for farmers to change their farming practices from traditional or conventional to organic farming.

According to Hidayat and Lesmana (2011), there are four important reasons why organic farming is feasible and should be promoted. Firstly, organic products have several advantages such as being more nutritious in terms of food value, and safer in terms of health and well-being. Secondly, organic products have indirect potential in creating more employment. Thirdly, the organic farming system is parallel to the initiatives at sustaining a quality environment; and lastly, organic farming has been documented to have a higher productivity factor compared to a conventional system.

Mayrowani (2012) claimed that Indonesia has great potentials as an agricultural organic producer, capable of competing in the global market. The country has several comparative and competitive advantages such as (1) availability of suitable land resources for organic farming, (2) availability of supporting technologies, e.g., composting, planting no-tillage, biological pesticides and others, and (3) the prices of agrochemicals (fertilizer and pesticides) have always increased, potentially leading farmers to utilize cheaper inputs (e.g. organic materials).

The Indonesian government has fully endorsed organic agriculture development. One of the initiatives, 'Go Organic 2010' program was launched in 2001. Programs such as the development of organic farming technology, the formation of organic farmers' groups, and the establishment of a marketing strategy for organic products (Hidayat and Lesmana 2011) have been initiated. The target of such programs was to promote Indonesia as the world's major player in organic agriculture markets by 2010. Being the world's fast-growing organic agriculture market was also assumed to create opportunities in improving farmers' income.

Especially for organic rice, indeed the prospect of this commodity is very promising, due to the increase in population triggers the demand for rice as a staple food. Along with more public awareness towards healthy food and concurrently with the increase of income potentially drives the demand for organic products (including rice). This implies that environmentally friendly agriculture practices enable organic farming to be extended in the future.

IOA (2017) conducted a survey to observe organic market conditions and trends in organic agricultural products circulation in the market. The results showed that awareness to consume organic food is quite high. Approximately 94% of the respondent consumed organic foods. The respondents mentioned because of health reasons and the rest were environment protection and followed trends. For organic foods, 92% of respondents chose vegetables as the most consumed food, followed by rice and fruits. In big cities, rice was still the main product in the mainstream market.

Hidayat and Lesmana (2011) made a projection about consumers of organic rice in Indonesia. The results showed that organic rice demand increased steadily every year. Their projection indicated that consumers of organic rice increased from 2.4 million (2008) to 12.9 million (2017). The proportion of organic rice consumers also increased from 1.07% to 5.02% in the same period.

In another study, Lestari (2013) predicted that 10 % of Indonesia's population was potential consumers of organic products. These were the middle-upper class community. Further, she mentioned that organic rice producers can only fulfill about 15% of the number of potential consumers. Thus, there is a great opportunity for organic rice farming development as the market was still and would create benefits if well-managed and efficient.

A study by Sulistyana et al. (2014) published that there were three categories in consumption patterns of organic rice at the household level in Yogyakarta City, i.e., routinely, mixed, and occasionally. The consumption of organic rice per month was 21-40 kg by a family of 5-7 members. Most of the consumers (85.71%) were satisfied consuming organic rice. Based on the study, it was assumed that the average demand for organic rice per household was 30 kg/month (range: 21-40 kg). By assuming the average number of the household was 6 members, the consumption per capita/month is 5 kg. Therefore, the aggregate of organic rice

per year was 60 kg. If the consumers' of consuming organic rice in line with the data, the estimation quantity of organic rice needed to fulfill the potential demand is 780,000 tons/year.

Apart from the domestic market, the organic rice is also potentially in demand from overseas markets. Indonesia has been exporting organic rice to several countries, although the quantity was still low and fluctuated. Fauzie (2016) reported that Indonesia exported 40 tons of organic rice to Belgium. The price of exported rice was IDR 60-70,000 or 3 times higher than the domestic market. Until December 2016, the number of organic rice exports was recorded as much as 81 tons. In 2018, the Ministry of Agriculture had issued recommendations for exporting 143 tons of organic rice (Gesha, 2019). The exported organic rice consisted of a number of types, i.e., white organic rice, black rice, red rice, and brown rice. Consumers preferred organic rice for several reasons, i.e., not using chemicals, non-GMOs, have special flavors and for specific use as a raw ingredient for other foods. Importing countries included Japan, Belgium, Hong Kong, Germany, the US, France, Malaysia, and Singapore.

Financial analyses of the three farming systems showed that organic rice farming appears to be more profitable compared to semi-organic and conventional systems (Sukristiyonubuwo et al. 2011). A fully organic rice farming system shows the highest benefit, followed by semi-organic and conventional systems. The benefits were translated in amounts of IDR 13,500,000 (equal to USD 1500), IDR 11,540,000 ( USD1283) and IDR 7,700,000 (USD 856) for fully organic rice, semi-organic and conventional rice farming systems, respectively. In terms of benefit-cost ratio (B/C) values, all paddy farming systems were higher than one, suggesting that all rice farming systems studied gave higher efficiency leading to higher profits.

A study by Suryadi (2011) reported that net income of organic rice farming was higher than conventional, recording a value of IDR 6.76 million/ha/season and IDR 4.44 million/ha/season with the R/C ratios of 2.96 and 2.5, respectively. Ningtyas (2011) revealed that SRI organic rice secured higher selling price, resulting in higher income received by organic farmers, namely IDR 10,559,276 while conventional farmers received IDR 3,342, 159. Consequently, R/C of SRI organic farming was also higher than conventional, i.e., at 2.55 vs. 1.65.

In terms of willingness to pay (WTP) for organic rice, Steinhübel et al. (2018) reported that, based on a study in the city of Jogjakarta, people were willing to pay an average premium price of 20% more for certified organic rice compared to the price they usually pay for conventional rice. A Similar study by Fathia et al. (2018) conducted in the city of Bogor showed that WTP (in consumers' average value) on organic rice was IDR 20,000 per kilogram. This value was IDR 4,000 (or 20%) higher than the lowest price for organic rice sold in markets. A study by Setiyadi et al (2016) in Pontianak reported that the average WTP was about IDR 26,120.00 /Kg. The WTP was higher (30%) than the retail organic price of IDR 20,000.00/Kg.

### The Challenge of Organic Farming Development

In terms of organic farming development, the Indonesian Organic Alliance (IOA, 2017) recorded that total organic areas in Indonesia in 2015 amounted to 261,383.65 ha. The development encompassed the total areas under organic cultivation, aquaculture, and wild harvesting areas. The compiled data show the extent of certified areas, ongoing certification processes, Participatory Guarantee System (PGS) certificated and non-certificated (self-claimed). The organic areas were dominated by "uncertificated organic" and covered almost 58% of the total area. Uncertificated refers to organic by self-claimed but guaranteed and supervised by the Indonesian Organic Alliance (IOA). The area of organic farming in Indonesia is approximately 0.56% of total agricultural land.

Related to rice farming, the development of areas of certificated organic rice farming also fluctuated during 2013-2015. Since then, the areas have not yet expanded significantly. As a priority commodity in GR technology application, the impact of GR in rice farming retains predominantly. However, only a small percentage of farmers performed organic farming. In addition, some farmers' groups practiced low external input farming. Based on a study by Sukristiyonubowo et al. (2011) in Sragen District, Central Province, there were three types of rice farming systems, namely: conventional, low external input management (called *semi-organic* in local terminology) and fully organic rice farming.

Sukristiyonubuwo et al. (2011) and Sugino et al. (2010) reported that a number of farmers groups in Sragen District (Central Java Province) did not fully perform organic farming. Instead, they mixed the chemicals and organic matter for use on their farm. The farmers applied

the minimum external input i.e., or semi-organic agriculture.

The prospect of organic rice farming did not counterbalance with the development of such farming, showed by the extent of cultivation. IOA (2017) reported that the area certified for organic paddy in 2015 amounted to 1,753.7 ha. The extent of organic rice areas tended to fluctuate every year. A little different, the Ministry of Agriculture reported that the extent of certified organic farming throughout Indonesia amounted to 1,816 ha. The organic farming system was also practiced in scattered areas in some provinces and districts across Indonesia. Not all of the provinces (34 provinces) were cultivated with organic rice due to agronomic, land availability or market reasons. Only 12 provinces were identified as suitable to carry out organic rice farming (in 2015). The provinces on Java Island still dominate the area in organic farming with Central Java Province the largest area of organic rice farming mainly in Sragen District.

Data from IOA (2017) demonstrated that the extent of organic rice farming was still extremely low compared to the total rice area in Indonesia of which covered about 14.3 million hectares in 2015 (CBS, 2015). The existing area of organic rice farming seems insufficient to fulfill the potential demand. It points to the fact that organic rice businesses in Indonesia are potentially promising. Rice farmers have the opportunity to extend cultivation more extensively using the organic farming system.

The main challenge that emerged from organic rice farming was farmers' anxiety on yield reduction when converting from conventional to the organic farming system. A study by Sukristiyonubowo et al. (2011) described that in the early stages of adopting fully organic rice farming, harvest dropped drastically. Yield dropped to about 1 to 2 tons/ha (1<sup>st</sup> season), nearly 1.5 to 2.0 tons/ha (2<sup>nd</sup> season), and 2.5 ton/ha (3<sup>rd</sup> season), while conventional farming was able to produce up to 8 tons/ha. In the semi-organic system, the decrease in yield was not extreme and farmers also reduced production cost through using local/organic materials.

Other studies demonstrated that the decrease in productivity was merely temporary. Suwanto (2008) admitted that the productivity of organic rice was lower than conventional in the first planting season, but in the following seasons, productivity increased gradually. Productivity was higher than conventional farming in the fourth planting season. A study

by Suryadi (2011) mentioned that the productivity of organic rice farming could equal to non-organic one. The author claimed that such a farming system would not compromise the rice self-sufficiency program.

Nugraheni and Purnama (2013) observed a number of problems and challenges existed in organic rice farming. *Firstly*, there was a significant lack of technical know-how or capacity among the farmers. *Secondly*, the lack of government supports has made most organic farmers organized. *Thirdly*, the increase in costs of land conversion and chemical contaminations from previous conventional farming. Chemical contamination hindered farmers to proceed with product certification. *Fourthly*, there was an indication in which member(s) of a group failed to maintain collective objective threatening the accountability of the group. Aminah et al. (2018) also observed various issues encountered in organic rice farming such as commitment development, motivation encouragement, credibility establishment, and bargaining power strengthening of organic rice farmers. They also needed solutions to resolve the problems of continuous draining of impurities from chemicals, to generate mutual teamwork in the rice fields, as well as to formulate organic fertilizers, biopesticides, and local micro-organism local (MOL).

## CLOSING REMARK

Green Revolution technology has made a significant contribution to increasing rice production in Indonesia. The accomplishment of rice self-sufficiency achieved by Indonesia could not be neglected from the role of GR technology. However, the impact of the technology is very disturbing, especially in view of environmental aspects and it potentially threatens the sustainability of agriculture in the future.

Organic farming is considered as the best alternative for maintaining food security and agricultural sustainability. However, the efforts to posit organic farming as the measure to develop sustainable agriculture are not easy. There are many obstacles to practicing organic farming more massively. A number of studies show that although in terms of economic the organic farming is profitable, the development of organic rice farming (area extent) in Indonesia is very slow.

Therefore, it is necessary to conduct a more in-depth study to identify the paddy farmers'



interest in organic farming. The study also should identify the factors causing their willingness to practice such farming. By recognizing these factors will be very useful for the government to design appropriate strategies and policies to accelerate the adoption of organic farming (especially the organic rice) in Indonesia.

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