

The organic fertilizer development program based on the utilization of regional potential and community activity waste in supporting the efficiency of agricultural production in Sembalun, Nusa Tenggara Barat

¹*R. Lestari, ²D. Purwanti, ³Q. G. Fadhilah, ⁴R. Yuniati, ⁵L.M. Dewi, ⁶F.R. Budiman, ⁷Sumali, ⁸A. Said

ABSTRACT--Sembalun has been known as one of the regions that produce horticulture plants such as potatoes, garlic, and chili. The intensification program of those commodities, such as provision of inorganic fertilizers, drugs, and pesticides continues to be done in order to increase their harvesting yields. It is indeed increasing the production in a short time, but on the other hand also increase production costs, can foment the environmental pollution, and cause nutrient imbalance in the soil. The organic fertilizer development program based on the utilization of regional potential and community activity waste in supporting the efficiency of agricultural production in Sembalun can be one of the solutions to those problems. The program is present as an effort which able to increase harvesting yields with relatively low costs and environmentally friendly so that their economics can increase through the efficiency of agricultural sector. The farmer whose participate in this program is trained to make organic fertilizer from the waste and materials surrounding them, then applied to their plantation. Organic fertilizer that has been develop can be a substituent and complement of inorganic fertilizers. The implementation of the program showed an improvement in the agriculture production. The program can also empower the community to manage their waste into something more beneficial and sustainable.

Keywords--agricultural production, organic fertilizer, Sembalun

I. INTRODUCTION

The earthquake that occurred in the Lombok and its vicinity in 2018 has made a huge economic loss amounted to 5.04 trillion rupiah. The loss was felt by the Lombok, Nusa Tenggara Barat (NTB) community, including the people in the Sembalun sub-district (Hadi, 2018: 1). Various efforts continue to be made to revive the economic

¹*Departemen of Biology, Faculty of Mathematics and Natural Sciences, Universitas Indonesia, retno.lestari.budiman@gmail.com.

² Departemen of Biology, Faculty of Mathematics and Natural Sciences, Universitas Indonesia.

³ Departemen of Biology, Faculty of Mathematics and Natural Sciences, Universitas Indonesia.

⁴ Departemen of Biology, Faculty of Mathematics and Natural Sciences, Universitas Indonesia.

⁵ Departemen of Biology, Faculty of Mathematics and Natural Sciences, Universitas Indonesia.

⁶ Pandu Cendekia Foundation.

⁷ Pandu Cendekia Foundation.

⁸ Pandu Cendekia Foundation.

activities of the community which had been stopped due to the earthquake. One of these economic activities is activities in agriculture. According to statistics in 2016, majority of Sembalun communities have a livelihood in the agriculture sector, both as owner farmers, cottiers, and landless farmers (BPS Kabupaten Lombok Timur, 2017: 53). In addition, Sembalun has also been known as one of the regions that produce horticultural commodities such as potato, garlic, and chili.

The agricultural intensification program of the commodities in Sembalun continues to be done in order to increase the harvesting yields. The intensification that carried out so far are expansion of land (Rahayu *et al.*, 2015), and provision of inorganic fertilizers, drugs, and pesticides (Hidayah *et al.*, 2011: 284--285). It is indeed increasing the production in a short time, but on the other hand also increase production costs, can foment the environmental pollution, and cause nutrient imbalance in the soil.

The use of fertilizers is one of the important components in the agricultural system including agriculture that carried out in the Sembalun area. Most of the production costs in the agricultural system are used for fertilizer supply (A Putra, 2008: 391). The people of Sembalun usually use factory-made inorganic fertilizers which only enrich one or a few nutrients. The use of these kind of fertilizers are known to have caused pollution and environmental damage (nutrient imbalance in the soil) that occurs in Sembalun (Djamhari, 2009: 228-- 230). In addition, the supply of these types of fertilizers also requires quite high costs. Therefore, it necessary to develop a fertilizer that is more environmentally friendly and relatively low in cost with nutrients content that able to improve the quality and quantity of harvesting yields.

The organic fertilizer development program based on the utilization of regional potential and community activity waste in supporting the efficiency of agricultural production in Sembalun can be one of the solutions to increase harvesting yields with relatively low cost and environmentally friendly. The fertilizer development is carried out by utilizing the regional potentials and the waste of community activities as raw material of the fertilizer and local wisdom in the process of its application. The addition of organic materials into the soil can improve the soil properties (Roidah, 2013: 35). The program is expected to be able to encourage efficiency, effectiveness, and sustainability of agricultural activities in Sembalun through various series of activities such as educate to community about the regional potentials and the community activities waste which are around them, develop those materials to be organic fertilizer, and apply the organic fertilizer to the existing agricultural system. This community service program in the future will be encouraged to become a model of community and environmental empowerment in Sembalun in creating innovative, conservative, and environmentally friendly agricultural systems.

II. METHOD

The program was implemented by involving the community in the Sembalun village, Lombok Timur regency, Nusa Tenggara Barat province. The methods used to gain the data in the program included questionnaire, interview, and observations. All of these methods are used to obtain basic information about respondents, information on agricultural commodities that are commonly grown, the use of fertilizers by the community, the regional potential and the community activities waste that existing, and finally the implementation of the program. The data that collected were analysed and presented descriptively.

In addition, in this community engagement program, people were invited to get to know and realize the regional potential and the waste of community activities which are around them. They were also taught to process these ingredients into liquid organic fertilizer. Then, the organic fertilizer was applied to the agricultural system carried out by the community. The outcomes of the program were defined as the society motivation to process regional potential and the waste that are around them into organic fertilizer so it can streamline the agriculture carried out by the community. This community service program in the future will be encouraged to become a model of community and environmental empowerment in Sembalun in creating innovative, conservative, and environmentally friendly agricultural systems.

III. RESULT AND DISCUSSION

Respondents Characterization

The total number of respondents in the program is 35 people. Majority of the respondents were farmer which have their own land. During the questionnaire distribution and interview, it is observed that most of them were 30-50 years old. It means respondents which in the productive ages are more interested to get involved in this program. Most of the respondents are also well educated at the university, senior high school, junior high school, and elementary school level (Fig. 1). Skirbekk, 2004 said the people of productive age have advantages in terms of stamina, physical, level of intelligence and creativity (Skirbekk, 2004: 143), and with their good education background, it can be more beneficial to the implementation, development, and sustainability of program because there were many people who can run the program actively.

Education background of the respondents

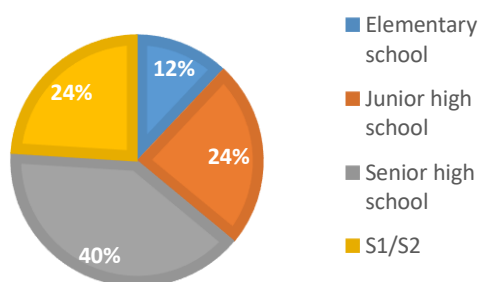


Figure 1: Diagram of education background of the respondents

Socialization and Organic Fertilizer Training

Based on the interview, all the respondents are known to use inorganic fertilizer in their agricultural systems. Most of them also use organic fertilizer such as animal manure in addition to inorganic fertilizer. The respondents generally have never used other material beside animal manure to make organic fertilizer including waste from their daily activities.

After socialization about the objectives of the programs which was held at the beginning of the program, the respondents were educated about other ingredients that could be used as raw materials for making liquid organic

fertilizer. Then, the respondents were thought how to make liquid organic fertilizer from those ingredients. The liquid fertilizer is made by mixing ingredients such as brown sugar, ginger, chicken manure, rice washing water, coconut water, egg whites and water (Table 1). These materials can easily be found in the Sembalun area.

Table 1: Composition of liquid organic fertilizer

No.	Materials	Quantity
1.	Brown sugar	50 g
2.	Ginger	10 g dissolve in 100 mL
3.	Chicken manure	200 g dissolve in 500 mL
4.	Rice washing water	100 mL
5.	Coconut water	100 mL
6.	Egg white	5 mL
7.	Water	95 mL
8.	Food colouring agent	Moderately

Chicken manure indeed has been widely used as raw materials for making organic fertilizer. Chicken manure has a higher nutrient content than other livestock manure. This is because the liquid part (urine) is mixed with the solid part (Roidah, 2013: 33). Utilization of other materials such as brown sugar and rice washing water as ingredients from liquid organic fertilizer is also carried out by Saefihim *et al.*, (2011: 364). In contrast to liquid organic fertilizer made by Saefihim *et al.*, in this program there are not additional EM (effective microorganism) and fermentation process were done. The respondents can immediately use the fertilizer after it has been made.

The enthusiasm of respondents in this program was quite high, they not only pay attention but also record independently the whole process of making liquid organic fertilizer that is shown. They are even interested in making their own liquid fertilizer (Fig. 2).



Figure 2: Training of making liquid organic fertilizer from the regional potential and community activities waste in Sembalun.

Implementation of Liquid Organic Fertilizer

The application of liquid organic fertilizer made by respondents was done on the chili plants which they planted. Chili is one of the commodities that widely grown by respondents besides garlic and potatoes. The first application is done 3 days before planting, then the application is done on 7-14 and 21 - 35 days after planting. The dose of the solution used is 100 mL-200 mL added to water until it reaches 14-15 L. So far, the application of fertilizer has had a positive impact on chili plants. The plants do not show any symptoms of nutritional deficiency or toxicity such as chlorosis and necrosis (Fig. 3).



Figure 3: Condition of chilli plants that are given liquid organic fertilizer.

The addition of organic materials into the soil can improve the soil properties (chemical, biology, and physical). The role of organic fertilizer on soil chemical properties is as a provider of macro nutrients (N, P, K, Ca, Mg and S) and micro (Zn, Cu, Mo, Co, B, Mn and Fe), increasing Cation Exchange Capacity (CEC) of the soil, can form complex compounds with toxic metal ions such as Al, Fe and Mn so that these metals do not poison. The role of organic fertilizer on soil biological properties is as a source of energy and food for micro and meso fauna of the soil. The role of organic fertilizer in soil physical properties include improving soil structure because organic matter can "bind" soil particles into solid aggregates, improve soil pore size distribution so that soil water holding capacity becomes better and air movement in the soil is also getting better, and reducing (buffering) soil temperature fluctuations (Hartatik *et al.*, 2015: 110).

The provision of organic fertilizer is known to be able to provide almost all the elements needed by plants in a relatively equilibrium ratio. The use of organic material in the soil must pay attention to the comparison of the levels of element C to nutrients (N, P, K, etc.), because if the ratio is very large, it can cause immobilization. For long-term management of the soil or the sustainability of agriculture, it is best to pay attention to and maintain levels of organic matter in the soil (Roidah, 2013: 35).

IV. CONCLUSION

The organic fertilizer development program based on the utilization of regional potential and community activity waste in supporting the efficiency of agricultural production in Sembalun so far has become one of the solutions to increase harvesting yields with relatively low cost and environmentally friendly. The program is also potential to be implemented to improve the value of the waste. The enthusiasm of people was quite high to be

involved in the program. The program was proven to be promising in empowering the community to create innovative, conservative, and environmentally friendly agricultural systems. Evaluating and monitoring is required to ensure the sustainability of the program thus it could be duplicated in other areas.

V. ACKNOWLEDGMENTS

We are grateful to the Directorate of Research and Community Engagement, Universitas Indonesia (DRPM UI) for the financial supports (Community Engagement Grant No. **NKB-1367/UN2.R3.1/HKP.05.00/2019**), Faculty of Mathematics and Sciences Universitas Indonesia (FMIPA UI), and also thank to Pandu Cendekia Foundation for the contribution and supports, so this program can be held.

REFERENCES

1. Hadi, S. 2018. Kerugian Ekonomi Akibat Gempa Lombok Capai Rp. 5,04 Triliun: 1 hlm. <https://nasional.tempo.co/read/1116615/kerugian-ekonomi-akibat-gempa-lombok-capai-rp-504-triliun>. accessed Februari 20th, 2019.
2. Badan Pusat Statistik (BPS) Kabupaten Lombok Timur. 2017. Kecamatan Sembalun Dalam Angka Tahun 2017: xx+180 pp. <https://lomboktimurkab.bps.go.id/publication/download>. accessed Februari 25th, 2019.
3. Rahayu, M., Fitrahtunnisah, Sujudi, & G. Marta.: Potensi Sumber Daya Genetik Tanaman Lokal Bawang Putih Di Kabupaten Lombok Timur, Propinsi Nusa Tenggara Barat, Prosiding Seminar Nasional Sumber Daya Genetik Pertanian, 287—292, 2015.
4. Hidayah, B. N., Sudjudi, L. Hadiawati, D.P. Sudjatmiko, P. Dawson, T. Hill, & J. M. Warren.: Optimising Potato Productivity in Sembalun Highlands, Nusa Tenggara Barat- Indonesia, Proceedings of the 7th ACSA Conference, 282—286, 2011
5. A. Putra, I. P. C. (Balai Pengkajian Teknologi Pertanian, NTB). 2008. Analisis Usaha Tani Kentang Sembalun. <http://pse.litbang.pertanian.go.id>. accessed Februari 21th, 2019.
6. Djamhari, S.: Pemupukan Dengan Bahan Organik Untuk Menuju Pertanian Yang Berwawasan Lingkungan Desa Sembalun Lawang, Nusa Tenggara Barat, *JRL* **5** (3), 225—232, 2009.
7. Roidah, I.S.: Manfaat Penggunaan Pupuk Organik Untuk Kesuburan Tanah, *Jurnal Universitas Tulungagung BONOROWO* **1** (1), 31—42, 2013.
8. Skirbekk, V.: Age and individual productivity: A literature survey, *Vienna Yearbook of Population Research*, 133—153, 2004.
9. Saefihim, M.Ulfa, and D.W. Hanjagi: Liquid Fertilizer as a Solution to Problem of Kitchen Waste (Organic) and The Empowerment of Rural Women, *International Conference on Chemical, Ecology and Environmental Sciences*, 2011.
10. Hartatik, W., Husnain, and L.R. Widowati. 2015: Peranan Pupuk Organik dalam Peningkatan Produktivitas Tanah dan Tanaman, *Jurnal Sumberdaya Lahan* **9** (2), 107-120, 2015