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LEAF COMPOST EDUCATION PROGRAM: A SOLUTION TO ORGANIC WASTE PROBLEMS IN CARANGWULUNG VILLAGE

*PROGRAM EDUKASI KOMPOS DAUN, SOLUSI PERMASALAHAN
SAMPAH ORGANIK DI DESA CARANGWULUNG*

Scope:
Applied Sciences

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ABSTRACT

Background: Leaf litter in Carangwulung Village, Wonosalam, Jombang, often accumulates and is either burned or discarded, potentially contributing to air pollution and environmental degradation. Processing leaf waste into compost is an appropriate and practical solution that is not yet widely known or implemented by the local community.

Objective: This activity aimed to improve the knowledge and skills of the community, particularly farmer groups, in independently managing dry leaf waste into compost fertilizer. **Method:** The methods used included education, outreach, and training involving 20 participants representing farmer groups. Evaluation was conducted using pre- and post-test questionnaires to assess knowledge levels, as well as direct observation during practical sessions and group discussions to assess participant skills. **Results:** There was an increase in participants' knowledge, with the average overall score rising from 7.5 on the pre-test to 9.0 on the post-test. **Conclusion:** This training successfully enhanced the community's capacity in managing organic waste and represents an initial step toward adopting simple technologies to support environmentally friendly farming at the village level.

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ABSTRAK

Latar belakang: Sampah daun di Desa Carangwulung, Kecamatan Wonosalam, Jombang sering menumpuk dan umumnya dibakar atau dibuang begitu saja, sehingga berpotensi menimbulkan pencemaran udara dan kerusakan lingkungan. Pengolahan sampah daun menjadi kompos merupakan solusi yang tepat dan praktis, namun belum banyak dikenal atau diterapkan oleh masyarakat setempat. **Tujuan:** Kegiatan ini bertujuan untuk meningkatkan pengetahuan dan keterampilan masyarakat, khususnya kelompok tani, dalam mengelola sampah daun kering secara mandiri menjadi pupuk kompos. **Metode:** Metode yang digunakan meliputi edukasi, sosialisasi, dan pelatihan dengan 20 peserta perwakilan kelompok tani. Evaluasi dilakukan menggunakan kuesioner pre-test dan post-test untuk tingkat pengetahuan serta observasi langsung pada sesi praktik untuk melihat ketrampilan peserta dan diskusi bersama. **Hasil:** Terdapat peningkatan pengetahuan peserta dengan rata-rata skor keseluruhan meningkat dari 7,5 pada pre-test menjadi 9,0 pada post-test. **Kesimpulan:** Pelatihan ini berhasil meningkatkan kapasitas masyarakat dalam pengelolaan sampah organik dan menjadi langkah awal dalam penerapan teknologi sederhana untuk mendukung pertanian ramah lingkungan di tingkat desa.

Kata kunci:

Kompos Daun; Sampah
Organik; Desa Carangwulung;
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BACKGROUND

Organic waste management remains a major problem, especially in rural and semi-urban areas. Poorly managed organic waste can be a source of greenhouse gas emissions. In Indonesia, most organic waste is still handled through dumping in landfills, burning in yards, or simply left to decompose without being utilized. A similar problem occurs in Carangwulung Village, Wonosalam District, Jombang Regency, which produces large amounts of leaf litter, particularly from household yards, gardens, and agricultural land. The majority of the leaf litter originates from resident-owned plantations such as coffee, salak (snake fruit), and durian. Thus, the dry leaves from these plantations have great potential as raw material for compost. According to research by Santoso et al. (2025) coffee plantations can generate leaf waste in very large quantities. A single Robusta coffee tree can produce around 270 leaves per year, meaning that a population of 150,000 trees can generate more than 40 million leaves annually. Although there is limited quantitative data on the disposal of dried leaf waste from plantations such as coffee, snake fruit, and durian, various studies in Indonesia have demonstrated that agricultural and plantation waste has significant potential as a source of organic material. However, in practice, most dried leaf waste is produced in large quantities and is generally burned by the community.

The burning of dry leaves remains common in tropical countries, including Indonesia. This practice poses serious risks such as air pollution, loss of soil nutrients, health hazards (e.g., respiratory problems), and an increased risk of fires. The persistence of open burning is mainly due to limited public knowledge of organic waste management and inadequate access to organic waste processing technologies, especially composting. Composting dry leaves is an effective and environmentally friendly solution for waste reduction and soil improvement (Armadi, 2025). Research by Parzych (2022) shows that urban leaf waste can be processed into a primary component of compost, increasing soil fertility and reducing the volume of solid waste in urban areas. Similarly, Li et al. (2022) found that fallen leaves are more effective than tree branches as a composting material because they possess a more suitable C/N ratio and moisture content to support microbial decomposition. A report by Singh et al. (2024) also indicated that community-level leaf composting can significantly reduce greenhouse gas emissions compared to open burning. This approach provides dual benefits: reducing waste volume and

improving soil fertility, which ultimately enhances agricultural productivity. Community involvement is a key factor in the success of composting initiatives. Several studies have shown that direct community participation in waste management programs—particularly composting—greatly contributes to their sustainability and effectiveness of their implementation (Armadi, 2025).

Piles of coffee, durian, and snake fruit leaves commonly accumulate during harvest seasons. Many residents manage this waste by burning it or leaving it to decay naturally. However, composting provides an environmentally friendly alternative. This process not only converts organic waste into nutrient-rich compost but also reduces greenhouse gas emissions and improves air quality, thereby contributing to environmental conservation (Handayani et al., 2023; Susilo et al., 2021). The implementation of composting can serve as a strategic step toward sustainable and environmentally friendly agriculture. This aligns with the Sustainable Development Goals (SDGs), which emphasize sustainable consumption and production patterns (Chandra et al., 2024; Koneri and Maabuat, 2024). Providing education and training on composting techniques to the people of Carangwulung Village is essential to help them utilize and manage natural resources more efficiently, effectively, and sustainably.

As a form of community service, this program offers simple composting training as a solution to the accumulation of dry leaf waste in the surrounding environment. The activity consists of outreach sessions on the dangers of burning waste, an introduction to the basic steps of composting, and hands-on practice in making compost from organic materials under the guidance of facilitators. Through this program, the community is expected to adopt more environmentally friendly and sustainable waste management habits.

The innovative aspect of this community service activity lies in the application of dry leaf waste processing into high-value compost. Another innovation developed in this program is the use of simple composting techniques adapted to local conditions and practices, while ensuring active community participation at every stage—from problem identification to the evaluation of results. This participatory approach also includes efforts to optimize the use of locally available resources in the village. The main focus of the program is the processing of dry leaves from local agricultural commodities such as coffee, durian, and snake fruit, which have not yet been widely utilized in composting activities in other regions.

METHOD

The community service activity was held on July 26, 2024, and was attended by 20 participants. The activity began with community outreach and continued with hands-on practice supervised by the community service team. The partners and participants were members of the Carangwulung Village, primarily farmers. The materials used in the composting practice were organic waste from dry leaves collected from plantations and residents' yards. The program consisted of three main stages:

1. Preparation Stage

This stage included a location survey, preparation of training materials, coordination with the village authorities, and preparation of supporting facilities and infrastructure for the practice. Mr. M. Arief (Village Head), Mr. Adison Putra (Hamlet Head), Mr. Dani (local MSME actor), and Mr. Sutikno (Farmer Group Leader) were community leaders in Carangwulung Village who participated in the initial coordination. The purpose of this coordination was to observe and analyze environmental problems faced by the local community. The main focus at this stage was to formulate solutions to the problem of dry leaf waste accumulation, which is often burned without processing, leading to air pollution and environmental disturbances.

2. Implementation Stage

The second stage involved direct implementation, carried out for approximately two hours (3:00 pm to 5:00 pm). The activity began with a one-hour educational session discussing the dangers of burning organic waste and the benefits of composting for the environment and agriculture, followed by an interactive question-and-answer session. The program then continued with hands-on practice in simple composting using the Takakura method, guided by a facilitator. Participants were divided into small groups of 4–5 people to ensure an effective practice process. Before the activity began, the committee team had prepared all necessary tools and materials, including:

1. Dry leaves chopped into pieces of approximately 3–5 cm,
2. EM4 (Effective Microorganism 4),
3. Sugar water (a mixture of 1 tablespoon of sugar per 1 liter of water),
4. Clean water to dissolve the EM4 and moisten the materials,
5. Compost soil or garden soil as a natural starter,
6. Stirring tools (wooden or plastic),
7. Compost containers such as buckets,

plastic drums, or used sacks, and

8. Covers made of cloth, perforated plastic, or burlap sacks.

This community service activity was designed to help participants understand the theory and apply it directly at home using simple and accessible materials. During the practice, each group received chopped dry leaves and a bottle of EM4 solution. The composting process was guided step-by-step by the community service team and facilitator. Step 1 is Mixing the chopped dry leaves evenly with the EM4 solution. Step 2 is placing the mixture into a perforated plastic container to maintain air circulation. In Step 3, the facilitator provided guidance on maintaining humidity, proper stirring techniques, and identifying mature compost based on changes in color, aroma, and texture. The fermentation process takes approximately 2–5 weeks. Every 3–5 days, the compost is stirred to accelerate decomposition and ensure proper aeration. If the compost becomes too dry, participants may add a small amount of water. The compost is considered ready for use after about 4–6 weeks, characterized by a dark brown to blackish color, a fresh, earthy aroma, and a loose texture.

RESULT AND DISCUSSION

On July 26, 2024, twenty participants from Carangwulung Village took part in a community service activity focused on leaf composting. The activity consisted of three main stages: education, composting practice, and evaluation of results through pre- and post-tests. The initial stage of the activity was coordinated with Mr. M. Arief (Village Head), Mr. Adison Putra (Hamlet Head), Mr. Dani (local MSME entrepreneur), and Mr. Sutikno (Head of the Carangwulung Village Farmers Group / Poktan). This coordination aimed to directly observe the environmental issues faced by the community, particularly those related to the accumulation of dry leaf waste. The piles of leaf litter primarily originate from durian, snake fruit, and coffee trees, which are the village's main agricultural commodities. To address this issue, the program introduced simple organic waste management techniques using the accumulated dry leaves as raw material for compost. Various composting methods can be used for this purpose, including the windrow method, vermicomposting, and the Takakura method, each offering distinct advantages in producing high-quality compost (Destiasari et al., 2024). The Takakura method was chosen for this program because it utilizes

organic materials such as leaf litter and kitchen waste, allowing them to decompose into nutrient-rich compost. This method is a type of anaerobic composting technique that is simple, low-cost, and suitable for household or community-scale use, as it does not require complex tools or equipment.

Prior to the composting practice, on July 25, 2024, the preparation of materials and equipment was conducted. The tools used included used gallon jugs, plastic bags for mixing leaf litter with EM4, gloves, cloth covers, and rice husk pads. The materials used consisted of dry leaf litter, EM4 solution, sugar solution, and finished compost. The EM4 solution functioned as a microbial activator, the sugar water served as an energy

source for microorganisms, and the compost soil acted as a natural inoculant. The main activity began with a 60-minute outreach session led by a resource person. During this session, participants learned about the negative impacts of burning organic waste and the benefits of composting for environmental sustainability and agricultural productivity. Participants showed high enthusiasm during the question-and-answer session that followed the material presentation and discussion (Figure 1). These findings align with those of Richardville et al. (2022) and Singh et al. (2024) who noted that participatory and contextual training can effectively encourage communities to adopt more environmentally friendly behaviors.



Figure 1. Material Presentation Activity on Composting

Figure 1 shows the composting outreach activity conducted by a resource person for participants. The resource person directly explained the dangers of burning waste and the benefits of composting organic waste. This activity aimed to increase participants' knowledge of the negative impacts of burning waste and to encourage them to adopt simple composting practices at home. The composting socialization activity was carried out first, consistent with the findings of Welerubun et al. (2024) who emphasized the importance of ensuring that the public understands and becomes familiar with information regarding compost fertilizer and its benefits.

The second stage involved hands-on composting using the simple Takakura method, using pre-chopped and prepared dry leaves, an EM4 (Effective Microorganisms 4) solution, sugar water, and compost soil as a starter. The resource person and facilitator introduced the Takakura method, a simple composting method based on locally available materials. Participants were divided into four small groups of 4-5 people

each, allowing each participant the opportunity to participate actively. Each group was accompanied by a team of two student facilitators. The participants, guided by the facilitator, mixed the chopped dry leaves with the EM4 solution and sugar water (half-wet), then stirred thoroughly until moist. The process of chopping dry leaves was initially carried out to reduce the size of leaf particles so as to accelerate the rate of decomposition (Nabil et al., 2024; Yuliananda et al., 2019). According to Nabil et al. (2024) and Yuliananda et al. (2019) finely chopped leaves decompose faster because smaller waste particles have a larger surface area that facilitates better air circulation, which in turn accelerates microbial decomposition.

After preparing the chopped leaves, the next step was to prepare a bioactivator from EM4 liquid and sugar water. The EM4 was dissolved in water at a ratio of 1:100 (1 ml EM4 : 100 ml molasses). As an energy source for the bacteria, molasses (sugar cane syrup) was used in the early fermentation stage. When molasses was unavailable, white or brown sugar served

as an alternative. Molasses provides complex nutrients that support the metabolic processes of decomposing microorganisms (Arumdapta et al., 2025). The selection of EM4 and granulated sugar was based on their easy availability and affordability. The mixture was then placed in a perforated recycling container and covered with a porous cloth to maintain aeration (Figure 2).

All participants actively participated in the hands-on composting practice. The process began with mixing chopped dry leaves with the sugar solution bioactivator and EM4, which serve as nutrients for decomposing bacteria (Figure 2). The active microorganisms contained in Effective Microorganisms 4 (EM4) act as primary bioactivators in the composting process, accelerating the decomposition of organic matter (Shitophyta et al., 2021).



Figure 2. Composting Practice by Participants

Figure 2 shows participants mixing chopped dry leaves with a sugar solution and EM4 before placing the mixture into a plastic gallon container. The community service team provided gloves to ensure participants' cleanliness and safety. Facilitators and team members accompanied participants throughout the practical session to offer guidance and corrections if any steps were performed incorrectly. This hands-on activity aimed to strengthen participants' understanding following the outreach session and to encourage them to apply composting practices at home. The SNI 19-7030-2004 standard served as a reference for the composting process, ensuring that the resulting compost met quality standards and was safe for use. Similar organic waste composting programs have been implemented in various regions to reduce the accumulation of dry leaf litter and support sustainable waste management (Aji et

al., 2024; Widiastuti et al., 2021). Through outreach methods and hands-on practice, participants can directly develop cognitive, psychomotor, and affective skills. Increased knowledge of organic waste management is essential for communities, as it enables them to become more aware and responsible for the waste they produce (Lanamana et al., 2021; Ramadhona et al., 2023).

Composting dry leaf litter is an easy-to-implement and environmentally friendly method for managing organic waste and reducing the overall volume of waste produced. Dry leaves originating from plantations and household yards contain essential nutrients such as carbon, nitrogen, phosphorus, and potassium, which play important roles in improving soil structure and enhancing soil fertility. Their balanced C/N ratio and moderate lignocellulose content make dry leaves a highly suitable organic material for composting.

According to Li et al. (2022) fallen leaves are more effective than twigs in the decomposition process because they are smaller and softer, making them easier for microorganisms to break down. The process of composting leaf litter generally involves aerobic microorganisms that decompose organic matter into humus compounds. Richardville et al. (2022) explained that using leaf mold compost or natural leaf compost can produce looser soil structures and increase water absorption in agricultural land. Furthermore, the addition of activators such as Effective Microorganisms (EM) or local fermentation solutions can accelerate decomposition by increasing the population of nitrifying bacteria and saprophytic fungi (Mahongnao et al., 2024).

In Indonesia, leaf waste composting has begun to be widely implemented at both household and community levels. Community service programs in Gresik (Welerubun et al., 2024) and Maluku Regency (Yuliananda et al., 2019) demonstrated that the use of dried leaves as the main composting ingredient was highly favored by farmers due to their abundance and low cost. Indonesia, known for its rich agricultural

and plantation output, produces large quantities of leaf waste during every harvest season. However, most farmers still practice open burning to reduce waste volume, which contributes to air pollution. Through community-based training and mentoring, processing leaves into compost can shift community behavior from burning waste to recycling it into economically valuable organic fertilizer (Yunita, 2024).

The final stage of this activity was the evaluation phase, conducted to measure the level of knowledge improvement among participants after completing the training. A pre-test and post-test were administered to compare participants' understanding before and after the session. The questionnaire consisted of ten multiple-choice questions covering the basic concepts of organic waste management, the benefits of composting, the materials and tools used, and the technical stages of the composting process. Before the event began, a pre-test was given to assess participants' initial knowledge, while at the end of the training, a post-test was conducted to evaluate their understanding after receiving the material (Table 1).

Table 1. Pre-test and Post-test Results on Leaf Composting Knowledge (n = 20)

Parameter	Minimum	Maximum	Average
Pre-test	5.0	7.0	7.5
Post-test	8.0	10.0	9.0

Table 1 shows an overall increase in knowledge, indicated by the rise in the minimum score from 5.0 to 8.0. This suggests that participants with lower prior knowledge were able to understand the material more effectively after the training. The maximum score also increased from 7.0 to 10.0, showing improvement among participants who already had a basic understanding of the topic. Furthermore, the average score rose from 7.5 to 9.0, a 1.5-point increase, reflecting a general improvement in knowledge following the activity.

Interactive outreach activities combined with hands-on practice proved effective in deepening participants' understanding of the composting process. This simple yet impactful educational approach contributed to encouraging behavioral change in the community toward independent and environmentally conscious leaf litter management. Post-training discussions revealed that participants were able to accurately describe the stages of the composting process—from mixing the ingredients and adding the EM4 solution to regularly turning the compost

to maintain air circulation and accelerate decomposition. These qualitative findings support the quantitative data and confirm that participants not only gained theoretical knowledge but also developed practical competence. These results align with Richardville et al. (2022) who found that field-based learning methods in organic waste processing are more effective than conventional training approaches because they involve direct participant experience. Similarly, Isaac and George (2024) stated that participatory learning in leaf-litter composting management helps communities understand the ecological and economic value of organic waste, thereby strengthening behavioral change toward sustainable waste management practices.

The implementation of outreach and training programs on dry leaf composting holds substantial importance, particularly in rural areas where agricultural activities dominate. Intensive farming practices often generate large quantities of organic waste—especially dry leaves—which are frequently burned for convenience. However,

this practice contributes to air pollution and results in the loss of valuable organic material that could otherwise enrich soil fertility. Accordingly, these outreach initiatives aim to enhance public knowledge and awareness of the importance of managing organic waste through composting. Beyond reducing the accumulation of dry leaf litter, the program also encourages a shift from inorganic fertilizers to sustainable natural compost, thereby supporting environmentally friendly and sustainable agriculture. This initiative aligns with the findings of Nabil et al. (2024) and Nurkhasanah et al. (2021) who demonstrated that outreach and composting programs are effective in addressing the problem of dry leaf accumulation. As shown in Table 1, the analysis revealed a significant improvement in participants' knowledge levels. Both pre- and post-training assessments were used to evaluate comprehension, with results analyzed using minimum, maximum, and mean scores. The post-test, administered at the end of the program, measured participants' understanding of the material presented, while the pre-training test, conducted at the beginning, identified baseline knowledge levels before the intervention (Fahriyah et al., 2023).

A notable challenge during the outreach activity was the inability of some participants to attend training sessions due to conflicting work schedules in the agriculture and plantation sectors. Nevertheless, the strategy of involving key representatives from each farmer group as knowledge conduits effectively facilitated the transfer of composting techniques to other community members who could not attend. Workshop observations further indicated that participants were able to independently apply composting methods using locally available materials, suggesting that the acquired knowledge and skills extended beyond direct participants. Thus, although attendance was limited, information dissemination within the community remained effective. To ensure sustained behavioral change and broader adoption, continued mentoring and follow-up support are recommended as subsequent steps.

Most participants initially possessed limited formal knowledge of composting, prompting the facilitation team to employ a participatory approach using interactive discussions and visual media such as slides and videos. This strategy proved effective in improving both theoretical understanding and practical competence. The integration of multimedia and active engagement significantly contributed to participants' ability to comprehend and apply composting concepts in daily practice.

CONCLUSION AND SUGGESTION

Educational and training activities on leaf composting in Carangwulung Village successfully enhanced the community's knowledge and competence in organic waste management, particularly regarding dry leaf composting techniques. Assessment results showed clear cognitive improvement, with the average knowledge score increasing from 7.5 before the intervention to 9.0 afterward. Although scheduling conflicts and limited attendance—caused by agricultural obligations—presented challenges, these were mitigated through adaptive scheduling and ongoing support. This program demonstrates potential for replication in other regions facing similar environmental issues and can promote collective community action toward environmentally sustainable waste management practices.

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