

ANALYSIS OF CONVENTIONAL AND ORGANIC FARMING PRACTICES TOWARD SUSTAINABLE AGRICULTURE IN BALI

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Introduction

These years, surrounding environment of our life is changing drastically due to global change such global warming or raising population. IPCC reported in AR5 “Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.” Moreover regarding as population, many studies have estimated the global population will reach at 9 or 10 billion people by 2050. We are forced to consider about how to adopt these global changes, and to build sustainable society and sustainable life.

The economy of Bali Province in Indonesia depends on three sectors: agriculture (primary), manufacturing industry (secondary), and tourism (tertiary). Agriculture accounts for 18.08% of Bali’s economy in 2011 (Budiasa, 2014), and also plays a vital role in ensuring food security. It has still applied conventional farming and now promotes to spread to organic farming in Bali.

Conventional farming system has program to increase crop production with the addition of an external element (chemical fertilizers and pesticides) to obtain high production. Farming system with high energy inputs such as chemical fertilizers and pesticides could damage the soil which ultimately could reduce the productivity of the soil, but organic farming is being attractive because it has been seen the environmentally-friendly farming method.

Along with increased public awareness about the dangers posed by the use of synthetic chemicals in agriculture to make organic farming attracted attention both at the producer and consumer. In the fact, The Bali Provincial Government has Bali’s Clean and Green (Go Organic) program to support organic farming. But, there are several problem to develop organic farming such as: consumer interest and understanding of organic products, the certification process is considered severe for farmers. However, organic farming is receiving increasing atttion. It is expected to have a positive impact on the development of organic farming.

Although organic farming is only one of methods for sustainable agriculture, it is supposed to be important to compare conventional and organic in Bali where has been active in developing organic farming.

Sustainable means “able to continue without causing damage to environment”, or “able to continue for a long time” according to Longman dictionary. When it comes to think of

agricultural sustainability, we have to consider environment, ecology, economics and food to feed people, because it is not only industry but also has a variety of functions.

This study aims to give information about development of conventional and organic farming system in Bali and find the solution to make agriculture in Bali keep in sustainable.

To discover for the way of sustainable agriculture we compared conventional and organic farming system, and researched circumstances of each farming systems in Bali. Then we considered each problems and solutions from the point of view of sustainability

Research Methods

To research circumstances of conventional and organic farming system in Bali, we observed farm land and interviewed farmers production, income, how to manage, products and problems. Activities were conducted at conventional and organic rice farming in Subak Buangga, Getasan Village, Badung Regency and also at each farming systems vegetable land in Bedugul Area, Tabanan Regency at 21–22, August, 2015.

And also, we collected soil at each sites rice and vegetable land, and analyzed chemical properties. Soil nutrient conditions in conventional and organic farms were very essential to know. This information was very important to take the next step in order to maintain and improve the productivity. The chemical analyzes were performed to clarify soil nutrient conditions such as: Nitrate (NO_3), phosphate (P_2O_5), potassium (K_2O), calcium (CaO), and the pH of the soil by using Dr. Soil Kits.

Results and Discussion

Conditions and problems in conventional and organic farming in Bali

Subak Buangga is located in Getasan Village at Badung regency. Subak Buangga has a land area of 148 hectares and is divided into 4 sections (tempek) with members of Subak 215 farmers. Subak is developing two types of agriculture that conventional farming and organic farming with the main commodity developed is rice. For the current conventional systems that implement land area of 100 ha. In the system of cultivation, farmers apply chemical fertilizers and pesticides. Farmers have some problems that the rat attack and pest so that rice production is not optimal, with an average yield of paddy 6-7 tons / ha, farmer's income are about Rp 4000/kg.

On the other hand, organic farming systems in Subak Buangga has an area of 48 ha that began in 2007. Farmers use cow manure produced from a local farmer groups. In the village Getasan organic farmers produced in Subak Buangga have gained organic certification of Lysos in 2012. The average yield generated by organic farmers is ranging 6-7 tons / ha.

But both; ricultural systems in Subak Buangga have problems of irrigation water crisis, as a result of prolonged drought. Based on observations and interviews in the field, show that in general the problems that arised in conventional and organic farming systems in Subak Buangga caused by several things such as : water was limited, prices was fluctuative , and pests and diseases problems, as shown in Table 1(a).

Marketing of the crops were done by cooperating with several distributors or sold directly to traditional market. Price was fluctuate. In Bedugul area, conventional farmland has been cultivated since 1982. In this area 4 farmers manage about 1 ha land. They use more than 5 types of pesticides chemical to control pests and diseases, but had not been able to control pests and diseases, and apply chicken manure and husk as fertilizer. In this season, they have discarded tomatoes or they don't harvest because recently tomatoes are very cheap in the market. In contrast, green onion is the most earning products, sell at Rp 15000/kg.

In organic farming, cultivation started 1999, this land was changed from conventional to organic in 1999. Udayana University has teached farmer, Runcha, how to cultivate in organic. Organic fertilizer is cow manure and liquid fertilizer made from disposal fruits juice. And also spicy spray which made from chili, ginger and halves has been used for prevent from insects and rats. Runcha has 1.5ha land, and his income about 20million/month. He sell his productions for nealy restaurants and Chinese area respective to more expensive than conventional productions. This farm land are used for training center to teach near farmers who want to start cultivate organic.

In organic farming, water crisis also was causing farmers could not grow rice as well as the difficulty to flush vegetables. For marketing of the crops were done by cooperating with several distributors, the company, as well as a restaurant. Marketed products were usually purchased directly on their own lands. Price was stable. Advantages in the application of organic farming systems by farmers was safe for the environment, not a lot of expenses incurred for the production process, and the benefits were also very tempting. So, they could increase their income. Pest and disease control carried out by mechanical means. If found pests and diseases in high enough quantities, the part of the plant disease and pest to be controlled in a way to throw it. In addition, farmers also use biopesticides such as Bali spices and biourine. Thus, pests and diseases can be controlled especially for rats. The problems in Bedugul area are shown table1(b).

Table1. Problems of conventional and organic farming in Subak Buaangga (a), Bedugul area(b)
(a) Subak Buaangga

Problem	Conventional	Organic
Water	Water was limited	Water was limited. .
Price of the product	Fluctuation in the market	Stable in the market, but demand is limited.
Pests and diseases	Crops are damaged by pest and diseases. To prevent with chemical reagents.	Crops are damaged by pest and diseases. To prevent with spicy spray.

(b) Bedugul area

Problem	Conventional	Organic
Water	limited. farmers could not rice planting.	Water was limited. Farmers could not rice planting..
Price of the product	Fluctuation in the market. High demand	Stable in the market, but demand is limited.
Pests and diseases	Rats, insect pests, and diseases of rice are always attack	Rats, insect pests, and diseases sometimes attack

Soil analysis rice farming

We analyzed chemical content of the soil in conventional and organic farms in Subak Buaangga, nitrate (NO_3), phosphorus (P_2O_5), potassium (K_2O), calcium (CaO), show Table3. It did not have the difference between conventional and organic. Only pH, there was a small difference, both sites pH are acidity. (Table2)

One solution could be to increase the pH of the agricultural land is to add organic materials such as lime and manure. Manure contains many macro nutrients such as Ca, Mg, S, N, P, and K (Junita *et al.*, 2002). Liming could raise soil pH, has been used often for pH correction reagents in Japan, where has a lot of Andsol.

Conditions chemical content of the soil in conventional and organic farms in Bedugul area were different. Nitrate (NO_3) in conventional farming was higher than organic farming. Calcium (CaO) in organic farming was higher than conventional farming. One of the reasons is that farmers added of dolomite to the soil. Giving a lot of dolomite could increase the content of calcium in the soil. Potassium in organic farming was higher conventional farming. In organic farms were found husk, it could increase potassium content in the soil. Only, phosphate (P_2O_5) and pH did not have difference between conventional and organic farming in Bedugul area . Value of pH was in neutral condition in the both places. (Table2)

Table 2. Comparative chemical properties of the soil in conventional and organic farming

Study sites	Subak Buangga (rice)		Bedugul Area (vegetable)	
	Conventional	Organic	Conventional	Organic
Nitrate(NO ₃) [mg/100g]	1	1	5	1<
Phosphate (P ₂ O ₅) [mg/100g]	5	5	150	150
Potassium (K ₂ O) [mg/100g]	100	100	35	150
Calcium (CaO) [mg/100g]	400	400	100	1,000
pH	5	5.5	7	7

Solutions for conventional and organic farming in Bali

We discussed solutions to problems conventional and organic farming in Bali. Table3 shows idea of solutions to problems we discussed.

Table 3. Solutions for conventional and organic farming in Bali

Management	Solutions of the problem
Conventional	a. Governments aid for initial investment for create new water sources and keeping costs
	b. Make standard of a minimum price for farmers
	c. Integrated pest management
Organic	a. Governments aid for initial investment for create new water sources and keeping costs
	b. Make standard of a minimum price for farmers
	c. Integrated pest management, the use of biopesticides, and insect pathogens
	d. Improving the quality of products and government facilitate farmers to market their products

Opportunity of sustainable agriculture in Bali

Sustainable agriculture is to keep producing and maintaining ecosystem for long time. Thus, it is important to maintain the balance of the ecosystem could be disturbed.

Organic farming may be the one way that can maintain the balance and to be sustainable agriculture in Bali. In fact little is known concerning how friendliness environment. Probably what is really important is stakeholder in the process of production to consume keep in mind environment is limited resource, using within a capacity of recovering from damage. In dry season, it is significant problem that water shortage regardless of organic or conventional and rice or vegetables. Building more reservoir and tank, completion more efficient irrigation system are needed. Payment of governments subsidy, providing private bank finance and company aggressive going into projects. Users are also required in appropriate way to utilize.

The things that can be done to create sustainable agriculture in Bali are:

- Must obtain the support of the implementation of the government's environmental policy. Policies are needed to promote a more sustainable agricultural practices when compared with conventional agricultural technologies.
- Fertilizer, pesticides and herbicides are needed less harmful for environment and also farmers. Farmers should study properly how to treat chemical products, in addition so that maintenance of low and institution are required.
- Created a special market for organic products that can enhance the attractiveness of the consumer to buy the product. Given consumer interest in organic agricultural products, farmers will seek to provide organic agricultural products.
- Government agencies and universities can provide counseling, training, and mentoring routine to farmers who apply conventional agriculture to be able to gradually reduce the use of chemical fertilizers and pesticides, and can combine the use of organic fertilizers and biopesticides. Thus, farmers can support to maintain environmental safety.

Conclusion

From this research agriculture of Bali, there are some problems that arise in the application of conventional and organic farming today, such as: water was limited, prices was fluctuative, and pests and diseases problems. The solving problems that can be done is Governments aid for initial investment for create new water sources and keeping costs, and support to diffuse integrated pest management. Universities are required to provide knowledge for farmers and make a contribution local. In this research soil chemical property does not significant difference in conventional and organic. More details research is needed in the future.

To build sustainable agriculture, ecology, economy are recognized material factors. Both of conventional farming and organic farming conditions in Bali have both or each problems of

ecology and economy. Actually, organic farming practices is the one way that can make-sustainable agriculture in Bali, but observed organic farmers are positive and anticipate organic farming's future. It is supposed to be supports and cooperation from governments and universities. Social cooperation is also one of material factors to be sustainable. Social cooperation means in this senses education supports from professionals of governments and universities, and more, understand local agriculture from community and community people they work agriculture or buy products. Today improper or excessive use pesticides and chemical fertilizers damage environment although unrecognized at the first glance. We keep in mind environment resource is limited and in utilizing that should be used properly not to exceed capacity of environment. To keep living a life and to increase workers in agriculture, farmer's income are needed to be higher and more stable. Cooperation of many relative agencies such governments universities and communities each other play a role in building sustainable agriculture.

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