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Empowering Ginger Farmer Through Fostering the Production of Liquid Organic Fertilizer During the Covid-19 Pandemic

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Abstract COVID-19 pandemic had several detrimental effects on the world's economy and people around the world. Ginger farmers in Genteng Kulon village, Banyuwangi Regency, are one of the communities affected by COVID-19. Since COVID-19 came, the price of chemical fertilizers has remained expensive, and the price of ginger is very high, up to IDR 90.000 per kg, so ginger farmers need a new affordable alternative fertilizer. Fostering the manufacture of liquid organic fertilizer from banana stem waste is the right option to help ginger farmers meet their fertilizer needs and make it efficient in using available waste. The method used in this community development was through the Community Service Program consisting of various activities: training on the production of liquid organic fertilizer; packaging; labeling; and application to ginger plants. The success of this program was evidenced by the level of farmers' understanding of the procedure being taught, which was assessed using a questionnaire. The results showed that the farmers' understanding of the material being taught significantly increased as compared with that before they were educated. The percentages of average understanding of the training material for liquid organic fertilizer, packaging, labeling, and application were 75%, 80%, 80%, and 85% respectively. These numbers were very different from those representing the farmers' knowledge before the training. These average percentages were 15.5%, 14%, 16.5%, and 11.5%. Therefore, this program was successful in providing new knowledge to farmers in the production of liquid organic fertilizer.

1. INTRODUCTION

Genteng Kulon is a village with the largest population in Banyuwangi. There are around 18,000 people residing in this village, and its population density is around 45/km2. Administratively, the area of Genteng Kulon village consists of 5 dusun (hamlets), 18 RW (community unit), and 159 RT (neighborhood unit). The majority of the villagers are farmers. Approximately 10 villagers are ginger farmers.

The Food and Agriculture Organization (FAO, 2020) states that the COVID-19 pandemic affected the agriculture sector in two significant aspects: the supply of and demand for food. These two aspects are directly related to food security, so food security is also at risk. According to Ilinova et al., (2021), fertilizer prices have risen because of the COVID-19 pandemic, owing to distribution issues and high demands. One of the agricultural problems during the COVID-19 pandemic in Genteng Kulon was that the ginger farmers had not been able to be independent in providing fertilizers. The high price of chemical fertilizers during the COVID-19 period had made the ginger farmers in Genteng Kulon only water their ginger plants. Therefore, the growth and development of their ginger plants were not optimal because there is no intake of nutrients that used to be provided by fertilizers.

An alternative that can be used as a fertilizer is banana stem waste available in Genteng Kulon's area. The availability of banana stem waste in this village was abundant. This was evidenced by the total area of land planted with bananas, which was two hectares. The number of banana trees planted reached thousands of trees, so they had a great potential to be raw materials for making liquid organic fertilizer. Organic fertilizers have a significant impact on soil nutrient availability, aggregate formation, and soil bacterial communities (Chai et al., 2019; Qaswar et al., 2020; Ye et al., 2019).

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According to Amini et al., (2019), banana stems contain several elements needed for plant growth and development; these stems have high calcium, magnesium, and high assimilation of nitrogen emissions. The function of each of these elements is as a stimulant for root growth and development, protein formation, and strengthening the plant body so that it can grow leaves that do not easily fall. The research of Laeliocattleya et al., (2018), showed that sugars, acids, vitamin C, amino acids, and pectin make up the soluble solid content of bananas, which varies depending on the variety grown and the degree of maturity. The findings of a study (Pangaribuan et al., 2019) showed that the use of a mixed liquid organic fertilizer made from banana humps could increase the growth, yield, and quality of corn. In addition, liquid organic fertilizer derived from ground bananas can also significantly increase the quality of tomato plants (Nossier, 2021). Therefore, the use of banana stem waste as a raw material for empowering the manufacture of liquid organic fertilizer for ginger farmers is the right choice because of its complete element content required by plants.

This empowerment and training program was very crucial for ginger farmers in Genteng Kulon because it was able to provide new alternatives for obtaining suitable and economically affordable fertilizers. The main objective of this program was to increase the self-reliance of ginger farmers in fulfilling their fertilizer needs by utilizing organic waste around their environment. In addition, this program was an effort to create healthy agriculture that is free from chemical fertilizer residues.

2. METHOD

2.1 Time and Location

This program was carried out in Genteng Kulon Village, Genteng Subdistrict, Banyuwangi Regency from July to August 2020.

2.2 Knowledge Transfer and Training

Before the implementation of the training, the farmers' knowledge of liquid organic fertilizers was assessed by a questionnaire which consisted of training on the manufacture of liquid organic fertilizer, packaging, labeling, and its application to plants. Thereafter, several activities in the form of lectures and discussions were conducted, followed by training and practice in making liquid organic fertilizer from banana stem waste, packaging, labeling, and its application to the farmers' ginger plants. The participants consisted of farmers who came from different partner members who were interested in producing and using liquid organic fertilizers.

2.3 The Production of Liquid Organic Fertilizer

The tools that were used comprised a vat fermenter, 1.5 L aqua bottle, clear plastic, insulation, hose, 500 ml measuring cup, stirrer, and rubber tires. In addition, the materials used were EM4 (1 liter), 25 kg of chopped banana stem waste, sugar solution, and 50 liters of water. All the ingredients that had been prepared were then mixed and fermented for a certain period in a fermenter barrel. The whole process of making liquid organic fertilizer took 14 days with the fermentation process lasting for 12 days.

2.4 Product Packaging

The packaging was done using used plastic bottles that had been washed clean. Afterward, the liquid organic fertilizer was poured into the used bottles using a filter and a shovel.

2.5 Product Labelling

Labeling was done by first creating a design using Corel Draw X7. The label contained directions to use the liquid organic fertilizer, the dosage of use, and how to store it. After the design process was completed, the label for the bottles of the liquid organic fertilizer was printed and attached to the bottle.

2.6 Application of Liquid Organic Fertilizer

The fertilizer application on ginger plants was carried out using a watering can. The dose of liquid organic fertilizer was determined based on a ratio of 1:15. The spraying of the fertilizer was in the direction of the wind.

2.7 Evaluation

This stage consisted of a review of the activities involved, such as several aspects involved during the process as well as an evaluation of the knowledge of the farmers and their skills acquired in terms of technology for making liquid organic fertilizers. The aspects of the results measured were the increase in farmers' understanding of the materials containing the process of making liquid organic fertilizer and its direct implementation. The indicators of success in each stage of the fertilizer production, according to the way the application was assessed, were in the form of percentages (%).

3. RESULT AND DISCUSSION

3.1 Knowledge Transfer, Discussion, and Training

The implementation of empowerment and training for the community affected by COVID-19 regarding the manufacturing of liquid organic fertilizer from banana stem waste in Genteng Kulon Village was attended by ten participants. The majority of the participants who attended this training were farmers, especially ginger farmers. The farmers' understanding of the function and importance of liquid organic fertilizer for plants had increased dramatically when compared with their understanding before the extension and training. The farmers' perceptions of the importance of organic fertilizers for environmental safety and plant health also increased significantly.

The farmers were directly and actively involved in every training phase facilitated by the trainers. They continued to use the products that they made during this empowerment and training program after the program was completed. This was because farmers had enjoyed the benefits of liquid organic fertilizer; this fertilizer was very easy to make and affordable. This alternative fertilizer was the right choice for the farmers because inorganic fertilizers were still expensive during the COVID-19 pandemic. In addition, the farmers were aware of the dangers of using chemical fertilizers after receiving training in making organic fertilizers.

As a result, these farmers had become wiser in using inorganic fertilizers.

3.2 The Production of Liquid Organic Fertilizer

The process of making liquid organic fertilizer began with chopping banana stem waste into pieces measuring two to three centimeters. Afterward, these chopped stems were put into a vat fermenter and filled with 50 liters of water. Subsequently, one liter of EM4 and one kilogram of sugar solution were added. The function of the addition of Em4 was to increase the diversity of soil microbes because it contained synthetic bacteria, actinomycetes, yeast, and lactic acid. The research showed that EM4 dosage with a 15-day application time was the best combination of treatment for plant height, plant biomass, and root length on Cayenne Pepper (Prabowo et al., 2018). After all the ingredients were mixed, stirring was done to evenly distribute the ingredients, so the fermentation process was successful. The last step was covering the vat fermenter with plastic and connecting it to a hose connected to the aqua glass to accommodate the gas during the fermentation process for approximately 10 to 14 days until the liquid organic fertilizer was fully fermented (Figure 1). The manufacturing steps can be seen in the following flowchart:

Figure 1. a) Chopping banana stem waste; b) Inserting chopped banana stem waste into a vat fermenter; c) Adding 50 litres of water; d) Adding 1 litre of EM4; e) Adding 1 kg of sugar solution; f) Stirring process to evenly distribute Material; g) Covers the fermenter with clear plastic and connects it to the aqua glass; h) The fermentation process is on progress

Well, fermented fertilizer has a tape-like odor or an earthy odor and a blackish color. The perfect fermentation process in the formation of organic fertilizer will cause a change of fertilizer into black color. A change of fertilizer to black color indicates that the fermentation process is completed, completely fermented ready to use.

The farmers' understanding of the material and practice of producing liquid organic fertilizer had greatly improved. The assessment was based on the test sheet given to farmers and the way farmers practiced. The farmers' understanding and practice of making liquid organic fertilizer have increased by 75% on average after the extension and training (Table 1). The following table contains data f the assessment of the farmers' achievements.

3.3 Packaging and Labelling

When the fermentation process was complete, the fertilizer was harvested by placing it in a 1-liter bottle. The harvesting process was carried out by first filtering to separate the solid and liquid parts of the fertilizer that had been produced. The liquid fertilizer was put into a 1-liter bottle and then a label that had been created using the Corel Draw X7 was attached (Figure 2). The label contained information on how to use liquid organic fertilizer to make it easier for farmers to use it. Both steps can be seen in the following flowchart (Figure 2)

The farmers' understanding of the practice of packaging and labeling liquid organic fertilizer had been comprehensive. This assessment was based on the test sheet given to farmers and the way farmers practiced. The farmers' understanding and skill in packaging and labeling have increased by 80% on average after they completed the extension and training (Table 2). The following table describes the assessment results of the farmers' achievements in packaging and labeling.

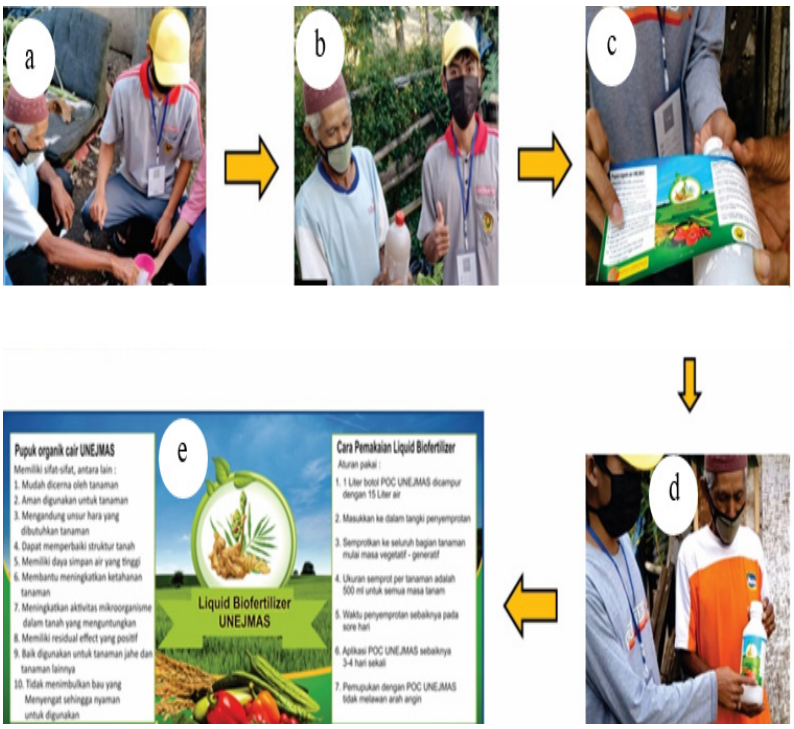

Figure 2. (a) Liquid organic fertilizer packaging process (b) Packaged liquid organic fertilizer (c) Labelling on liquid organic fertilizer packaging (d) Labelled liquid organic fertilizer (e) Information on benefits and how to use it

Figure 3. a) Combining 1 L of liquid organic fertilizer with 15 L of water; b) Stirring the mixture; c) Applying liquid organic fertilizer.

Figure 3. (a) Using liquid organic fertilizer ; (b) Without using liquid organic fertilizer

3.3 Application of Liquid Organic Fertilizer

The application of liquid organic fertilizer was carried out on the fields of the ginger farmers. The rules for its application were: (1) dilution of 1 litter of liquid organic fertilizer into 15 liters of water; (2) application of liquid fertilizer by spraying around the plants; (3) spraying is done every 3 to 4 days; (4) dosing is done every 3 to 4 days in a week, 200 to 300 ml of the liquid fertilizer per plant (Figure 3). An overview of the application of the liquid organic fertilizer can be seen below:

The farmers' understanding of the application of liquid organic fertilizer has greatly enhanced. This assessment was based on the test sheet given to farmers and the way they practiced. The farmers' understanding and skill in applying the liquid organic fertilizer had increased by 85% on average after they completed the extension and training (Table 3). The following table describes the assessment results of the farmers' achievements in the application of liquid organic fertilizer.

Meanwhile, the results of fertilizer application on ginger plants showed very significant results. The liquid organic fertilizer had been applied to ginger plants three times a week and there was a difference. Ginger plants that were sprayed with the liquid organic fertilizer looked greener and fresher while those that were not sprayed with liquid organic fertilizer looked pale yellow and unhealthy (figure 4). This was in accordance with the findings of research conducted by Abro et al., (2019). The use of organic fertilizer derived from bananas and other organic sources accelerated composting and increased organic matter, resulting in increased plant growth quality.

3.4 The Evaluation of Community Engagement and Sustainability

In terms of the activity process, the evaluation results

revealed that the farmers' knowledge of liquid organic fertilizer increased dramatically following the training. This assessment was based on the activities with varying levels of training. The farmers expected to find a new alternative to banana stem waste that can be used as liquid organic fertilizer as a result of the activities that had been carried out, so that farmers could have more options in making liquid organic fertilizers.

4. CONCLUSION

The implementation of this program was able to enhance the knowledge and skills of the farmers in producing liquid organic fertilizer. In addition, these farmers had been able to understand all materials and skills in every phase during the training, starting from material exposure, making liquid organic fertilizer, packaging, and labeling, and spraying the liquid fertilizer to their ginger plants. The increases in the average knowledge and skills of the farmers regarding the training that was carried out were as follow: manufacturing 75%, packaging and labeling 80%, and application 85%. These numbers showed that this program was greatly beneficial for the farmers because they became able to make organic fertilizers independently and enjoyed the benefits.

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CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest in this research publication. We also confirm that the manuscript entitled "Empowering Ginger Farmer Through Fostering the Production of Liquid Organic Fertilizer During the Covid-19 Pandemic" has been read and approved by all named authors. Furthermore, the corresponding author is the contact person who will communicate the editorial process of this manuscript.

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ATTACHMENT

Table 1. Farmers' achievements in the manufacture of fertilizers

Group	Percentage		Enhancement (%)
	Pre-test	Post-test	
Farmer A	20	95	75
Farmer B	15	90	75
Farmer C	10	85	75
Farmer D	25	95	70
Farmer E	10	90	80
Farmer F	15	80	65
Farmer G	10	95	85
Farmer H	15	90	75
Farmer I	20	90	70
Farmer J	15	95	80
Averages	15.5	95.5	75

Table 2. Farmers' achievements in packaging and labeling

Group	Percentage		Labeling		Enhancement (%)
	Pre-test	Post-test	Pre-test	Post-test	
Farmer A	10	90	15	85	80
Farmer B	15	90	20	95	75
Farmer C	10	95	15	100	85
Farmer D	25	95	20	100	80
Farmer E	10	90	15	95	80
Farmer F	15	100	10	95	85
Farmer G	10	85	25	100	75
Farmer H	15	95	20	100	80
Farmer I	20	90	15	85	70
Farmer J	10	100	10	100	90
Averages	14	94	16.5	96.5	80

Table 3. Farmers' achievements in the application of fertilizer

Group	Percentage		Enhancement (%)
	Pre-test	Post-test	
Farmer A	10	95	85
Farmer B	10	90	80
Farmer C	10	90	90
Farmer D	15	95	80
Farmer E	10	100	90
Farmer F	10	100	90
Farmer G	10	90	80
Farmer H	15	95	80
Farmer I	15	95	90
Farmer J	10	95	85
Averages	11.5	94.5	85