

Organic Rice Farming Development: Principles, Challenges, and Strategies: The Case of Subak Jatiluwih, Bali Province, Indonesia

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Abstract

In Bali province, a green revolution program has been introduced to increase rice productivity, but resulted in environmental degradation, including soil, water, and air, which is detrimental and endangers human health. One of the programs that has been implemented is organic rice farming practices, and encouraged to back to nature. This study has objectives to determine the application of organic rice farming principles by farmers, the challenges faced by farmers in developing organic rice farming and the implications of developing organic rice farming. Subak Jatiluwih was selected by purposively selected as a research site. There are 60 farmer samples were taken by using simple random sampling. The collected data were then analyzed using qualitative descriptive methods.

The results pointed out that principles of organic rice farming applied by farmers are environmental and cultural friendly, integrated system, non-synthetic materials, utilization of local resources, and justice. The challenges faced by farmers in developing organic rice farming, namely: (i) farmers' perception toward highly-cost for production; (ii) relative low productivity; (iii) number of consumers are limited; (iv) pest and disease risks; (v) farmers' dependence on synthetic chemical fertilizers; (vi) program of rice self-sufficiency; (vii) uncertainty market of organic rice; and (viii) limited organic materials. Government's strategic efforts needed are: (i) increasing the production; (ii) empowering farmers; (iii) developing and implementing organic farming practices; (iv) strengthening institutions of farmers; and (v) establishing a market for rice organic.

Keywords: Organic rice, farming, integrated system, non-synthetic materials, production, market

1. INTRODUCTION

The agricultural sector plays a crucial role in economic development in developing countries, including Indonesia (Yogi et al, 2025, Ricciardi *et al* 2018; Praburaj, 2018; Scheidel *et al* 2014). The agricultural sector is developed by utilizing new technologies to manage natural resources to increase productivity (Sedana et al., 2025; Sedana and Astawa 2019; Amato et al., 2022). The agricultural sector's role is to provide food for people in both urban and rural areas, provide raw materials for the industrial sector, consume or use products produced by the industry, and provide employment opportunities (Anríquez and Stamoulis 2007; Holcer et al., 2013; Sertoğlu et al., 2017; Sedana et al., 2021; Ferreira et al., 2022; Till 2022).

In rice farming, for example, a green revolution program has been introduced to increase rice productivity and faster harvest periods (Kaur et al., 2022). This program introduced the use of new or hybrid seed varieties, agricultural mechanization, and the use of synthetic chemical fertilizers and pesticides, supported by the provision of sufficient irrigation water through the construction of irrigation networks (Cassman and Grassini, 2013). Subsistence agriculture shifted to commercial agriculture, requiring technological advances and knowledge of the market for agricultural products (rice) (Gómez-Baggethun and Naredo 2015).

However, the success of the Green Revolution also resulted in environmental degradation, including soil, water, and air, which is detrimental and endangers human health. This condition occurs because the use of chemical fertilizers, pesticides, and herbicides has detrimental environmental impacts, as well as the widespread use of chemical fertilizers, pesticides, and herbicides, as well as the exploitation of agricultural land (Lenton et al. 2019).

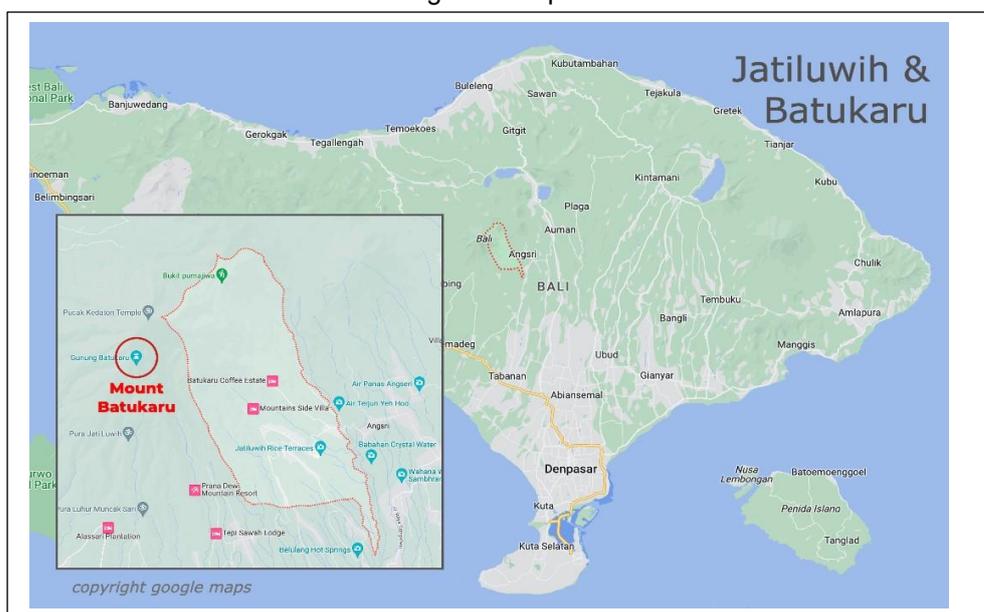
As a province in Indonesia, Bali has participated in the Green Revolution program for the past five decades and has even achieved rice self-sufficiency. Like other provinces, Bali has also experienced environmental degradation, particularly in land and water, due to agricultural development, particularly in rice paddy fields. Therefore, over the past five years, Bali has been making efforts to restore nature (water and land) to its former state, ensuring sustainable land quality and fertility. The Bali provincial government has implemented various programs to restore environmental health and ensure a healthier and better quality of life for all living things through the development of organic farming systems. One such program is the development of organic rice farming. In several areas of Bali, particularly in mountainous areas or highlands, farmers are encouraged to return to nature,

adopting organic farming practices. The aim of this study is to determine the application of organic rice farming principles by farmers, the challenges faced by farmers in developing organic rice farming and the implications of developing organic rice farming.

2. RESEACH AND METODOLOGY

This research was conducted in Subak Jatiluwih which was selected by purposive sampling with the consideration that Subak Jatiluwih is a world cultural heritage area that has been recognized by UNESCO since 2012. Another consideration is that most farmers in the Subak Jatiluwih area have developed organic rice farming since long ago even though the government introduced the green revolution program that applies synthetic chemical fertilizers and pesticides. The location of Subak Jatiluwih can be seen in Figure 1. In this study, 60 farmer samples were taken from the farmer population in Subak Jatiluwih. The sample selection was carried out by simple random sampling. The data collected were primary data and secondary data obtained from surveys, interviews, focus group discussions and documentation. The collected data were then analyzed using qualitative descriptive methods.

Figure 1 Map of Jatiluwih



Source: *Jatiluwih - Rice Terraces & Subak Irrigation System (UNESCO)*

3. RESULTS AND DISCUSSION

Subak Jatiluwih is located in Jatiluwih Village which has clear boundaries, where to the North is state forest, to the East is Senganan Village, to the South is Babahan Village, and to the West is Wongaya Gede Village. The Jatiluwih village area is a highland or mountainous area suitable for agriculture, and the majority of its residents are farmers who are members of an organization called Subak, Subak Jatiluwih. Subak Jatiluwih is led by one leader called Pekaseh and has 7 subsubak called *tempek* as presented in Table 1.

Table 1 Subsubak in Subak of Jatiluwih

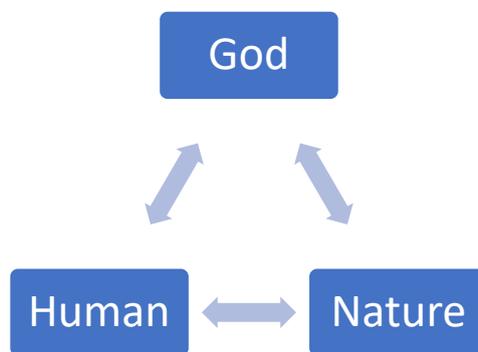
No	Subsubak	Areal (ha)	Members (people)
1	Umakayu	21.94	49
2	Gunungsari	48.48	115
3	Kedamaian	22.06	50
4	Besikalung	37.53	96
5	Kesamba	13.86	37
6	Telabah Gede	65.00	140
7	Umadewi	18.53	58
	Total		

Source: Primary data, 2025

In the Subak Jatiluwih area there are important temples as holy places for Hinduism, namely Puncak Petali Temple, Batu Karu Temple, Puncak Sari Temple, Tamba Waras Temple, and Besi Kalung Temple. The main products of Jatiluwih Village are Balinese rice, Red Sandalwood Rice for the agricultural sector. In addition, farmers in the Subak Jatiluwih area also raise livestock, such as cows, chickens, pigs, and raise fish.

As a world cultural heritage area, the Subak Jatiluwih area has an attraction for tourists to enjoy the diversity of agricultural culture and the natural beauty of terraced rice fields. These terraced rice fields are one of the manifestations of farmers since thousands of years ago in maintaining the balance of nature, namely making rice fields according to the natural contour or natural topography (Sholeh et al, 2020; wang et al, 2024). Maintaining balance or harmony in the relationship between farmers and nature is one form of implementation of the Balinese philosophy, namely tri hita karana (three causes of happiness), which consists of three components (see Figure 2). These three components are the harmony of the relationship between humans and God, the relationship between humans and humans, and the relationship between humans and nature (Sedana, 2023).

Figure 2 Tri hita karana



Based on the study, it is found that the farmers have been applying the principles of organic rice farming comprising: making environmental and cultural friendly, having integrated system, avoiding synthetic materials, utilizing local resources, and ensuring a justice. Regarding environmentally friendly, farmers implement rice farming practices that emphasize ecological principles to maintain and improve the health of soil, plants, animals, humans, and the environment, such as water quality, as an inseparable whole. They recognize that environmental balance is crucial to ensuring the sustainability of their rice farming, as passed down from their ancestors. Interviews with farmers indicate that soil quality, including degradation of soil fertility, and low water quality, will disrupt plant growth, ultimately reducing yields. Therefore, preserving the natural environment is crucial for farmers in their production. The culturally friendly practices implemented by farmers in their rice farming include a close adherence to the belief that the land used for planting rice is a manifestation of Dewa Sri, the God of Fertility. Maintaining soil fertility is believed to honour and worship Dewa Sri. Research shows that the land or rice fields they cultivate are a blessing from God, producing food that is beneficial for the lives of farmers, their families, and the wider community.

Integrated system implemented by farmers in the research site is an integrated production management system that prioritizes ecological recycling and minimizes negative impacts. This is related to avoiding the use of synthetic chemicals in the rice farming. The farmers as members of subak organization have agreed and made internal regulations stipulating that they are prohibited from using synthetic chemical fertilizers, pesticides, herbicides, and fungicides in their rice farming activities. Interviewed farmers revealed that the use of synthetic chemicals has killed certain insects and eliminated biodiversity within the rice fields or Subak. These synthetic chemicals are highly toxic to flora and fauna, which are essential for rice plant growth and impact rice production.

Regarding the use of local resources, farmers in the study locations stated that the organic fertilizers they use are derived from natural materials available in the Subak area, such as green manure, manure, and compost from agricultural waste (leaves, livestock manure, straw). Organic fertilizers are produced independently and also obtained through government assistance, which improves soil structure and fertilizes the soil. The concept of justice referred to in this study is the view of farmers who always maintain harmonious relations with their environment, and provide opportunities for current and future generations to benefit from the agricultural practices they have implemented. The principle of justice is also related to inclusive agricultural practices which include production, distribution

and trade systems that are transparent, fair, beneficial to various parties and take into account sustainable social, cultural and environmental aspects (Purwantini and Sunarsih. 2019).

Challenges in Developing Organic Rice Farming

Based on survey results at the study sites, it was discovered that farmers face several challenges in developing organic rice farming, including: (i) farmers' perception about higher production costs; (ii) lower productivity; (iii) the small number of consumers; (iv) risk of pest and disease attacks; (v) farmers' dependence on synthetic chemical fertilizers; (vi) food self-sufficiency program; (vii) uncertainty market of organic rice; and (viii) limited availability of organic materials. According to farmers, the high-cost stems from the high use of organic fertilizer compared to synthetic chemical fertilizers. Organic fertilizer requires 1,000 kg/ha, while synthetic fertilizers only require around 300 kg/ha (including urea, phosphate, and potassium). This assumption, of course, remains a factor for farmers considering organic fertilizer use. However, farmers who have already implemented organic rice farming do not consider the high use of organic fertilizer a problem because it is cheaper than synthetic chemical fertilizers.

Farmers initially experienced lower rice productivity from organic fertilizer use compared to those using synthetic chemical fertilizers. However, some farmers also noted that organic fertilizer use has long-term benefits, such as improved soil health and fertility. Research results show that the number of consumers consuming organic rice, particularly in Bali, is still relatively small, leading farmers to worry about low demand for organic rice. Therefore, these concerns should be addressed by reassuring farmers that organic rice can be marketed through sales promotions in supermarkets and even outside Bali. Research conducted at the study site also indicates that farmers experience a higher risk of pest and disease attacks in organic rice farming compared to those using synthetic chemical fertilizers. According to farmers, the main risk of pest and disease attacks in organic rice is the potential for higher damage compared to conventional rice due to the limited use of chemical pesticides. Pests such as brown planthoppers (BPH), rats, golden apple snails, and stem borers can damage plants and cause reduced yields, even crop failure. Furthermore, diseases such as tungro, leaf spots, and stem rot are also high risks, especially if environmental conditions are unfavorable, such as high humidity or poor land sanitation.

The dependence of farmers in Bali is similar to that of farmers elsewhere in Indonesia, where they are highly dependent on synthetic chemical fertilizers due to their long-standing adoption of green revolution-based agricultural technologies and practices. Under the green revolution program, farmers receive a technology package that includes superior seeds, synthetic chemical fertilizers, and synthetic chemical pesticides each planting season. Therefore, this dependency remains a challenge in the development of organic rice farming in the study area and for other farmers in Bali.

The central government program currently being promoted by the President is to achieve food (rice) self-sufficiency in order to reduce, or even eliminate, rice imports. This situation is clearly at odds with the development of organic rice farming in regions such as Bali. Achieving rice self-sufficiency requires the application of relatively large amounts of synthetic chemical fertilizers and pesticides, posing a challenge for farmers in Bali to develop organic rice farming, as agricultural extension workers in the field recommend using the technology package established by the central government.

Research conducted at the study sites indicates that organic rice marketing is relatively unstable, given its higher price compared to conventional rice. Consumers still prefer conventional rice, which they are accustomed to consuming. The organic rice market still targets a small number of consumers, and demand remains volatile. The use of organic fertilizer for rice farming requires locally available organic materials. According to farmers, they still face limitations in obtaining organic materials locally for use and processing into organic fertilizer, resulting in relatively limited fertilizer production. Meanwhile, government assistance or subsidies are not commensurate with the needs of organic rice farming.

The challenges mentioned above require more serious government attention to achieve broader and more sustainable development of organic rice farming. Strategic government efforts are a crucial component of organic rice farming development, alongside independent efforts from farmers and other stakeholders involved in organic rice production.

Implications of the studies: Strategies

The Bali provincial government has a vision, locally known as Nangun Sat Kerthi Loka Bali (building a harmonious Bali and moving towards the well-being of the Balinese people), to maintain harmony and balance between nature, people, culture, and God. One of the missions formulated in developing this vision is the development of an organic farming system. Bali, as a small island teeming

with tangible and intangible cultures, must maintain balance to ensure sustainable development across various sectors and aspects as a manifestation of tri hita karana.

The subaks in the Jatiluwih area, considered a world cultural heritage, must be maintained and preserved from a cultural, economic, and environmental perspective. Farmers, as key actors in the subak system, must be protected to maintain the area through sustainable agricultural management, namely cultivating organic rice farming. The government is obligated to undertake various efforts to increase the success of organic rice farming development in the study area. Some of these efforts include: (i) increasing production capacity; (ii) empowering farmers; (iii) developing and implementing organic farming technology; (iv) strengthening farmer institutions; and (v) building a market for organic products.

Increasing production capacity is one of the strategic efforts that needs to be undertaken to provide confidence to farmers that organic rice farming has higher productivity than the use of synthetic chemical fertilizers or conventional rice farming. In the Jatiluwih area, all rice fields meet the requirements for organic farming development, specifically rice cultivation, due to adequate water availability and favourable soil conditions. Developing organic rice production capacity is achieved by increasing the number of farmers willing to adopt organic farming. Efforts to encourage and motivate farmers to adopt organic rice farming include the provision of subsidized seeds and fertilizers from the government.

Farmer Empowerment should be done by the government at the provincial and regency levels. Providing agricultural extension and training on organic farming practices, such as the use of compost, green manure, and homemade botanical pesticides. Besides, encouraging farmers to be independent in managing and producing organic inputs. The government provides infrastructure and facilities, including equipment for producing organic fertilizer on a large scale. Besides, developing local institutions to support organic farmers, for example through support from universities or research and development institution. The farmers and their groups should be introduced technological and methodological innovation relating to the utilization of the potential of local resources, such as azolla, as a nutrient-rich organic fertilizer and animal feed. Using decomposer technology to process livestock waste into organic fertilizer is also needed for the farmers. The government provides processing equipment to produce organic fertilizer on a sufficient scale for farmer groups. Strengthening farmer institutions and encouraging active community participation includes facilitating farmer groups or subak (farmer groups) to obtain organic certification through the certification process. Organic certification is a crucial component in providing consumer assurance that products are organic. Therefore, the government provides financial assistance for completing the certification process, sometimes free of charge. Farmer incentives for implementing organic fertilizers include providing agricultural inputs and product management.

Market and institutional strengthening meant is building a strong marketing network for organic products, both for domestic and international markets. Organic product promotion should be done through expanding networks and market access for organic products. Aside from this, the effort needed is product marketing partnerships to ensure a market.

4. CONCLUSION

The principles of organic rice farming which have been applied by farmers in Subak of Jatiluwih are environmental and cultural friendly, integrated system, non-synthetic materials, utilization of local resources, and justice. Farmers face challenges in developing organic rice farming, namely: (i) farmers' perception toward highly-cost for production; (ii) relative low productivity; (iii) number of consumer are limited; (iv) pest and disease risks; (v) farmers' dependence on synthetic chemical fertilizers; (vi) program of rice self-sufficiency; (vii) uncertainty market of organic rice; and (viii) limited organic materials. The strategic efforts that should be done by government are: (i) increasing the production; (ii) empowering farmers; (iii) developing and implementing organic farming practices; (iv) strengthening institutions of farmers; and (v) establishing a market for rice organic.

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