Bull. Fac. Agr. Kagoshima Univ., **52**, 57-62, 2002

Organic Farming and Its Prospect in Indonesia

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Received for Publication September 10, 2001

Introduction

Increasing demand for food production has resulted in the application of more chemical fertilizers and the introduction of mechanization in agricultural management in the last few decades. It has been reported that, in some areas, intensive agricultural practices have caused environmental problems such as excess residual N remains in agricultural farmland[11]. This problem should be taken into account in order to practice better management of agricultural-environmental conditions.

It is well known that the use of organic materials such as crop residues, green manure and animal waste in soil-crop systems may improve soil structure and support the development of soil microorganisms[8, 15]. This condition leads to a process of biological transformation of N in soil and results in the conversion of an organic form of N into an inorganic form available for crops. Practicing organic farming, therefore, should be promoted in order to produce safe foods and a clean environment.

In the European Union (EU) countries, the USA, Canada, Australia and Japan agriculture under organic management has developed rapidly. It has been reported that the area of land managed under organic management in Europe increased from 250,000 to close to 2,000,000 ha, in recent years (1990-1997)[9]. In the same period, the organic farmland certified in the EU countries increased from 258,974 to 2,102,209 ha with the number of organic farms increasing from 12,735 to 81,783 farms[16]. In Italy, one of the EU countries advanced in practicing organic farming, the area of agricultural farmland under organic management increased from 13,000 to 641,149 ha[16]. The portion of organically produced foods in the food systems in many developed countries such as the USA, France and Japan has increased by more than 20% annually[6]. This is due to the fact that organic farming not only produces safe foods but also creates a better environment. The marketing of organically produced foods has also gained worldwide patronage. These are believed to be the factors behind the blooming of organic farming in the world, especially in the developed countries.

In contrast, the practice of organic farming in Asian countries remains limited. It has been reported that agricultural activity under organic management has only been recorded in China, Japan, Israel, Korea, and Lebanon. The figures for the areas of organically farmed land throughout this region range from 100 ha (Lebanon) to 14,000 ha (China)[7]. Indonesia has a great potential to develop organic farming, but people still do not realize the benefits that may be derived from it. Currently, even though the practice of organic farming has been promoted throughout the country, only a few farmers have changed their agricultural activity from inorganic to organic farming.

Over the last few years, researchers at our university from a variety of fields have contributed to the research project research entitled, "Interactive studies on food, health and environmental sciences in Kagoshima". The project has focused mainly on organic farming. The authors have participated in this project. Accordingly, this article is being written in order to share knowledge of organic farming and to contribute towards the further development of organic farming, especially in Asian countries.

Discussion

1. Indonesia in brief

Indonesia is located in the South East Asian region. It consists of more than 17,700 islands, stretching around 5,200 km along the equator at 95° WL-141° EL and 1,600 km at 11° SA-7° NA. Only 6000 of these islands are inhabited. The total area is about 1,010,443 km^2.

The East and West monsoons strongly influence the weather in Indonesia. These bring a dry season (April — September) and a wet season (October-March). The average annual rainfall is 1,755 mm, with humidity of around 75-100%, and daily temperatures ranging between 21° and 33° C, except at the higher altitudes.

2. Use of land and other natural resources

Land use, mainly as agricultural farmland plays an important role in the economy of the country. There was no significant change in the distribution of land use over the four-year period from 1995 to 1998[5]. Human resources, fertilizer production, and animal farms can be used simultaneously to support the practice of agriculture. Agricultural activity in Indonesia is dominated by small farming systems. The number of such systems is very high and has increased by about 7.3% in the 30-year period from 1963 to1993[5].

The population of livestock has increased in the last 5 years (Table 1), with beef cattle, goats and sheep being the main livestock. Their population has increased in the last 5 years with the exception of 1998 when the populations of beef cattle, goats and sheep decreased by around 2.5%, 4.3% and 7.5%, respectively. On the other hand, the population of layers and broilers decreased drastically from 1997 to 1998, showing a drop of almost 50%, while the indigenous chicken and duck population seems to be stable (Table 2).

Table 1. The population of livestock (head)

Livestock	1995	1996	1997	1998	1999
Goats	13,167,062	13,840,070	14,162,547	13,560,449	14,120,520
Beef cattle	11,534,066	11,815,606	11,938,856	11,633,876	12,102,501
Pigs	7,720,156	7,597,210	8,232,839	7,797,558	9,352,937
Sheep	7,168,056	7,724,447	7,698,636	7,144,003	7,502,437
Buffalo	3,135,542	3,171,185	3,064,532	2,829,291	2,859,032
Horses	609,373	579,314	582,284	566,485	578,821
Dairy cattle	341,334	347,989	334,577	321,992	333,985

Source: Directorate General of Livestock of the Republic of Indonesia, 2000

Table 2. The population of poultry (head)

Poultry	1995	1996	1997	1998	1999
Broilers	689,467.2	755,955.9	641,374.0	354,003.5	418,940.5
Indigenous chickens	250,080.4	260,712.8	260,834.7	253,133.4	265,998.4
Layers	68,896.5	78,706.5	70,622.8	38,861.3	41,966.5
Ducks	29,616.2	29,958.8	30,319.9	25,950.0	26,284.0

Source: Directorate General of Livestock of the Republic of Indonesia, 2000

3. Agricultural profile of Indonesia

In Asian countries, rice is one of the most important staple foods. In 2000, the rice production in Asia amounted to 545,477,012 Mt or 91% of the total world production (598,851,733 Mt)[6]. In Indonesia, the area of land planted with rice increased by almost 50% from 1963 to 1983. However, it decreased by around 3.7% in 1993[5]. The area of dry land fields almost doubled compared to that of wetland fields. The agricultural farmland is dominated by small farms, which number peaked in 1993 when their percentage of all farms reached more than 50%. The area used for paddy fields has increased in the last five years (1995-1999), with the exception of 1997. During this period the production of rice remained unstable, and the growth in productivity decreased from 6.65% in 1995 to −0.36% in 1998 (Table 3). Secondary crops such as cassava, maize, and sweet potatoes are also very important, particularly when the rice harvest fails. The production of secondary crops remains unstable and has tended to decrease in the last five years, except for the maize yield (Table 4).

The production of horticultural crops is also important to the economy of Indonesia. Horticultural crops such as vegetables and fruits are planted throughout the country. The main vegetables are spinach, carrots, chillies, garlic, and onions. The yield has fluctuated during the last five years, mainly in 1997 when vegetable production decreased. Chilli production outstrips that of the other horticul-

Table 3. Harvested area, production and the growth rate of rice yield

Year	Harvest area (ha)	Production (tons)	Growth rate of production (%)
1995	11,438,764	49,744,140	6.65
1996	11,569,729	51,101,506	2.73
1997	11,140,594	49,377,054	−3.37
1998	11,716,499	49,199,844	−0.36
1999	11,718,577	49,875,284	−1.37

Source: Central Bureau of Statistics of Indonesia, 2000

Table 4. The production of secondary crops

Crops	1995	1996	1997	1998	1999
	tons				
Cassava	15,441,481	17,002,455	15,134,021	14,696,203	16,346,688
Maize	8,245,905	9,307,423	8,770,851	10,110,557	9,507,347
Sweet potatoes	2,171,027	2,017,516	1,847,492	1,923,055	1,847,135
Soybean	1,680,007	1,517,181	1,356,891	1,304,950	1,369,156
Peanuts	760,148	737,815	688,345	687,688	657,681

Source: Central Bureau of Statistics of Indonesia, 2000

Table 5. The production and plantation areas of vegetables

Crops	1993	1994	1995	1996	1997	1993	1994	1995	1996	1997
	Production (tons)					Plantation areas (ha)				
Chillies	772,715	724,445	1,589,978	1,043,792	801,832	157,499	177,639	182,263	169,764	161,602
Onions	561,267	636,864	592,548	768,567	605,736	75,123	84,630	77,210	96,292	88,540
Carrots	192,482	234,178	247,179	269,837	227,322	15,228	17,126	18,311	19,502	17,428
Garlic	127,974	134,940	152,421	145,836	102,283	20,011	20,809	21,896	20,511	18,567
Spinach	92,601	101,783	150,147	120,182	73,790	30,796	34,336	39,869	38,182	35,068

Source: Central Bureau of Statistics of Indonesia, 2000

tural crops in terms of both tonnage and land area farmed (Table 5).

The four main fruit products are bananas, mangos, oranges and pineapples. The fruit yield has fluctuated during the last five years, peaking in 1995, with the exception of the mango yield, which peaked in 1997 (Table 6). The area under plantation has also fluctuated, peaking in 1995 with the exception of the areas used for orange and banana production which peaked in 1994 and 1997, respectively (Table 6).

Table 6. The production and plantation areas of fruits

Crops	1993	1994	1995	1996	1997	1993	1994	1995	1996	1997
	Production (tons)					Plantation areas (ha)				
Bananas	2,643,812	3,086,557	3,805,431	3,023,485	3,057,081	70,721	50,041	49,044	49,019	78,115
Mangos	460,357	668,048	888,960	782,937	1,087,692	126,184	133,454	196,604	148,820	48,336
Oranges	260,341	393,427	1,004,632	730,860	696,422	36,910	61,402	46,036	38,193	24,653
Pineapples	459,105	346,519	703,300	501,112	385,779	19,985	20,131	50,718	29,586	5,608

Source: Central Bureau of Statistics of Indonesia, 2000

4. Organic farming in Indonesia

With a population of more than 200 million, a large population of livestock, a huge diversity of crops, and a tropical climate Indonesia will appear well-suited to the practice of organic farming. Animals play an important role in organic farming through their distribution of animal waste as an organic resource. The population of livestock (Tables 1 and 2) can be expected to be an important component in determining the amount of farmland under organic farming management as animal waste plays the key role in organic agriculture. Through the application of dung and urine from livestock, the soil health and fertility of farmland may be maintained and improved. It has been reported that livestock produced amount of 19-40 kg day^{-1} of dung. Around 3.5 kg $animal^{-1}$ day^{-1} of organic matter (OM) and about 0.045 kg N day^{-1} has been excreted by housed Jersey cattle and young cattle steers, respectively[8].

The information on organic farming activity is very sparse, even though experiments on it have been conducted widely throughout the country. Some activities involving the practice of organic farming or reduced chemical use have been reported from Central Java, and results obtained were good. For example, the application of organic fertilizers such as *biokom* and *bio guano super* influenced the performance of rice. Using *biokom* the rice production in Wonogiri district increased from 6.0 to 8.5 ton ha^{-1} [1]. While, in Karang Anyar district the rice production increased from 5.0 to 8.3 ton ha^{-1} due to the application of organic fertilizer on agricultural farmland[2]. Moreover, the use of an organic fertilizer such as *bio guano super* in combination with inorganic fertilizer increased the production of rice in Klaten district from 5.5 to 7.3 ton ha^{-1} [3].

The practice of organic farming remains limited, although a lot of experiments on it have been conducted by applying organic materials such as cover crops, green manure, crop residues[10, 12], and the addition of animal waste and microorganisms (EM4)[14]. Legumes play an important role in maintaining and improving soil N status through their ability in fixing atmospheric nitrogen. There is evidence that legume and crop residues have improved soil N status[13]. It has been reported that *Centrosema pubescent* influenced the yield of crops in mixed cropping with King grass (*Pennisetum purpuphoides*) both in low and upland soil in Karang Anyar district, Central Java[10]. Moreover, the application of tea residue into the soil-crop system increased the dry matter production of *Setaria sphacelata*[12]. Research on Effective Microorganisms (EM) has been widely carried out. Wididana and Higa[14] evaluated the

effect of EM on the yield of some horticultural crops such as garlic, onions, tomatoes and watermelon. The yields of garlic, onions, and tomatoes were significantly affected, while the production of watermelon was not influenced by the implementation of EM.

Constraints related to such factors as environmental impact and sustainability, markets, and farm productivity may impose on the practice of organic farming[6]. The fertility of soil remains very low due to high rainfall in the tropical climate that leads to soil nutrient leaching. This phenomenon may be a hindrance to the practice of organic farming. However, as organic agriculture may give more benefits compared to the practice of inorganic farming, special efforts should be made to carry out organic agriculture. However, in the developing countries, people have paid less attention to environmental conditions. This may affect the behavior of farmers and also influence the government in making policy on the implementation of organic farming. A reliable market should be established in order to promote agricultural production under organic management. However, it is very difficult to create reliable markets in the developing countries, as the demand for organic produce is very low compared to that in developed countries. In addition, official inspections and certification are required to confirm that products are being cultivated under organic conditions.

Summary

As environmental problems increase due to misapplication of mineral fertilizers on agricultural farmland, the practice of organic farming may become a priority in order to reduce the pollution of the environment. Currently, organic farming is blooming, especially in the developed countries. In contrast, it seems to be difficult to develop agriculture under organic farming management in the developing countries where the quantity of food production is the priority. In Indonesia, the land use system, quantity of livestock, farming practices, abundance of leguminous crops, and human resources make it a place with the potential to support the practice of organic farming. However, the lack of a reliable market is a major challenge to the development of organic farming.

Acknowledgments

The authors would like to thank Mr. Richard Gyimah and Mr. Hamid Sulaiman for their help and for giving valuable criticisms on this manuscript.

References

1) Anonymous: Organic fertilizer produced by Indonesian farmers in Central Java. *Suara Merdeka*, Semarang, Indonesia pp. 10 (1999) (in Indonesian)
2) Anonymous: Organic fertilizer depressed cost production of agriculture. *Suara Merdeka*, Semarang, Indonesia pp. 6 (2000) (in Indonesian)
3) Anonymous: Organic fertilizer increased agricultural production up to 30%. *Suara Merdeka*, Semarang, Indonesia pp. 5 (2000) (in Indonesian)
4) Anonymous: The population of livestock in Indonesia 1995-1999. Directorate General of Livestock of the Republic of Indonesia. Jakarta, Indonesia (2000)
5) Anonymous: National statistical data on land use distribution and agriculture. Central Bureau of Statistics of Indonesia (2000)
6) FAO: Organic Agriculture. FAO-Committee on Agriculture. Rome-Italy (1999)

7) IFOAM: Organic agriculture statistics worldwide (Asia) (2000)
8) Kerley, S. J. and Darvis, S. C.: Preliminary studies of the impact of excreted N on cycling and uptake of N in pasture systems using natural abundance stable isotopic discrimination. *Plant and Soil*, **178**, 287-294 (1996)
9) Lampkin, N.: Organic farming in Europe (1997) http://www.wirs.aber.ac.uk/research/organics/europe/
10) Lukiwati, D. R., Sumarsono, Soelistyono, H. S., Rahmadi, D., Widjajanto, D. W. and Darmawati, A.: The productivity of king grass-centro mixture in upland and lowland in Central Java, Indonesia. Proceeding of national seminar in higher educational research. Directory of Higher Education, Department of Education, Bogor, Indonesia. pp. 297-313 (1993)
11) Mashima, S. I., Matsumoto, N. and Kenjiro, O.: Nitrogen flow associated with agricultural practices and environmental risk in Japan. *Soil Sci. and Plant Nutr.*, **45**, 881-889 (1999)
12) Sadat, A., Sukamto, B. and Widjajanto, D. W.: The effect of incubation and doses of tea residues on the regrowth of *Setaria sphacelata* at the second defoliation. *Pastura Journal*, **1**, 53-58 (1997)
13) White, R. E.: Introduction to the principles and practice of soil science. 2nd Ed. Blackwell Scientific Publications. Oxford, The United Kingdom. pp.153-171 (1987)
14) Wididana, G. N. and Higa, T.: Effect of EM on the production of vegetable crops in Indonesia. Proceeding of the 4th International Conference on kyusei nature farming. Paris, France pp. 80-84 (1995)
15) Yaacob, O. and Blair, G. J.: Mineralisation of ^{15}N-labelled legume residues in soils with different nitrogen contents and its uptake by rhodes grass. *Plant and Soil*, **57**, 237-248 (1980)
16) Zanoli, R.: The organic boom in Italy. *Ecology and Farming*, **22**, 22-24 (1999)