Development of Integrated Farming Technology for Farmer Community Empowerment in Banjararum Java Indonesia: Assessment and Introducing of Integrated Farming System

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Abstract- *Single type of land use on agricultural practice is not a wise way to meet all the requirements for sustainability or agriculture. On the other hand, integrating crop, animal and fish productions may allow an enhancement of agro-ecosystem productivity and stability through efficient nutrient management, integrated management of soil and water resources, and a wider variety of crop, livestock and fisheries products (National Academic Sciences, 1993b). The study is conducted at Banjararum village, Kaibawang district, Kulon Progo regency, Daerah Istimewa Yogyakarta (DIY) province, Java Island, Indonesia. The objectives of this study were: (1) to develop integrated farming technology (IFT), and (2) to increase agricultural community empowerment for sustainable agriculture. Totally there were three years required for conducting the study, i.e. 2010-2012. It was divided in to three periods of programs for every year. The present study, as the first period of the study, was focused to assess the agricultural resources and introduce the Integrated Farming technology to the farmer communities. While the second period would be done on the implementation of model IFT, and the last third period would be focused on evaluation development of the model capacity building of farmer group. Participatory Rural Appraisal (PRA) method was used in this study and implementation technique was by Focus Group Discussion (FGD). There were three farmer communities in Banjararum village were chosen in this study as a development center of integrated farming, i.e., Mejing, Klepu and Sentul hamlets. The results of the first period of the study showed that the three farmer communities at Banjararum was very appreciate on the development program of IFT, especially for Mejing farmer community. They also understand how to develop the IFT according to the potential of their land resources. It is recommended that developing the IFT can be continued for the next in achieving the sustainability of agriculture.*

Keywords: *hygienic fence, IFT, liquid organic compost, solid organic compost*

INTRODUCTION

Single type of land use on agricultural practice is not a wise way to meet all the requirements for sustainability or agriculture. On the other hand, integrating crop, animal and fish productions may allow an enhancement of agro-ecosystem productivity and stability through efficient nutrient management, integrated management of soil and water resources, and a wider variety of crop, livestock and fisheries products (National Academic Sciences, 1993b). Integrated Farming Technology is a system in agriculture by arranging many agricultural resources that potentially developed to be a nearly closed system in purposes to produce healthy foods and maintaining the agro-ecosystem in order to achieve sustainability.

According to the Middle Scale Development Plan (RPJM) at Kulon Progo regency, for the objectives of the development program of five years period were focused on the economical strength based on the community economy in order to create people in Kulon Progo regency in self

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sufficiency, peace and prosperity on the basis of belief and devotion of God. Implementations of the government programs of the Kulon Progo regency are oriented on the community services, community empowerment, agribusiness development, agro-industry and tourism that are supported by a sufficient infrastructure and it is based on the spirit of cooperation.

Banjararaum, that is included in Kalibawang district, is also positioned as the third order in the regional land use planning of the Kulon Progo regency. The area that included in this order is established as center of local activities which services on self locality, and it is arranged by: 1) increasing in environmental quality by supporting city welfare and infrastructure in the integrated and community empowerment, and 2) usage of rural institution, installation and development of environmental welfare and infrastructure, such as clean water, road, rice field irrigation and residential environment. Development and strengthening on welfares and infrastructures of regional connections are aimed to increase currents smoothness among development orders and also with regional boarder. Banjararum village is also established as for location development of agropollitant zone based on the decision of Chief Kulon Progo regency no. 222 at year of 2002. The land of this area has potential for developing agriculture as productions of durian, *rambutan*, clove and cacao.

Banjararum village is included in the east part of the Menoreh Ridges in Java Island. This area has variability in physiography from plain to mountainous and also has a gently to steep slopes. The east part boundary of this village is the Progo River, and this river is also as a boundary between Kulon Progo regency and Sleman regency. As for variability of physiography and soil parent material, it resulted in land resources with variation in agriculture potential. Land resources have major factors on the soil fertility and it may determine the kinds of commodity that will be developed in agricultural practice. It needs alternative strategies, albeit in limited areas, for confronting land use problems and for moving toward sustainability (National Academic of Sciences, 1993). Some agricultural areas of Banjararum village are supported by irrigation system that developed more than seven decades before. Therefore, these areas are dominated by paddy field and farmers of this village have a high motivation to practice an innovation of agricultural technology well.

Farmers at Banjararum village have done best practices in agriculture from several centuries ago, and these have been their culture. Although in most of the upland areas physical and social infrastructure is weak and agricultural services have to be provided to scattered farming population (Haryanto, 2004). It was stated by Juo (2004) that People living in the upland areas generally have fewer economic opportunities than those in the valleys and coastal lowlands. A part of soil of Banjarum village that receives water from irrigation channel is cultivated by paddy rice, but for that does not receive this irrigated water is cultivated by perennial and annual crops. As for tropical region that there are two seasons of dry and wet, irrigated water is not enough for all paddy soils at dry season. So they make a cultivation pattern of rice-rice-*palawija* cultivation annually. They cultivate a dry land for a mixed rather than monoculture farming. Cacao as an estate commodity is also cultivate by them, but it is mixed with other annual plants that higher than cacao. So the cacao plant is almost under shading of the other kind plants. This condition causes the cacao plant may not grow and produce well. Farmers in this area also a group

Humid tropic conditions are found over nearly 50 percent of the tropical land mass and 20 percent of the earth's total land surface—an area of about 3 billions ha. Asia contains about 25 percent of the world's humid tropics. As many as 62 countries are located partly or entirely within the humid tropics (National Academy of Sciences, 1993).

Objectives of the present study, as the first period of the study, were focused to assess the agricultural resources and introduce the Integrated Farming technology to the farmer communities. While the second period would be done on the implementation of model IFT, and the last third period would be focused on evaluation development of the model capacity building of farmer group.

METHODS

The study is conducted at Banjararum village, Kalibawang district, Kulon Progo regency, Daerah Istimewa Yogyakarta (DIY) province, Java Island, Indonesia. The objectives of this study were: (1) to develop integrated farming technology (IFT), and (2) to increase agricultural community empowerment for sustainable agriculture. Totally there were three years required for conducting the study, i.e. 2010-2012. It was divided in to three periods of programs for every year. Participatory Rural Appraisal (PRA) method was used in this study and implementation technique by Focus Group

Discussion (FGD). There were three farmer communities in Banjararum villages were chosen in this study as a development center of integrated farming, i.e. at Mejing, Klepu and Sentul hamlets.

RESULTS AND DISCUSSION

Implementations of the Programs

Coordination activities

For beginning the IFT program, it was serial coordination among two universities and all offices that involved in the program. The results of the coordination are presented in Table 1. Coordination between UPNV and UMY resulted in the agreements of kind and schedule of the activities.

There were also same perception and agreement with the Agriculture Office DIY Province and Agriculture and Forestry Office, Kulon Progo regency in activities and also management of allocating budged for developing IFT. There was also a positive response on this program, and also they would allocate sharing budged for supporting the developing the integrated farming in this village. They also planned that this area was established as a pilot project of the integrated farming. The Development Plan Board of Kulon Progo regency also agreed within developing IFT at Mejing, Klepu san Sentul hamlets at Banjararum village.

Table 1. The results of the coordination activities

No	Name of activity	Result
1	Coordination between UPNV and UMY	Coordination between UPNV and UMY resulted in the agreements of kind and schedule of the activities
2	Coordination with the Agriculture Office, DIY Province	There was a same perception and agreement with the Agriculture Office, DIY Province in activities and also management of allocating budged for developing IFT
3	Coordination with the Agriculture and Forestry Office, Kulon Progo regency	There was a same perception and agreement with the Agriculture and Forestry Office, Kulon Progo regency in activities and also management of allocating budged for developing IFT
4	Coordination with the Development Plan Board, Kulon Progo regency	There was an agreement by Development Plan Board in developing IFT at Mejing, Klepu san Sentul hamlets at Banjararum village, and also an endorsement of the board for real work activity in these three hamlets

Agriculture extension

The results of the agriculture extension are shown in Table 2. This step of the implementation program was introducing the integrated farming technology to the community at three hamlets (Mejing, Klepu and Sentul) as part area of the Banjararum village. There was a good appreciation from them as they wanted to increase their knowledge and get better farming practice. The results of Farmer communities appreciation to the socialization of IFT are shown as follows. After the IFT socialization, farmer community at Mejing hamlet then began to reconstruct the communal cattle fence. They have developed a technology in production of solid organic compost and processing livestock feed. They wanted to analyze chemical characteristic of the solid organic fertilizer and it would be use as a product specification. So we analyzed the chemical properties of their organic fertilizer, and then it is used as a product specification. They also wanted to extend the agriculture commodity by eel (*belut*) production on farmyard.

Table 2. The results of the extension activities

No	Activity	Result
1	Socialization of IFT	1. Farmer community appreciated well to the socialization IFT 2. They began to reconstruct the communal cattle fence 3. They have an experience in production of solid organic compost and processing feed 4. They wanted to analyze chemical characteristic of the solid organic fertilizer and it would be use as a product specification 5. They wanted to extend the agriculture commodity by eel (*belut*) production on farmyard
2	Management of livestock	All participants actively participated on the material and the wanted to know more on the artificial insemination on cattle, characteristic of cattle mother, biogas and usage of it
3	Production of the solid organic fertilizer	They could understand on production of solid organic fertilizer, anaerobic and aerobic processes, and also method on the process starter on producing fertilizer
4	Production of the solute organic fertilizer	They could understand on production of solid organic fertilizer and how to identify the quality
5	Land management	They can understand how to manage the land in the right way, especially in the soil plowing and planting preparation according to the land steepness
6	Technology of annual crops production	They can understand how to plant the annual crops in the right way, especially in the management of horticulture crops
7	Multiple Cropping System	The can understand the benefit of the multiple copping system and technology in the multiple cropping practice. This system is important in developing the IFT
8	Production of terrestrial fisheries, especially ell (*belut*)	They can understand technology how to produce the terrestrial fisheries the land in the right way, especially in ell production by using the residue of the biogas production.
9	Workshop of the IFT implementation	Every farmer group of each hamlet may arrange a plan on a management of vertical and horizontal integration of the IFT components, and it will be made a plot demonstration on the next second year

All participants actively participated on the material extensions. They wanted to know more on the artificial insemination on cattle, characteristic of cattle mother, biogas and usage of it. They could understand on production of solid organic fertilizer, anaerobic and aerobic processes, and also method on the process starter on producing fertilizer. By the extension, they could understand on production of solid organic fertilizer and how to identify the quality. They can understand how to manage the land in the right way, especially in the soil plowing and planting preparation according to the land steepness. They can understand how to plant the annual crops in the right way, especially in the management of horticulture crops. The can understand the benefit of the multiple copping system and technology in the multiple cropping practice. This system is important in developing the IFT. They can understand technology how to produce the terrestrial fisheries the land in the right way, especially in ell production by using the residue of the biogas production. Finally, every farmer group of each hamlet may arrange a plan on a management of vertical and horizontal integration of the IFT components, and then it will be made a plot demonstration on the next second year.

Advisor activity

Advisory activities were done especially in some techniques that supporting the IFT implementation. Table 3 shows the results of the serial advisors for three farmer communities at three hamlets. They can practice by themselves in producing liquid and solid organic fertilizers from cattle urine and feces, respectively. They also can practice by themselves in producing starter that would be used in producing liquid and solid organic fertilizers. The organic fertilizer was then analyzed in soil science laboratory in order to give fertilizer specification that they produced.

Table 3. The results of the advisor activities

No	Name of activity	Result
1	Technique of the liquid organic fertilizer	They can practice by themselves in producing a liquid organic fertilizer from cattle urine
2	Technique of the solid organic fertilizer	They can practice by themselves in producing a solid organic fertilizer from a cattle feces
3	Technique of the starter	They can practice by themselves in producing starter that would be used in producing liquid and solid organic fertilizers
4	Analysis of the solid organic fertilizer quality	The organic fertilizer was analyzed in soil science laboratory in order to give fertilizer specification that they produced

Educational management

Education aspect is important for increasing the knowledge of the farmer communities. The results are presented in Table 4. The farmer groups had a field trip to CV Pendawa Kencana Multi Farm Pagerjurang, Kepuhharjo, Cangkringan. They got explanations on developing IFT and its management that had been successfully practiced by this family company. They also got knowledge in producing biogas, purifying biogas, using biogas for electric generator and compression of gas for filling gas in tube after they visited the Agriculture laboratory and field station at UGM.

There were 42 student of the UPNVY attend the thematic real work in IFT for a month. They were students from faculties of agriculture, economy and mining technique. They were appreciated well by the farmers in developing IFT, and also by Banjararum people the programs of education, social, culture and religion. Three thematic maps of the land potential of three hamlets of Mejing, Klepu and Sentul were produced by this real work.

Table 4. The results of the education activities

No	Name of activity	Result
1	Field trip to CV Pendawa Kencana Multi Farm	The farmer groups had a field trip to CV Pendawa Kencana Multi Farm Pagerjurang, Kepuhharjo, Cangkringan. They got explanations on developing IFT and its management that had been successfully practiced by this family company
2	Field trip to UGM Agriculture laboratory and field station	The farmer groups got knowledge in management of cattle livestock management, producing biogas, purifying biogas and using biogas for electric generator and compression of gas for filling gas in tube
3	Real work (KKN) of the UPNVY student	1. The students were appreciated well by the farmers in developing IFT, and also by Banjararum people the programs of education, social, culture and religion 2. Three thematic maps of the land potential of three hamlets of Mejing, Klepu and Sentul were produced by this real work.

Designing healthy fence

A healthy fence is very important for contributing the IFT as it can improve the farm environment and also it make farmers feel easy to do the daily farming works. It was designed a fence construction in order to divide urine and feces of cattle easily. There were three conditions differences in three

hamlets of Mejing, Klepu and Sentul that is shown in Table 5. Therefore, there were different activities in preparing the IFT implementation.

Table 5. The results of the design product

No	Name of activity	Result
1	Dividing urine and feces design at Mejing hamlet	The communal cattle fence at Mejing hamlet was repaired for increasing the health and environment quality by designing the fence that dividing urine and feces easily.
2	Built a hygienic communal fence at Klepu hamlet	The farmer group at Klepu built a communal fence that design by dividing urine and feces like Mejing communal fence
3.	Introducing a hygienic communal fence at Sentul hamlet	This activity was still introducing the communal cattle fence at Sentul for increasing the health and environment quality by designing the fence that dividing urine and feces easily. It would be realized at the second year.

Resources Assessment

In the agricultural practices, almost farmers at Banjararum village have used land and water resources for combination plant, livestock and fish production. As it was a culture that has been heritage form their great-grandparents. However, they did not integrated these three commodities as system that one kind commodity might contribute others and how to use a waste as a resource for increasing production and improving quality of other resources. Also they did not manage sanitation well on the livestock fence, especially for cleaning the feces, urine and residual feed. So that environmental of the livestock and is surrounding was polluted by these wastes.

To overcome the problems, it can be done by processing the feces to be biogas. Therefore, it needs a bio-digester to separate the unused gas that may cause polluted gas emission to be biogas that can be used as renewable energy. Unfortunately, there was a bio-digester producing biogas that its location was far from fence, so they had to bring the feces to it. The residues of the cattle feed were also managed well, so it can be processed to produce compost and it would be applied to their farmland to improve the soil quality.

Appropriate technology in the composting process was needed to produce high quality compost without consumed long period. Of course, high quality compost can be made by a good composting system and it had to be added by other materials that high in nutrition and it also can induce the composting process. Besides the knowledge on the composting technique, farmers also need to understand how to manage the farmland, production of perennial and annual crops, double cropping system, livestock management and terrestrial fisheries. All these knowledge were needed for them in relation to arrange all agricultural components to be an integrated farming system in the right way.

Management in Developing IFT

The efficiency of tropical agriculture is determined by a combination of environmental factors (including climate, soil, and biological conditions) and social, cultural, and economic factors. Steady progress toward sustainability and the resolution of problems in the humid tropics requires that several scientific disciplines be integrated and managed to ensure collaboration and synergy. Implementation of the IFT is determined by all components of the agricultural system which have to refer the aspects of successfully system of agriculture production, minimized waste emission, converting wastes to be resources, minimizing input from outer agriculture resources and sustainability of agriculture. Geographically, land resources for implementation of the IFT must be plotted in the high similarity characteristics. Therefore, it is required a technical guidance for determining the minimum land area, kinds and population of suitable commodities of plants, livestock and fish, then kinds or models of the integration of these commodities, and also farmers organization which supporting IFT system. The development and implementation of approved integrated farming system plans should be the basis for delivery of education and technical assistances, should be the condition under which producers become eligible for financial assistance, and should be the basis for determining whether producers are complying with soil and water quality programs (National Academy of Sciences, 1993a).

Arrangement of the IFT design must be based on the result of the analysis of all components of the agricultural system in which able to maintain a sustainability, that are: 1) characteristics of the soil resources, 2) characteristics of the landform, 3) availability of water resource, 4) macro and micro climate, 5) suitable and prospect of plants, livestock and fish, 6) farmer skill, 7) available appropriate technology, 8) group of IF, 9) micro financial institution, 10) integrator of the IF groups, 11) market system of the agriculture products and 12) advisor institutions.

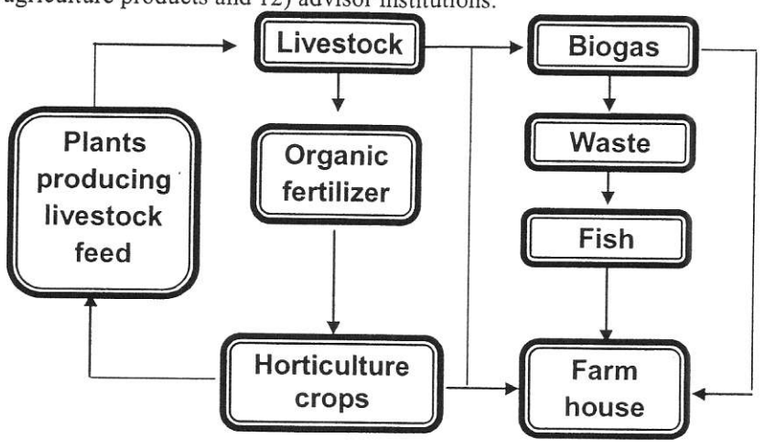

Figure 1. IFT design of crops, livestock and terrestrial fisheries at Banjararum

Improved land use in the humid tropics requires an approach that recognizes the characteristic cultural and biological diversity of these lands, incorporates ecological processes, and involves local communities at all stages of the development process. Banjararum land as is included in sloping area, it is a fragile land. So, development of IFT is better to produce high-value farming and income-generating options, such as horticulture, cattle and fish (Figure 1). There is a chain relation among crops, livestock and terrestrial fish productions (Little and Edwards, 2003). It was reported by Partap (2004) that the agriculture practices in Japan are focused on: vegetable farming and floriculture with special highland products; animal husbandry on grasslands; labor-intensive organic farming; developing forestry; microenterprises development – food processing, etc.; adding value to the local farm produce; and changing tourism development approach to build stronger tourism-farming linkages "farming for tourism". In the long-term, implementation of an integrated farming system plan should be required of producers, regardless of their participation in government farm programs (National Academy of Sciences, 1993a).

Developing a Prospectus Products

In the implementation of IFT in Banjararum village, it was also supported by a university program that is a duty of student to serve the rural community by attending a real work lecture. There were 40 students from any different scientific disciplines involved in the real work lecture, and they lived on Banjararum village for a month. Many activities were done by them for motivating people, especially farmers, in developing IFT at Banjararum. The activities of the students were accepted by people although not all students have an agricultural science background. Student as a agent of change can contribute on the introducing IFT by their ability to adapt in the rural living.

After a year activities in developing IFT by assessments of all resources involving the IFT at three hamlets of Mejing, Klepu and Sentul, there were three commodities that prospected for develop. These products of the IFT at Banjararum are: 1) solid organic compost with chemical specifications (Figure 2), 2) hygienic communal fence that can divide urine and feces easily (Figure 3), and 3) organic liquid compost (Figure 4). The fence model and both solid and liquid composts are a unity continue process that can make farmer easy do for their daily farming works and converting residues to commercial products. It was stated by Little and Edwards (2003) that wastes from intensive animal production can be converted to industrial products, and these are valuable inputs into other parts of the farming system.

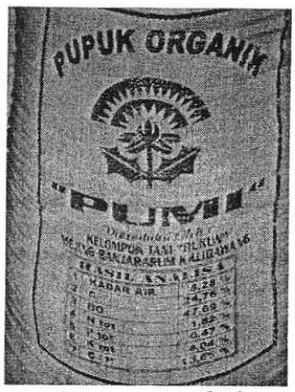

Figure 2. Solid organic compost with chemical specifications

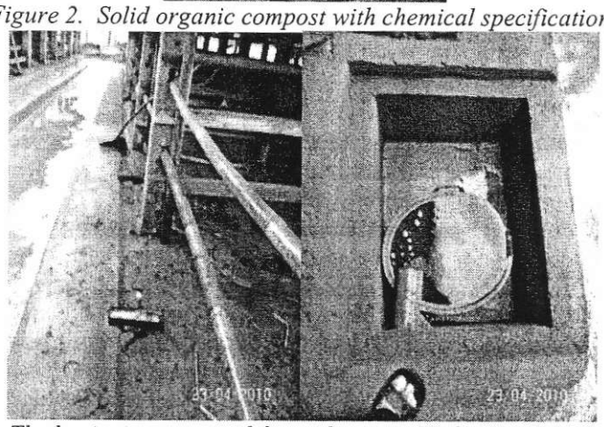

Figure 3. The hygienic communal fence that can divide urine and feces easily

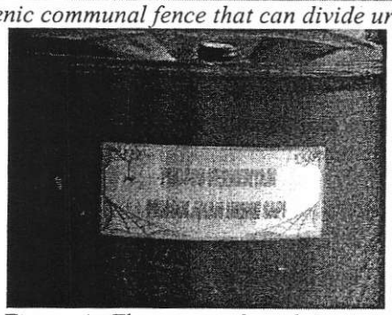

Figure 4. The organic liquid compost

CONCLUSSIONS

The results of the first period of the study showed that the three farmer communities at Banjararum was very appreciate on the development program of IFT, especially for Mejing farmer community. They also understand how to develop the IFT according to the potential of their land resources. It is recommended that developing the IFT can be continued for the next in achieving the sustainability of agriculture. Three prospects products would be developed in the IFT at Banjararum are: 1) solid organic compost with chemical specifications, 2) hygienic communal fence that can divide urine and feces easily, and 3) liquid organic compost.

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REFERENCES

Haryanto. 2004. Indonesia (Country Report). Sustainable Farming Systems in Upland Areas. in T. Partap (Ed). Asian Productivity Organization. Tokyo. p. 107-112

Juo, A. S. R. 2004. Technologies for Sustainable Management of Steep Lands in Asia: Harmonizing Economic and Ecological Sustainability. Sustainable Farming Systems in Upland Areas. in T. Partap (Ed). Asian Productivity Organization. Tokyo. p. 48-58.

Little, D.C. and P. Edwards. 2003. Integrated livestock-fish farming systems. Inland Water Resources and Aquaculture Service Animal Production Service. Food and Agriculture Organization of the United Nations. Rome.

National Academy of Sciences. 1993a. Soil and water quality: an agenda for agriculture/Committee on Long-Range Soil and Water Conservation, Board on Agriculture, National Research Council. National Academy Press. Washington, D.C.

National Academy of Sciences. 1993b. Sustainable Agriculture and the Environment in the Humid Tropics. National Academy Press. Washington, D.C.

Partap. T. 2004. Farming on Sloping Uplands of Asia: Sustainability Perspectives and Issues. Sustainable Farming Systems in Upland Areas. in T. Partap (Ed). Asian Productivity Organization. Tokyo. p. 25-47.