Coffee pulp fermentation techniques for the sustainable organic agriculture

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Abstract. This paper discusses the potential issues in Lampung province of Sumatera, Indonesia where the majority of the people are to earn a livelihood as a coffee farmer. This place has potential benefits to increase land of coffee farms in order to make greater capacity and economic sector by using an environmentally-friendly technology. To date, the utilization of coffee pulps is only by freely spreading to the coffee farms. In doing so, the technological fermentation by using Indigenous bacteria that has role to produce organic fertilizer of coffee pulps helps gain the soil fertility. This study used descriptive data analysis with community practical approach. The results show that the growth of coffee and other intercropping plants like chili is more fertilized, easy to flower, and it lengthens the shoot growth. In addition, the coffee production seems like changing in the amount of quantity that tends to get better. The significant number also showed by the production of chili because the harvest season is longer than usual. Another advantage by using this fermentation is that the use of non-organic fertilizer can be reduced up to level 80 per cent. Likewise, this condition automatically dropped the production cost.

1. Introduction
West Lampung Regency has a plantation area of 65,211.8 Ha with a total of 16 commodities developed, namely: Robusta coffee, Arabica coffee, cocoa, pepper, sugar palm, clove, cinnamon, coconut, hybrid coconut, palm oil, candlenut, areca nut, rubber, vanilla, patchouli, and tobacco [1]. Of the 16 commodities, there are three leading commodities, namely Robusta coffee, pepper and cocoa [2]. Nationally, the commodities of coffee, pepper and cocoa are also national leading commodities whose increased production will be prioritized for the purpose of foreign exchange / export revenues, meeting the needs of domestic industrial raw materials and import substitution [3,4]. Coffee is the main commodity and the biggest supplier of coffee products in Lampung Province both for export and for domestic production raw materials so that West Lampung is a coffee shop in Lampung Province and even national [5].

One of the areas where coffee and plantation products are grown is Air Hitam District [6]. Air Hitam District has an area of 76.23 km2 with a population of 11,878 people with a density of 154.43 people / km2 [7]. Administratively, Air Hitam sub-district has 10 villages / pekon with the capital in Semarang Jaya. The village / Pekon consists of Mount Terang, Sidodadi, Semarang Jaya, Srimenanti, Sumber
Alam, Sukajadi, Sinar Jaya, Rigis Jaya, Suka Damai and Manggarai. Srimenanti Village is one of the villages in Air Hitam sub-district, with land / land areas for villages, plantations, and a few fields [8].

This service will be held in the village of Srimenanti, Air Hitam sub-district. The selection of Srimenanti Village because this village has the potential for plantations and has the potential to develop plantation products in order to increase the capacity and economy of the community, besides that the community is open to receive renewal in terms of environmentally friendly technology [9]. The development of plantation cultivation such as organic coffee, bananas and other plantation products in the village of Srimenanti has prospective opportunities, geographical conditions, and an open and friendly community culture that supports the development of the cultivation business [10,11]. As for the cultivation of the plantation carried out at Srimenanti majorities, it is carried out by small-scale farmers using simple technology, namely utilizing garden land and very little use of home yards as land [12]. In this utilization the results obtained have not been maximized. Increased income of farmers, especially coffee farmers, seems to have not been able to improve welfare. This is because the coffee farmers only sell their products to distributors in the form of coffee beans. The coffee beans without any processing of the final product of ground coffee, but dried coffee beans [13].

From this problem the authors provide solutions to provide training and mentoring on the development of organic plantations, especially the cultivation of coffee, bananas, organic vegetables, which are focused on the maintenance and processing of post-harvest crops [14]. The program that will be implemented is the application of organic plantation cultivation technology, business management and forming a pioneering plantation product processing business in Srimenanti Village into an industrial product. The implementation of the Muhammadiyah Metro University Service, in collaboration with farmer group partners in the location of Srimenanti Village. Because there have already started farmers depending on chemical fertilizers and chemical drugs to eradicate pests and plant diseases. The results of developing organic liquid fertilizer (LCN) is expected to help the development of organic agriculture in Srimenanti Village, Air Hitam sub-district, West Lampung Regency.

2. Method
This social community services experiment is conducted by using descriptive analysis with the man approach by practical community experience. The research is placed in the village of Sri Menanti, Way Tenong of West Lampung for more than six months. The community participated in this program is based on two domains namely local coffee farmers and local women farmer’s community.

3. Results and discussion
3.1. The absence of products directly from the community, or selling agricultural production in the form of raw materials produced by plantations and agriculture
The lack of creativity in the processing of food produced by the land and the abundance of crops in plantation areas such as coffee, bananas and vegetables requires high creativity for their use. This is because the existing produce cannot be sold to consumers in the market or processed by themselves. During this time housewife manage crops still in a simple way for their own consumption. Another alternative that is used only by making organic coffee powder with additional fruit flavor. The absence of creative ideas in processing the results of plantations and agriculture to become ready-to-eat snacks with packaging that has long-lasting and more selling on the market. The results of the product are pressed towards modern over-processing from the product appearance to attractive packaging.

Based on the analysis of the situation, the problems of the partners and the results of discussions with partners priority issues that must be resolved during the implementation of the PPDM program are the need to increase community income by increasing the yield of crops with products touched by environmentally friendly science and technology.

The research team conducted monitoring on the partner's coffee plantation owned by the Karya Maju farmer group. Monitoring was held in Srimenanti Village, Air Hitam District, West Lampung Regency. The coffee produced at this harvest is quite satisfying because of the large and healthy quantities. Each
coffee bar produces a large and large amount of coffee. Increased coffee production from 8 kg to 9 kg, average 0-1 kg. The use of coffee pulp, which so far has only been sprinkled into the coffee plantation into organic coffee leaf fertilizer with the addition of starter Pineapple Liquid Waste has been able to increase the fertility of coffee plants. This can be seen from the growth of coffee plants which are given organic fertilizer of coffee pulp from the treatment, more fertile and the length of the shoot growth. The efficiency of chemical fertilizers was also felt by farmers, at first farmers needed 50 kg of chemical fertilizer every planting period but after using waste coffee organic fertilizer with a starter of Pineapple Liquid Waste (LCN) the chemical fertilizer used was only 10 kg for 600 coffee bars. Of course this makes farmers very economical in buying fertilizer. Likewise, the growth of chilli grown on top of the treatment site is better than that planted without treatment. The intercropping of chillies has a fast rotation of 3-4 months has produced a lot of fruit. Plant life of up to 3-4 years. What is very encouraging for farmers is the harvest in the first 9 months of 600 stems of IDR. 650,000.

Increased income of coffee farmers also occurred from the sale of organic coffee pulp fertilizers, where the unprocessed coffee pulp was valued at IDR. 3000, and when it has become fertilizer the coffee pulp organ becomes IDR. 30,000. Gapoktan can maximize the production of organic waste coffee fertilizers due to its very easy manufacturing process and the availability of abundant raw materials.

As for the superiority of local coffee produced by Karya Maju farmer group, the aroma is shallDERer, the taste is more typical. This coffee is called KOROLA (Kopi Hitam Barat Lampung). For the coffee that is processed is women farmer community. In the village of Srimenanti in Air Hitam subdistrict, there has a women farmer community named KWT (Kelompok Wanita Tani) of Mekar Sari. This community was founded in 2003 and now has 44 members. The chairman is lead by Ibu Dwi Nurhayati. The community named their coffee product with Lambarco.

3.2. Local needed training during the program

3.2.1. Various flavors of coffee processing training. Lambarco coffee is the same as that produced by other home industries, only producing original flavoured coffee. Given the needs of the market who want coffee with additional flavours of food, the PPDM team conducts training in coffee processing. The latest variants of Lambarco coffee products are: wet red-processed coffee, ginger coffee, lanang coffee, kawa coffee leaves of ant’s sugar, young areca coffee and civet coffee. All processed coffee products are produced at women farmer community Mekar Sari. At first lambarco coffee was only packed with ordinary plastic packaging with a selling price of IDR. 5,000- IDR. 20,000. Lambarco coffee sales only rely on consumers who buy directly to women farmer community locations. Currently coffee packaging has undergone a change into a more attractive pouch packaging and a higher selling value of 200 grams of coffee worth IDR. 30,000, - while for Luwak 125 gr worth IDR. 90,000. Coffee variants produced by women farmer community of Mekar Sari: ginger coffee, young areca coffee, wet red picking coffee, lanang coffee, kawa coffee ant sugar leaves and civet coffee. Coffee sales have now spread throughout West Lampung. Women farmer community is not only waiting for consumers to come to the location but now they have left the product in the shop and souvenir shop in West Lampung. This of course increases the number of coffee sales on a regular basis.

3.2.2. Smoked-dried banana fritters (pisang sale) training. Banana is one of the intercropping plants in the coffee garden. The types of bananas planted in the coffee garden are Ambon Lumut bananas, banana milk and male bananas. On average, bananas are sold in the form of fresh bananas to Bandar Lampung and Jakarta. Abundant yields make the sale value of bananas low so that processing innovations are needed in addition to being processed into banana chips. One way to process bananas is to make bananas sale. The type of banana used to make sale bananas is Ambon bananas. This banana has a sweet taste and a relatively large size. The making of sale bananas is located next to the WFM chairman's house so as to facilitate coordination. The community production results have been sold out of the city precisely in the city of Bandung and its surroundings.
3.2.3. **Coffee candy and food training.** The research team also provided training in making coffee and banana foods at Mekar Sari. This is to maximize the potential that exists in the region. Therefore, the housewives become more productive and they do not only depend on the coffee harvest which is only done a year or two. The mainstay product besides coffee is coffee candy.

3.2.4. **Financial management program.** Women farmer community Mekar Sari has another activity, namely a savings and loan business named as savings and loans. This activity has 60 members. Each member must provide a mandatory contribution of 5000 rupiah at each meeting. This meeting is held regularly every month. Money that can be lent to its members is 1,000,000 rupiah.

3.2.5. **Fish nursery training.** Srimenanti Village has abundant water potential due to its position in the hilly area. This potential can be used to make fish ponds because the funds needed for the maintenance of fish are not large. In carrying out nursery training there are several things that need to be emphasized on group members, namely: the farmer community must be in a position to make the pH (acidity) of the pool water appropriately. This is so that fish that are spawned and kept safe from attacks by fish diseases. In addition the farmers were given training in spawning and maintenance of several types of fish, such as: calDR, catfish and betta fish.

3.2.6. **Training on making banana organic fertilizer.** In the first year of the farmer community has been taught how to produce waste coffee organic fertilizer. The second year of the annual research program, the team carried out a training program on the manufacture of organic fertilizer from banana stem waste. This is because after the banana harvest, the waste of banana stems are not used by the community. Only a few parts are used for animal feed. In addition, the farmer community is distributed to make its own starter. So, it does not depend on the starter taken from team’s assistance.

4. **Target and output**
The targets to be achieved in the framework of the economic empowerment of these farmers are the realization of productive and efficient organic cultivation and the development of the processing business pioneering into food industry products that have added value such as organic coffee powder, organic coffee powder with additional fruit flavor, durian, strawberry and others, various processed banana chips, jams etc. Products from vegetables such as *dodol* (a sweet toffee-like confection) chayote, *dodol* tomatoes etc. Become the central organic coffee and organic farming / agricultural products in Srimenanti village, Air Hitam sub-district, West Lampung Regency.

The expected output through these economic empowerment activities of coffee farmers in Srimenanti village are:

- Developmental organic plantations, especially the cultivation of coffee, bananas, organic vegetables, which are focused on maintaining and processing post-harvest crops.
- The emergence of agricultural and product processing businesses into processed products such as organic coffee powder, organic coffee powder with the addition of fruit, durian, strawberry and other flavors, various processed banana chips, jams etc. The active participation of housewives in realizing increased household income.
- Activate the participation of youth in realizing young entrepreneurship.
- Increasing income of coffee and vegetable farmers through the creation of added commodities value.

5. **Conclusion**
These activities that have been carried out during the experiment are the use of waste coffee organic fertilizer with starter of Pineapple Liquid Waste (PLW), replacing or substituting with chemical fertilizers commonly used by farmers and training on the organic fertilizer made from banana stems and coffee peels. In addition, training in fish farming and fermentation of animal feed is included to the last part of this experiment. For women farmers group, activities were done through management of wet
red-processed coffee, ginger coffee, kawa coffee, palm sugar leaves, young areca coffee and civet coffee. Furthermore, packaging of the results of processed coffee products has undergone a change to a more attractive pouch packaging and a higher selling value.

Acknowledgment
We would like to thank to the Ministry of Higher Education and Institution of Indonesia (Kemenristekdikti) for giving us this chance and for funding our social community services under the cooperation program between Universitas Muhammadiyah Metro and Sri Menanti Village in West Lampung 2018.

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