

Socialization on the utilization of household organic waste as liquid organic fertilizer in vegetable cultivation

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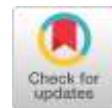
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ABSTRACT

Waste or organic waste from households can be converted into liquid organic fertilizer (POC) because organic waste contains nutrients that can be used as fertilizer. Waste becomes a problem not only in urban areas but also in rural areas because the population is increasing, so that waste production is also more. Household waste that is generated every day can be used as fertilizer by composting, but its utilization is not optimal. The socialization activity aims to provide education and increase insight to the community into the use of household organic waste. The community is given knowledge about the importance of utilizing household organic waste, how to manage household organic waste through the composting process, utilizing household organic waste as liquid organic fertilizer in cultivating vegetable crops, the benefits and cost-efficiency of organic vegetables for family self-sufficiency and organic vegetable business opportunities. The socialization involved 35 people, and the form of activity evaluation uses a questionnaire containing general characteristics of the respondent and selected questions. The results of the evaluation show that the age characteristics of the respondents are 50 - 59 years old, and the level of formal education is from Junior High School to Senior High School. On average, respondents already know and understand how to use household waste by composting a composter bucket (100%) as liquid organic fertilizer.



KEYWORDS

Organic waste
Household waste
Composting
Liquid organic fertilizer



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1. Introduction

Household waste is still a problem in big cities, one of which is in Yogyakarta. Every day the city of Yogyakarta throws 250 tons of garbage per day into the Piyungan Integrated Waste Disposal Site (TPST) and keeps increasing with new waste that continues to be produced. This has led to an extraordinary accumulation of waste in several depots and waste disposal sites (TPS) at various points in the Yogyakarta area [1]. If the accumulation of waste is not addressed, then the TPS needs to be expanded. The latest conditions reveal that the TPST has rejected incoming waste. This causes the accumulation of garbage in homes. This can actually be avoided if there is a system for processing and managing household waste. The waste is discharged material produced from a production process, both industrial and domestic (household). This waste is better known as a waste whose presence at a certain time and place is not desired by the environment because it has no economic value. The ingredient contained in the waste generally consists of organic compounds and inorganic compounds. The presence of waste can have a negative impact on the environment, especially on human health [2], so it is necessary to take action to handle waste in certain concentrations and quantities. The danger of poisoning levels caused by waste depends on the type and characteristics of the waste [3].

The types of waste can be divided based on their nature. Waste can be separated and categorized into organic waste and inorganic waste. Organic waste or wet waste is a waste that comes from living things, such as food scraps and kitchen waste. Waste is very easily biodegradable and easy to decompose, while inorganic waste is non-biodegradable waste such as rubber, plastic, cans and metal [4]. Several approaches that can be used to deal with the waste problem include (1) Reduce (restrictions): strive to produce as little waste as possible. The more materials used, the more waste is generated; (2) Reuse (reused): if the waste is finally formed, then try to use the waste directly; (3) Recycle: residue or waste that remains or cannot be used directly, then processed to be utilized, either as raw materials or as energy sources; (4) Treatment: residues produced or which cannot be utilized are then processed, in order to facilitate subsequent handling, or able to be safely released into the environment; (5) Dispose of: residues/waste that cannot be processed need to be released into the environment safely through good and safe engineering such as removing them in a properly designed and prepared landfill; and (6) Remediation: environmental media (especially water and soil media) which have been polluted due to unmanaged waste, need to be rehabilitated or repaired through appropriate engineering efforts, such as bioremediation and etc.; and (7) Replace: replace items that can only be used once with more durable items [5].

Household waste or organic waste has the potential to be converted into Liquid Organic Fertilizer (POC) because the organic waste contains nutrients that can be used as fertilizer and are useful for application to plants. Fertilizer is a substance that is added to increase the nutrient content in the soil. Organic fertilizers have several benefits, including encouraging and increasing the formation of leaf chlorophyll and improving soil properties. This liquid organic fertilizer has many advantages, including quickly overcoming nutrient deficiencies, not causing problems in nutrient leaching, and providing nutrients quickly. Liquid organic fertilizer can be processed from raw materials in animal manure, compost, natural waste, growth hormones, and other natural materials processed naturally [6]. Vegetable plants are types of vegetables that are favoured by the community, especially housewives—these types of vegetables such as spinach, pakcoy, caisin, and lettuce. Fertilization is one of the important factors in plant cultivation that can support the success of vegetable crop production. Vegetable crops can be fertilised using liquid organic fertilizer [7]. Liquid organic fertilizer is a solution containing one or more water-soluble forms of nutrients. Fertilization through leaves has a faster effect on plant growth than through roots [8].

Members of the PKK Hamlet Wonosalam RT 06 RW 09 Sukoharjo Village, Ngaglik District, Sleman Regency are the targets of community service activities in 2019. This is because most of these mothers work as housewives who produce household waste from cooking activities. The waste produced every day can actually be used as raw material for making fertilizer by composting and can be worth more, both in terms of economics and other indirect benefits. Therefore, it is necessary to provide socialization as a place to provide knowledge and assistance related to the processing of household organic waste, both from the technical side of production, benefits, management, and efficiency to realize community independence with superior value, especially housewives. This service activity aims to provide education and insight to the community in the utilization of household organic waste.

2. Method

As part of this community service activity, the mentoring activity was carried out on Saturday, July 6 2019, at 15.00 – 17.30 WIB in Wonosalam Hamlet RT 06 RW 09, Sukoharjo Village Ngaglik District, Sleman Regency, Yogyakarta, with a total of 35 people. This activity targets a group of PKK Hamlet Wonosalam woman members RT 06 RW 09, Sukoharjo Village, Ngaglik District, Sleman Regency, Yogyakarta, and this service partners. This service activity begins with a meeting with the Chairperson of the Wonosalam Hamlet as the Chair of the PKK to discuss issues related to the housewives activities and the waste/household waste generated, the technical method of implementation and the determination of the extension application letter signed by the Chair of the PKK related to the management household organic waste that has not been utilized properly. After that, a letter of application for counselling is given

to the Research and Community Service Unit (UPPM) of the LPP Polytechnic and a service proposal prepared for administrative completeness in making a letter of assignment for a team of lecturers. The assignment letter for the lecturer team is made two (2) days before the implementation of the service. Mentoring activities were carried out on July 6, 2019, and after the service activities were completed, the lecturer team was given a statement from the partner containing the lecturer team that had carried out counselling activities according to the theme and time set on the same day. This activity is carried out with lecture methods and question and answer (discussion) about how to treat household organic waste, both from the technical side of production, benefits, management, and cost-efficiency. This activity also explains the benefits and uses of liquid organic fertilizer (POC) derived from household organic waste. Besides discussions, this activity also distributed spinach seeds, poly bags and composter buckets to participants. The details of the implementation of service activities regarding organic waste management are presented in [Table 1](#).

Table 1. Details of the implementation of service activities regarding organic waste management

No.	Theme	Speaker	Method
1	The technique of making POC from organic household waste	Anna Kusumawati, SP, M.Sc.	Socialization and practice of composting and POC
2	POC fertilizer and its contents	Lestari H.S, ST., M.Eng	Socialization of POC fertilizer content
3	POC application on vegetable crops	Rina Ekawati, SP., M. Si	Socialization of vegetable planting using POC and distribution of vegetable seeds
4	Community management for household waste treatment	Ir. Pantjaswi V R I, MP	Socialization of how to do community management to support household-scale waste treatment
5	Cost efficiency of using POC for family vegetable self-sufficiency and business opportunities for POC and organic vegetables	Luci Paonganen, SE., M.Acc	Socialization of the cost efficiency on growing vegetables using POC and POC business opportunities and organic vegetables

3. Results and Discussion

3.1. The technique of making POC from organic household waste

Liquid organic fertilizer (POC) made from household waste can be an alternative management option to create zero waste. The black army fly (*Hermetia illucens*), an insect belonging to the order Diptera, has larvae with the ability to consume various types of organic matter converted into biomass with high fat and protein content as food reserves during the adult phase. This property causes *Hermetia illucens* larvae to be often used as waste bioconversion agents, especially household organic waste and agricultural waste [9]. The initial activity of this socialization was about the technique of making POC from organic household waste using a composter bucket ([Figure 1](#)). Making POC requires several main materials and tools. The equipment needed is a drill, ruler, cutter, scissors, nails, knife, and saw. The materials needed include two plastic buckets and lids with a size of 25 L, plastic faucets, rotten fruit/other organic household waste.



Fig. 1. Socialization of making POC technique

Five composter buckets were provided for the technical socialization of making this POC. The composter bucket (Figure 2) has two main components: (1) The bottom bucket. The bottom bucket serves to collect the leaching results from the decomposition. A faucet is installed on the bottom side in the bottom bucket, and the lid grabs the edges only for the top bucket to make the results easier to take. (2). Top bucket. The top bucket has a function as a storage for POC raw materials. In the top bucket, make small holes in the bottom for drainage, make a small hole (4) on the top side under the lid. The stages in making POC are; (1) Enter the fruit (rotten) periodically, in a hot and humid atmosphere, microbes grow quickly, the volatile compounds aroma produced will invite black tantara flies (*Hermetia illucens*) to come to the lay eggs; (2) Wait until the larvae of the black tantara fly (*Hermetia illucens*) are abundant and actively working, then you can add other perishable waste (vegetables, kitchen scraps, etc.); (3) The leachate is left in the bottom bucket, after two months, it is continued with the ripening process into liquid organic fertilizer (POC). The trick is to put the leachate into a clear bottle, just half of it, loosen the lid, dry it in the sun until it turns black and brown and has a soft aroma on the nose; (4) The black army fly (*Hermetia illucens*) larvae and compost, can be harvested periodically.

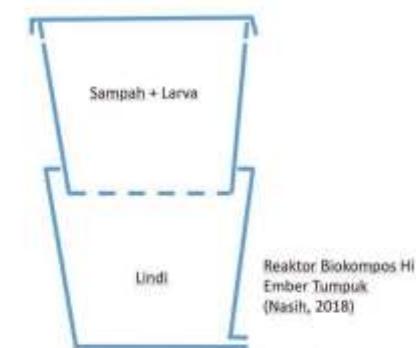


Fig. 2. POC composter bucket

3.2. Liquid organic fertilizer and nutrient content

Liquid Organic Fertilizer (POC) is a decomposition or organic waste solution. The advantage of liquid organic fertilizer is the ability to provide nutrients quickly, does not damage the soil and plants even though it is used continuously. Plants more easily absorb liquid fertilizer because the elements in it have been decomposed [10]. Liquid organic fertilizer contains essential macro and micronutrients (N, P, K, Ca, Mg, S, B, Mo, Cu, Fe, Mn and organic matter). POC applications are usually sprayed on the leaves and soil around the plant. The benefits of POC on plants include encouraging and increasing the formation of chlorophyll, while in soil, this fertilizer can improve soil fertility and stimulate soil microorganism activity [11]. The nutrients needed by plants include:

- Nitrogen (N): Plants need nitrogen for their growth. Nitrogen content in plants is around 2-4% of the dry weight of the plant. More than 98% of N in the soil is not available to plants due to accumulation in organic matter. In addition, the element N serves as a stimulant for the growth of roots, stems and leaves. Nitrogen can also help in improving the quality and yield of crops. Nutrient N has a major role in cell division, tiller formation and stem elongation [12]. Plants need nitrogen because it has a role in the formation of chlorophyll, the growth of stems, branches and leaves, so it has a major role in the photosynthesis process [13]. Nitrogen deficiency in plants will have an impact on plant stems that grow stunted; the leaves are smaller and pale yellow, the lower leaves dry easily, and yields are low [14].
- Phosphorus (P): Phosphorus for plants plays a role in the process of photosynthesis, respiration, transfer and storage of energy, cell division, enlargement and other processes. In addition, phosphorus also extends roots, accelerates fruit ripening, and improves the quality and quantity of harvest. Phosphorus (P) is one of the essential nutrients needed by plants for optimum growth and

yields. Nutrient P is a component of enzymes and proteins, ATP, RNA, and DNA, and has an important function in the process of photosynthesis and energy transfer. There are no other nutrients that can replace the function of P in plants so that plants must get enough P for growth and development. P deficiency can cause slow, weak, and stunted plant growth [15]. Lack of phosphorus will make the plant stunted, the edges and tips of the leaves are purplish, the fruit is slow to ripen, the seeds lack content, and the fruit's quality decreases [16].

- Kalium (K); Kalium that plants need is in the form of potassium ions. In plants, potassium improves plant growth, increases pest resistance, and improves crop quality. K has a role as an activator of several enzymes in plant metabolism. K also plays a role in protein and carbohydrate synthesis and increases photosynthetic translocation to all parts of the plant [17]. K can maintain cell turgor pressure and water content in plants, increase plant resistance to disease and drought, and improve yields and crop quality [18]. Potassium deficiency results in reddish-white edges and spots, shrivelled leaves, stunted plants, easily broken stems, small fruit, and wound spots on the fruit.

3.3. Application of liquid organic fertilizer from household organic waste on leaf vegetable cultivation in polybags

Application or provision of liquid organic fertilizer (POC) is one of the plant maintenance activities in leaf vegetable cultivation that must be carried out in order to produce good plant growth and development as expected. Liquid organic fertilizer (POC) produced from household organic waste can be used after going through the composting/decomposition process for about 1-2 months. Liquid organic fertilizer can be given at a dose of 10 ml (about two teaspoons) of liquid organic fertilizer dissolved in 40 ml of water [19]. Application of liquid organic fertilizer is made once a week after planting until harvest time arrives in accordance with the treatment dose. The socialization of leaf vegetable cultivation, POC application and distribution of seeds and polybags to participants can be seen in [Figures 3 \(a\)](#) Socialization about vegetable cultivation & Liquid Organic Fertilizer application, and [Figure 3 \(b\)](#) Distribution of seeds and polybags.



Fig. 3. Figures 3 (a) Socialization about vegetable cultivation & Liquid Organic Fertilizer application, and Figure 3 (b) Distribution of seeds and polybags.

3.4. Community management for household waste treatment

Housewives empowerment aims to improve the understanding and skills of housewives toward the problem that occurs in their surroundings. This is done in an effort to improve the quality of life of housewives and provide a positive and active role in society. Housewives empowerment in the community can be started through *arisan* groups or PKK groups which are generally used as a place for regular meetings to establish friendship and increase knowledge. The meeting is very necessary and a necessity for every member of the community. Empowering housewives is not easy to do because the characteristics of each housewife are different. The human approach must be the basis for empowerment. One of the factors that determine the success of the empowerment program is the character of the group leader. In general,

housewives will believe and want to carry out an empowerment program if the leader they follow sets an example and can motivate each member. The activities of housewives as producers of organic waste from food scraps, vegetables, fruits must be given an understanding of the negative impact of the waste generated on the environment and given education on how to handle waste so that it can be used as a by-product and sustainably. Household waste can be processed into organic fertilizer, which can be used to fertilize plants around the house or other yards. Therefore, by knowing the knowledge of waste management, housewives will desire to produce safer and healthier organic vegetable commodities.

3.5. Cost efficiency and business opportunity of growing organic vegetables

Along with the increasing public awareness of eating healthy and nutritious that is free from chemicals, organic food ingredients are becoming increasingly popular. Organic food products are believed to be good for health and environmentally friendly [20]. Organic food ingredients such as organic vegetables, organic beans, organic fruit, to organic rice are now easier to find in supermarkets and online stores. This shows that the demand and supply of organic food ingredients are increasing. The existence of consumer/community awareness of the environment, premium prices, and consumer involvement positively influence the purchase intention of organic food products [21]. The price of organic food, which is expensive, is not a significant obstacle if people want to work themselves. Organic food, such as organic vegetables consumed daily, can be grown anywhere, whether on limited lands such as the yard/house yard or greenhouse (planting house) and wider agricultural land. For the woman members of PKK Hamlet Wonosalam RT 06 RW 09, Sukoharjo Village, Ngaglik District, Sleman Regency, Yogyakarta, they can cultivate organic vegetables in their respective yards/yards by using polybags or pots from the old items such as paint cans. Large old bottles, fruit baskets, and so etc. Planting in polybags or pots is easy to do, and the yield crops can also fill family needs. The following Table 2 presented a simulation to grow organic vegetables cost and a simulation of housewife's vegetable shopping (Table 3).

Table 2. Simulation of growing organic vegetable cost

Ingredients	Alternative 1 (Rp)	Alternative 2 (Rp)	Alternative 3 (Rp)
Composter bucket, 1 paket	100.000,00	48.000,00	8.000,00
10 Polybag	5.000,00	0,00	0,00
5 kg planting media, manure xx 10 polybags x Rp. 500,00	25.000,00	0,00	0,00
Liquid organic fertilizer	100.000,00	0,00	0,00
5 types of vegetable seeds @ Rp. 1000,00	5.000,00	5.000,00	5.000,00
Total Cost (Rp)	235.000,00	53.000,00	13.000,00

Description: Alternative 1, if all materials and supplies are purchased on the market; Alternative 2, if the materials for the composter bucket are two old buckets and a faucet, purchased separately and then assembled by yourself. Meanwhile, the other equipment and materials are available except for vegetable seeds; Alternative 3, if the two old buckets and other equipment are available, you only need to buy a plastic faucet and vegetable seeds. Table 3 shows that growing vegetables in the yard of the house can save the spending on family food needs, so it is hoped that this can motivate PKK mothers to play an active role in realizing healthy, sustainable and environmentally friendly family vegetable self-reliance through the use of household organic waste for cultivation the organic vegetable crops.

Table 3. Simulation of housewife's vegetable shopping

Description	Buy Non Organic Vegetables	Buy Organic Vegetables	Growing Organic Vegetables
Every day	Rp. 10.000,00	Rp. 40.000,00	Rp. 1.500,00
Every 30 days (1 month)	300.000,00	1.200.000,00	Rp 45.000,00*
Save Rp. 1.155.000,00 per month compared to buying organic vegetables			
Save Rp. 255.000,00 per month compared to buying non-organic vegetables			

Description; Rp 45.000,00 is the cost incurred for growing organic vegetables are. The costs of purchasing plant seeds and other equipment also need water for watering plants. In addition, other planting materials and supplies were obtained around the house (See Alternative 3 in Table 2). [Figure 4 \(a\)](#) and [Figure 4 \(b\)](#) is the activity of mothers listening to the material.



Fig. 4. Figures (a) and (b) Mothers listen to the explanation of the material

The service activity in the form of socialization to PKK members held in Wonosalam Hamlet, RW 09, Sukoharjo, Ngaglik, Sleman, Yogyakarta went well and had a positive impact, [Figure 5 \(a\)](#) One of the active participants gave feedback on the material presented, and [Figure 5 \(b\)](#) Participants receive a composer's tool which is symbolically handed over. The enthusiasm of the members was quite good, and the question and answer process took place intensively. Most of the members want to know how to process the waste using the provided composter/bucket. In addition, the members were also quite happy with the provision of polybags, EM-4 bio activator, and caisim vegetable seeds. It is hoped that with the provision of composter tools/buckets, polybags, and vegetable seeds, PKK members can practice in their respective homes.



Fig. 5. Figure 5 (a) one of the active participants in the question and answer session, and (b) symbolically, the participant gets a composer tool

3.6. Evaluation of The Activity

Evaluation activity is only carried out to the appointed participants by the PKK Chair to use the composter bucket that has been given. The number of participants who received was five (5) people. The five respondents/participants were given a number of questions in the form of a questionnaire related to the utilization of organic waste from household waste using a composter bucket. The questions in the questionnaire consist of age, level of formal education and 13 choice questions.

1) General Characteristics of Respondents Age

Figure 6 shows that the highest percentage of respondents/participants in community service activities is the age interval of 50 – 59 years. This is presumably because most of the members of the PKK group are mothers over the age of 50 and have a higher level of knowledge related to household waste management and the length of time they have been members of the PKK. The age characteristics of the respondents have also been widely used as observation variables related to the knowledge of the mothers in managing waste.

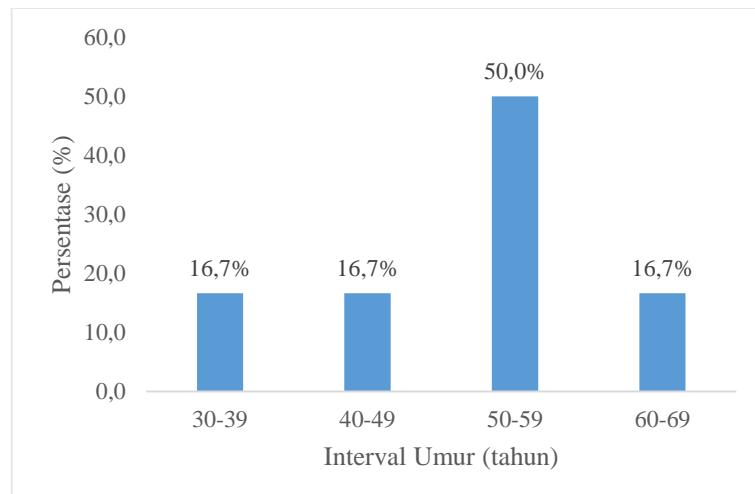


Fig. 6. Age percentage of service participants

2) Formal Education Level

In addition to the age characteristics, the level of formal education is also used as a measurement of the characteristics of respondents/service participants. Participants in the activity generally took various education levels, from low to high levels of education, **Figure 7**. The average level of formal education that service participants mostly take is the junior high school to the senior high school level. The two levels of education are also one of the determining factors in knowledge related to waste management, accompanied by the role of the internet/social media. The higher a person's level of education, will affect attitudes and behaviour towards something, one of which is waste management that can be used as a more beneficial product for the environment.

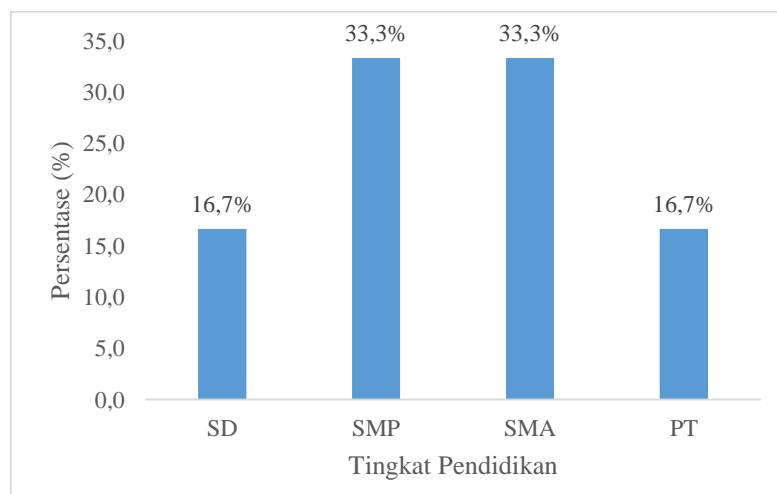


Fig. 7. Percentages of the participants' education level

3) Respondents' Questionnaire Results Based on Questions

Besides measuring general characteristics based on the age and level of formal education, respondents were also asked several questions related to knowledge about household waste management. The results of the questionnaire can be seen in [Table 4](#).

Table 4. Questionnaire results based on choice questions

Questions	Result
Do you cook the meals for the family by yourself every day?	Yes (100%)
If yes, how much household waste per day?	1-2 bags
Where did the trash throw?	Around the house
Have you ever received knowledge about handling kitchen waste?	Yes
If so, where did it come from?	From LPP Polytechnic
Have you ever received help with a kitchen waste bucket?	Yes (100%)
If so, what is the function of the bucket for?	To accommodate kitchen waste
Did you use the bucket?	Yes (100%)
If not, why don't you use it?	-
Kitchen waste must be managed properly	Strongly agree
Kitchen waste can be used for organic fertilizer	Strongly agree
To make organic fertilizer for kitchen waste, socialization of its handling is needed	Strongly agree
We need tools that can be used to make the household waste organic fertilizer	Agree - Strongly agree

The questionnaire results show that every day all the housewives who are PKK members cook for their family's food needs (100%). This cooking activity, of course, produces about 1-2 bags of household waste/waste per day, and the waste is thrown around the house. If the household waste is managed properly, it can produce a product, such as liquid organic fertilizer, which can fertilize the vegetable crops owned. How to process household waste into fertilizer, of course, needs to be given through the dissemination of knowledge, skills and supporting tools, namely a composter bucket. The provision of composter bucket assistance has been used by minimum service participants to accommodate the kitchen waste produced and can then be used to make liquid organic fertilizer from the household waste.

4) Impact and Advantage of The Activity

The impact of this activity can be seen from the activity evaluation results that overall service participants have been able to know and understand how to use household waste through composting using a composter bucket. The results of the waste compost will produce liquid organic fertilizer that can be used to add soil nutrients and increase plant growth, especially vegetable plants that have a short life. The existence of counselling regarding household waste processing is expected to increase the knowledge of housewives as members of the Wonosalam PKK Hamlet in utilizing and processing household waste more wisely. Utilization of household waste into liquid organic fertilizer will have a higher added value and can be used as an alternative in reducing waste problems in the village environment so that it can create a clean, healthy, and comfortable environment.

4. Conclusion

The purpose of the socialization activity was to inform and educate the women of PKK Hamlet Wonosalam RT 06 RW 09 Sukoharjo Village, Ngaglik District, Sleman Regency about the importance of utilizing household organic waste, how to manage household organic waste through the composting process, the use of household organic waste as a liquid organic fertilizer in vegetable cultivation, and the benefits and cost-efficiency of organic vegetables for family vegetable cultivation. According to the evaluation's findings, the respondents' age ranges from 50 to 59 years old, and their level of formal education ranges from SMP to SMA. On average, respondents already know and understand how to use household trash as liquid organic fertilizer by composting it in a composter bucket (100 per cent).

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