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Community Empowerment through the Production of 'Komposku': A Fermented Organic Fertilizer Based on Local Bio-Waste

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Abstract
Farmers' reliance on inorganic fertilizers, limited access to fertilizer, and underutilized organic resources motivated this community service initiative. This program aimed to improve farmers' knowledge and skills in producing Komposku, a fermented organic fertilizer made from cow manure, banana peels, eggshells, rice husks, and turmeric. Using a Participatory Action Research (PAR) approach, the program involved 30 participants in needs assessment, training, fertilizer production, fermentation monitoring, application to tomato plants, and evaluation. Knowledge was assessed using a 10-item yes/no questionnaire in a one-group pretest–posttest design. The mean knowledge score increased from 34.2 to 86.8, with an N-gain of 0.80 (79.94%), classified as high. A preliminary comparison involving 40 polybags showed that, at 20 days after planting, tomato plants grown in soil mixed with Komposku reached approximately 5 cm in height and developed 10 leaves, compared with 3.5 cm and five leaves in soil mixed with cow manure. These observations suggest differences in early vegetative growth, although controlled experiments are needed to establish Komposku's effectiveness. Participant acceptance was high, with 96% of responses positive. In the short term, the program encouraged the use of local organic waste as an alternative fertilizer, potentially reducing dependence on externally supplied fertilizers. Practical training also established a foundation for sustained community-based production using locally available materials. However, continued mentoring and monitoring are necessary to assess adoption, cost savings, and long-term environmental benefits. Overall, this initiative strengthened farmer capacity and promoted sustainable agricultural practices.

Keywords: *Community Empowerment, Organic Fertilizer, Fermentation, Sustainable Agriculture.*

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Introduction

Farmers in Bungbaruh Village, Kadur District, Pamekasan Regency, face challenges obtaining sufficient chemical fertilizer to meet their agricultural needs. Initial observations and interviews with partner farmers also revealed that locally available organic materials, including cow manure, banana peels, rice husks, eggshells, and turmeric, were not yet being used optimally as alternative fertilizers. Using organic materials available in the surrounding environment can improve soil conditions, provide nutrients for plants, increase soil microbial activity, and reduce farmers' dependence on chemical fertilizers. Two materials that have the potential to be developed into organic fertilizer are cow dung and banana peel waste. Cow dung contains organic matter and nutrients that can be used in the composting process, while banana peels can be a source of potassium and other minerals needed by plants. Kalemelawa et al. (2012) found that adding cow dung to the composting of banana peels can accelerate the mineralization of organic matter and produce compost that has the potential to be a source of nitrogen and potassium. The use of banana peel-based fertilizer has also been reported to improve several plant growth parameters when processed and applied at appropriate doses (Khanyile et al., 2024; Teshome, 2022). The development of fermented organic fertilizer combining cow manure, banana peels, eggshells, rice husk charcoal, and turmeric offers a practical approach to utilizing locally available organic resources while supporting sustainable soil fertility management. Each ingredient contributes a complementary function to the formulation: cow manure provides organic matter and nutrients; banana peels serve as a potential source of potassium and other minerals; eggshells contribute calcium and may help moderate soil acidity; rice husk charcoal provides carbon, silica, and a porous structure that can support water and nutrient retention; and turmeric introduces plant-derived compounds into the formulation. Combining these materials is intended to integrate their complementary properties into a single fermented fertilizer product while reducing the accumulation of underutilized organic waste. However, the actual agronomic benefits depend on the fertilizer's composition and maturity, application rate, soil conditions, crop type, and cultivation practices. The success of organic fertilizer in increasing crop yields is still influenced by the quality of the raw materials, the maturity of the fertilizer, the application rate, the type of plant, soil conditions, and the cultivation techniques used.

In reality, agricultural productivity at the farm level remains suboptimal. Various factors, including declining soil quality, high production costs, improper fertilization practices, and heavy reliance on chemical fertilizers influence this situation. Farmers in some regions also face difficulties in obtaining subsidized fertilizers in the required quantities and at the right time. Maulia et al. (2023) revealed that the scarcity of subsidized fertilizers at the farm level stems from discrepancies between requested and actual allocation volumes and delays in the distribution process. Issues regarding fertilizer prices and affordability also prevent some farmers from applying fertilizers at the optimal time and in the correct amounts, potentially reducing agricultural output (Zainuddin et al., 2022). Beyond availability concerns, the excessive and continuous use of chemical fertilizers can negatively impact soil health. While applying chemical nitrogen fertilizers at appropriate rates can boost crop yields, excessive use can accelerate soil acidification, disrupt the carbon-nitrogen balance, and reduce soil microbial diversity (Deng et al., 2023). Consequently, the use of chemical fertilizers without a balanced approach, or the failure to replenish organic matter, can lead to a long-term decline in soil quality and fertility.

Several previous studies have examined the use of animal manure and banana peels as organic fertilizers. Kalemelawa et al. (2012) compared aerobic and anaerobic composting processes for banana peels using various inoculants, including cattle manure, focusing on decomposition, mineralization, and the nutrient content of the resulting compost. Teshome (2022) investigated the effects of different banana peel compost application rates on Swiss chard growth and yield under experimental conditions, while Khanyile et al. (2024) reviewed various methods of processing banana peels into fertilizers—such as compost, powder, extract, ash, biochar, and composite fertilizers. These studies demonstrate that banana peels have potential as fertilizer material and can positively influence plant growth. However, prior research has generally focused on characterizing fertilizers and assessing plant responses within laboratory, greenhouse, or controlled experimental settings. Furthermore, few studies have integrated cattle manure, banana peels, and turmeric into a single fermented organic fertilizer formulation. There is also limited research on community empowerment aspects—such as improvements in farmers' knowledge, skills, and production capabilities, as well as the sustainability of fertilizer adoption. These conditions

highlight a gap between technical research findings on organic fertilizers and the direct application of such technology through community service programs.

The novelty of this community service initiative lies in the development and technology transfer of a fermented organic fertilizer production process that combines three local ingredients: cow manure as the primary source of organic matter, banana peels as organic waste capable of contributing minerals, and turmeric as an additional plant-based ingredient tested within the fertilizer formulation. The project's novelty extends beyond the combination of materials to the empowerment approach employed, which integrates awareness-raising, demonstrations, hands-on production, fermentation guidance, monitoring of fertilizer maturity, packaging, and field application. This approach enables farmers not only to receive the fertilizer as a finished product but also to acquire the knowledge and skills to produce it independently. Furthermore, the initiative applies circular economy principles by transforming livestock and household waste into products that benefit agriculture. Based on this overview, the project aims to enhance the knowledge and skills of partner farmer groups in producing fermented organic fertilizer from cow manure, banana peels, and turmeric; reduce organic waste accumulation; provide an easily accessible fertilizer alternative; decrease reliance on chemical fertilizers; and promote more sustainable soil fertility management and agricultural practices.

Methods

This community service initiative involved training in organic fertilizer production, aimed at honing the skills of young farmers in food self-sufficiency and increased agricultural productivity. The activity took place in Bungbaruh Village, Kadur District, Pamekasan Regency, between July and August 2026 (Figure 1). It involved 30 participants, comprising members of the community service team from the Islamic University of Madura, members of village youth organizations, farmer groups, and representatives from the Kadur District Agriculture Office. Participants were selected based on their active involvement in agriculture, ownership of or access to cattle manure, willingness to complete the entire training series, and commitment to implementing the introduced technology. The activity was conducted in seven stages: identifying partner needs, program preparation, outreach/dissemination, training and demonstration, hands-on organic

fertilizer production, fermentation monitoring, and evaluation and follow-up (Osumba et al., 2021; Sharifzadeh & Abdollahzadeh, 2021).

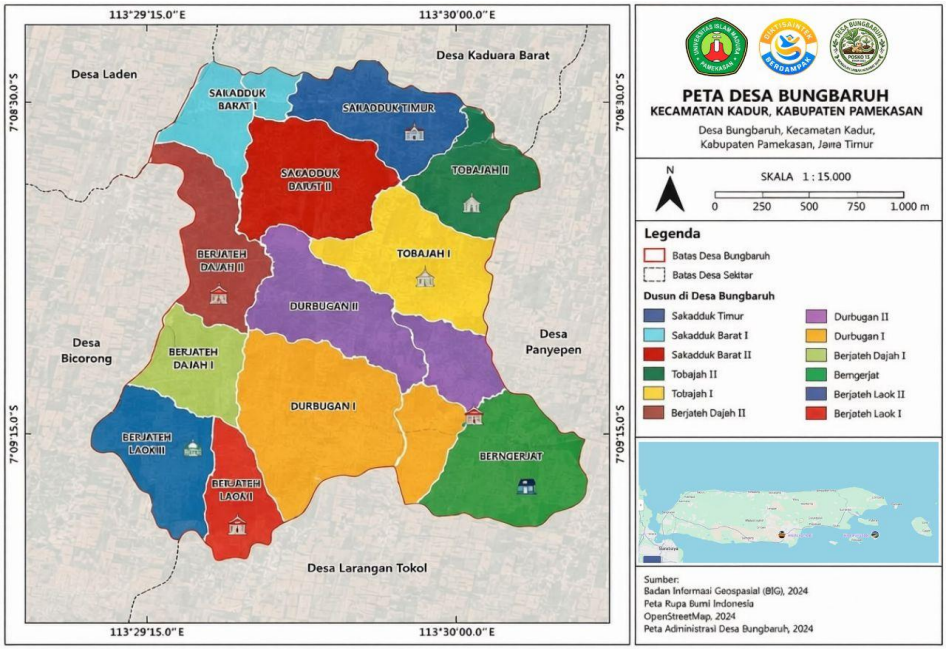

Figure 1. Map of the community service activity location.

This community service initiative comprises several stages; the implementation stages are detailed in Figure 2.

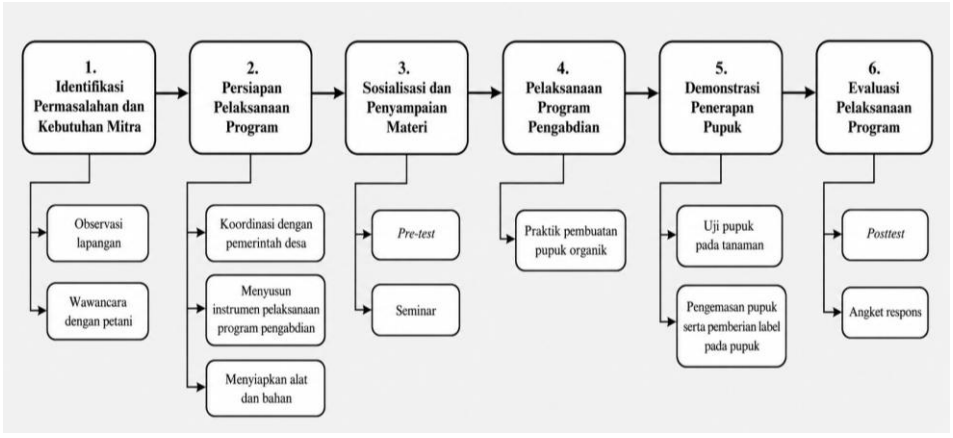

Figure 2. Stages of the community service program implementation.

The first stage was carried out through field observations, interviews, and group discussions with the management and members of the farmer group (Figure 3). The knowledge evaluation instrument consisted of a structured questionnaire containing 10 dichotomous (yes/no) questions covering the benefits of organic fertilizers, the potential uses of locally available organic materials, and basic knowledge of organic fertilizer production. The same or equivalent questions were administered before and after the training to assess changes in participants' knowledge. Responses were scored and converted to percentages, and the mean pre-test and post-test scores were compared to determine knowledge improvement. Observations were conducted to assess farming activities, fertilizer usage, the availability of cow manure and banana peel waste, organic waste handling methods, the availability of eggshells and rice husks, and the facilities available for fertilizer production. Interviews were conducted to gather information on the difficulties farmers face in obtaining fertilizer, fertilization costs, experience with producing organic fertilizer, and farmers' level of dependence on chemical fertilizers.



Figure 3. Field observations and interviews with farmers.

The implementation team and partners subsequently identified priority issues: the suboptimal utilization of cow manure, eggshells, banana peels, rice husks, and turmeric waste, and the lack of guidance on producing effective organic fertilizer. These findings served as the basis for tailoring the training materials, methods, equipment quantities, material compositions, and the schedule for ongoing support. Partner involvement in decision-making was essential to ensure that the introduced technology aligned with the local community's resources, experience, and needs. During this stage, a pre-test

was also administered to all participants to assess their baseline knowledge regarding the benefits of organic fertilizer and the potential uses of cow manure, banana peels, eggshells, and rice husk charcoal. The pre-test consisted of 10 questions requiring "yes" or "no" answers. The use of pre-tests and post-tests enables assessment of changes in participants' knowledge following the training program (Sharifzadeh & Abdollahzadeh, 2021).

The preparation phase involves coordinating with village authorities or farmer group leaders, selecting participants, scheduling activities, developing modules, creating evaluation instruments, and procuring necessary tools and materials. The equipment used includes tarpaulins, buckets, fermentation vessels or compost bins, shovels, scales, knives or chopping tools, gloves, masks, compost thermometers (if available), pH meters, watering cans, and storage sacks. The primary materials consist of cow manure, which serves as a source of microorganisms and nutrients, and banana peels, which provide potassium. Eggshells contribute calcium (Ca) and trace minerals that help neutralize overly acidic soil. Turmeric acts as a natural source of antioxidant and antimicrobial compounds. Rice husk charcoal contains silica, carbon, and trace minerals, which serve to enhance water and nutrient absorption (Kalemelawa et al., 2012; Mago et al., 2021).

The outreach activity was conducted through presentations, interactive discussions, Q&A sessions, simple guidelines, and demonstrations of mature fertilizer, all using easily understandable language. The material covered soil fertility status, the consequences of improper chemical fertilizer use, the benefits of returning organic matter to the soil, the potential of cow manure, banana peels, and turmeric as organic fertilizers, and the principles of fermentation or composting (Figure 4). Participants received information on workplace safety and indicators of fertilizer maturity. Composting success is influenced by aeration, moisture, temperature, material size, and the carbon-to-nitrogen balance; optimal moisture content ranges from 40–65% (with an initial level of 50–60%), as overly dry material slows decomposition, while excessively wet material triggers anaerobic conditions and unpleasant odors (Misra et al., 2023). Approaches involving group dynamics, media, field practice, and interaction enhanced participant engagement and understanding (Osumba et al., 2021; Sharifzadeh & Abdollahzadeh, 2021).



Figure 4. Seminar on the production of organic fertilizer.

The production of organic fertilizer begins with selecting and weighing materials according to the formulation. The cow manure used is cleaned of foreign objects, including plastic, metal, stones, and other inorganic materials. Banana peels, eggshells, rice husks, and turmeric are washed and then chopped into small pieces to increase their surface area, thereby accelerating decomposition. Chopping materials helps speed up composting because microorganisms can more easily break down smaller pieces (Misra et al., 2003). The chopped cow manure, banana peels, eggshells, rice husks, and turmeric are mixed gradually until uniform. Once thoroughly mixed, the material undergoes fermentation using a microbial activator base consisting of EM-4, molasses, palm sugar, and water, at a ratio of 20 ml of fermentation solution per 10 kg of fertilizer. The fermentation process is managed to be aerobic or semi-aerobic through periodic turning (Figure 5). Aerobic fermentation requires an adequate oxygen supply; a lack of oxygen can slow decomposition and lead to unpleasant odors. Aeration can be improved by managing particle size, moisture content, and porosity, as well as by periodically turning the pile (Misra et al., 2003; Kalemelawa et al., 2012).



Figure 5. Fertilizer ingredient mixing and fermentation process.

The fermentation process is monitored for 10-15 days until the fertilizer reaches maturity. The duration of fermentation is influenced by the timing and types of materials used, particle size, ambient humidity and temperature, and the use of activators. Fertilizer is considered mature if its temperature approaches ambient levels, it exhibits a dark brown to blackish color and a crumbly texture, lacks a foul odor (smelling instead like soil), and the original materials are no longer easily recognizable. While these physical characteristics serve as useful field indicators, laboratory analysis remains advisable if the fertilizer is intended for large-scale production or commercialization. Relevant laboratory parameters include moisture content, pH, organic carbon, total nitrogen, C/N ratio, phosphorus, potassium, and contaminant levels, in accordance with applicable standards. Research on the processing of banana waste and cattle manure indicates that a decrease in the C/N ratio, changes in carbon content, and increased nutrient availability can serve as indicators to assess the progress of decomposition and compost maturity (Kalemelawa et al., 2012; Mago et al., 2021).

The matured fertilizer is sieved to achieve a more uniform particle size, then packaged and labeled (Figure 6). The label specifies the product name, ingredient composition, production date, maturity date, net weight, application instructions, and the identity of the farmer group. Subsequently, application demonstrations are conducted on crops widely cultivated by the partners specifically chili peppers and tomatoes. These demonstrations use a setup of 40 polybags: 20 containing a mixture of soil and raw cow manure, and 20 containing a mixture of soil and organic compost. Fertilizer dosages are adjusted based on the crop type, soil conditions, and local technical recommendations. Parameters observed include the plant survival rate, plant height, number of leaves, visual plant condition, and crop yield.

The evaluation covered aspects of the process, knowledge, skills, products, participant responses, and the sustainability of the activities. The process evaluation assessed attendance rates, participation in discussions, engagement during practical sessions, and adherence to the monitoring schedule. Knowledge evaluation was conducted via a post-test with questions comparable to those on the pre-test; average scores before and after the training were compared to determine changes in participants' knowledge.

The use of pre- and post-intervention assessments can help illustrate changes in participants' knowledge, although such changes do not always

directly indicate changes in practice. Therefore, knowledge evaluation needs to be complemented by observation of skills and follow-up on technology implementation (Sharifzadeh & Abdollahzadeh, 2021). Next, participant responses were collected through a questionnaire on community service activities. The results were analyzed based on three categories: usefulness, knowledge, and participant enthusiasm. Once obtained, they were calculated using the equation.

$$Response = \frac{score}{maximum\ score} \times 100\%$$

Following the participant evaluation, an assessment was conducted on the results of applying the product to chili and tomato plants. The evaluation of the fertilizer's effectiveness involved monitoring the seedlings from day 5 post-planting through day 25, using specific parameters: the number of seedlings that sprouted, plant height, leaf count, and leaf chlorophyll levels. To analyze the findings, success indicators were calculated by expressing the numbers of sprouted seedlings, plant height, and leaf count as percentages of the total number of plants.

Product success and increased knowledge indicate the effectiveness of the team's community service activities. The results obtained provide a basis for follow-up actions to ensure the continuity of future community service programs. Evaluation and follow-up involve tracking the number of participants who independently produce the fertilizer, the number of batches produced, the volume of waste utilized, the application of the fertilizer on the land, and any challenges encountered. A field-based approach incorporating direct interaction, demonstrations, personal mentoring, and peer-to-peer learning is essential for transforming knowledge into sustainable skills and practices (Osumba et al., 2021; Sharifzadeh & Abdollahzadeh, 2021).

Result and Discussion

A community service project conducted by a team from the Islamic University of Madura supported by the Agriculture Agency and carried out in Bungbaruh Village, Kadur District, Pamekasan Regency resulted in the production of an organic fertilizer named "Komposku." The initiative began with an assessment of the partners' problems and needs. Interviews with the participating farmers revealed an insufficient supply of chemical fertilizers; the farmers typically cultivate plots ranging from 1 to 2 hectares, with each hectare requiring approximately 300 kg of chemical fertilizer.

Table 1. Fertilizer requirements per hectare based on soil type

Soil Type	Chemical Fertilizer Requirement	Fertilizer Availability
Clay soil	250–300 kg/ha	100–150 kg/ha
Loam soil	300 kg/ha	150 kg/ha
Sandy soil	300–350 kg/ha	150 kg/ha
Sandy loam soil	300–350 kg/ha	100 kg/ha
Clay loam soil	250–300 kg/ha	150 kg/ha

Based on the assessment of fertilizer requirements shown in Table 1, farmers face challenges with fertilizer availability, specifically the difficulty of obtaining the ideal amount needed for their crops. On the other hand, these farmers possess cattle that produce abundant manure; they also cultivate bananas and turmeric and have access to plentiful rice husks from rice milling operations. In light of this, the community service team utilized these materials to provide an alternative source of organic fertilizer for the farmers. Organic fertilizers are comparable to chemical fertilizers in terms of benefits; one key advantage is the input of organic carbon into the soil. This carbon becomes part of the soil's organic matter, playing a vital role in soil fertility, soil structure, and nutrient retention (Ren et al., 2019; Yu et al., 2012).

The second stage of the community service activity consisted of a seminar on producing organic fertilizer from locally available materials, such as cow manure, eggshells, banana peels, turmeric, and rice husks, following the initial training session. This seminar aimed to provide practical experience and deepen understanding of organic fertilizer production as a problem-

solving strategy. To assess the increase in knowledge, participants took a post-test; the results are presented in Table 2.

Table 2. Pre-test and post-test knowledge results of 30 community service participants.

Aspect	Pre-test Mean Score	Post-test Mean Score	Percentage Difference Between Pre-test and Post-test (%)
Benefits of organic fertilizers	30	87	81
Basic concepts of organic fertilizers	42	85	74
Composition of organic fertilizer materials	44	90	82
Function of the fermentation process	35	95	92
Understanding of fertilizer requirements for different soil types	20	77	71

Evaluation results from 30 participants showed knowledge gains across all aspects following the seminar and training on organic fertilizer production; the average score rose from 34.2 in the pre-test to 86.8 in the post-test, with a mean normalized gain of approximately 80% a figure classified as "high" according to Hake (1998). The greatest improvement occurred in the understanding of fermentation functions (92%), followed by organic fertilizer material content (82%), material benefits (81%), basic organic fertilizer concepts (74%), and fertilizer requirements based on soil type (71%). These findings demonstrate that combining material delivery with practical application effectively bridges conceptual knowledge and hands-on experience in processing local materials into organic fertilizer; this aligns with van den Berg et al. (2020), who emphasized the effectiveness of participatory,

experience-based agricultural learning, and Charatsari et al. (2022), who noted that agroecological knowledge is reinforced through direct experience, social interaction, and contextual learning. The substantial improvement in fermentation highlights the importance of practical learning about the decomposition of organic matter into more stable, beneficial forms for the soil. Liu et al. (2024) further explain that organic fertilizers can enhance soil organic matter, aggregate stability, water-holding capacity, microbial activity, nutrient availability, and nutrient use efficiency. Meanwhile, the increased understanding of fertilizer requirements by soil type indicates a growing awareness that fertilization practices must be tailored to soil characteristics, organic matter quality, crop needs, and environmental conditions (Xu et al., 2025).

The implementation phase involved applying the finished organic fertilizer to tomato plants. The process began by raising seedlings in polybags, divided into two groups: the first group consisted of 20 polybags filled with a mixture of soil and cow manure. In contrast, the second group consisted of 20 polybags filled with soil mixed with "Komposku" organic fertilizer (Figure 7). After planting, both groups were placed in an open area where they received equal exposure to sunlight. The observation results are presented in Table 3.

Table 3. Comparison of Vegetative Growth of Tomato Plants on 'Komposku' Organic Fertilizer Medium and Comparison Medium

Observation Day	Komposku Organic Compost Treatment	Comparison Medium (Soil + Cow Manure)	Observation Results
Day 5	Seedlings began to emerge from the growing medium.	Seedlings began to emerge from the growing medium.	Both groups exhibited relatively similar germination and seedling emergence processes.
Day 10	Plant height reached approximately 2	Plant height reached approximately	Plant growth in the Komposku treatment began to show better

	cm with 3 leaves.	1.5 cm with 2 leaves.	performance compared with the comparison medium.
Day 15	Plant height reached approximately 3 cm with 5 leaves.	Plant height reached approximately 2.75 cm with 3 leaves.	Differences in plant growth became increasingly evident, particularly in terms of leaf number.
Day 20	Plant height reached approximately 5 cm with 10 leaves.	Plant height reached approximately 3.5 cm with 5 leaves.	Plant height ±5 cm; 10 leaves.
Final Comparison	Plant height: 5 cm; 10 leaves	Plant height: 3.5 cm; 5 leaves	Plant height: 5 cm; 10 leaves

Based on Table 3, the use of Komposku shows potential to support the early growth of tomato plants, particularly in increasing plant height and leaf count. These findings align with Wang et al. (2017), who reported that vermicompost and poultry manure compost can enhance tomato growth, and with Traoré et al. (2022), who demonstrated that combining organic matter with mineral fertilizers boosts growth by improving nutrient availability and soil fertility. Li et al. (2023) also found that digestate-based organic fertilization increased plant height, stem diameter, chlorophyll content, and photosynthetic activity, and improved soil biological conditions. Physiologically, an increased number of leaves supports expanded photosynthetic area and biomass accumulation, whereas organic matter improves water retention, cation exchange capacity, and nutrient availability. This is supported by Savy et al. (2022), who showed that compost improves the nutritional status and growth of tomatoes, and by Oueld Lhaj et al. (2026), who reported increases of 35–55% in plant height and 40–70% in leaf area, accompanied by improvements in moisture retention, chlorophyll content,

and productivity. Thus, the growth trends observed in the Komposku medium are consistent with the benefits of organic matter as both a nutrient source and a growing-medium amendment.



Figure 6. Nursery process using organic compost fertilizer

Following the implementation of the planting activities and the production of organic fertilizer, questionnaires were distributed to the community service participants to gauge their responses, as shown in Figure 7.

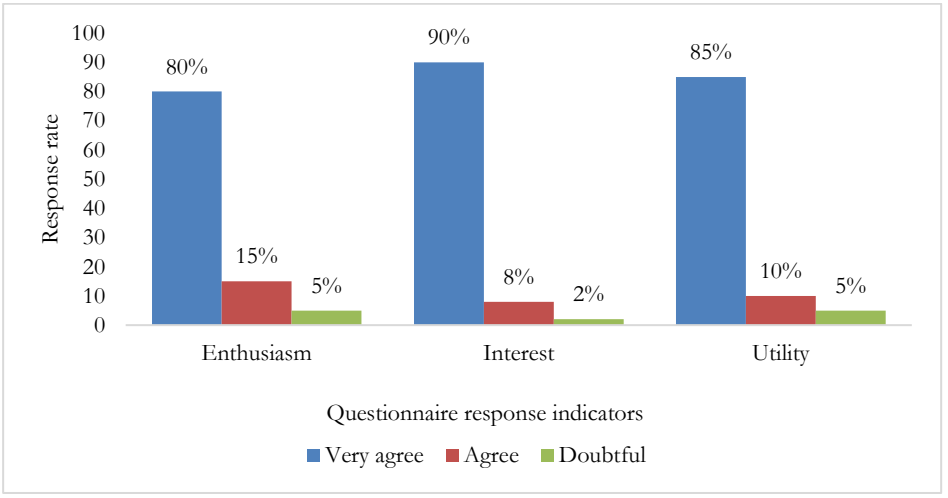

Figure 7. Percentage of responses from community service participants.

Based on the participant response survey results shown in Figure 7, participants reacted very positively to the mentoring activity on producing organic fertilizer from cow manure, eggshells, banana peels, and turmeric; positive responses (combining "strongly agree" and "agree") reached 95% for

enthusiasm, 98% for interest, and 95% for perceived benefits, with an overall average positive response of 96%. These results indicate that the community service activity not only captured participants' attention but was also perceived as relevant and beneficial for supporting the utilization of local organic materials. This high level of positive response can be attributed to a mentoring approach that provided participants with opportunities to gain both knowledge and practical experience. Charatsari et al. (2022) explain that agroecology learning is reinforced through hands-on experience, social interaction, and contextual learning processes, thereby enhancing participant engagement. These findings also align with Pawar and Channaveer (2025), who found that community-based educational interventions improved farmers' knowledge, attitudes, and positive perceptions regarding sustainable farming practices, while emphasizing the importance of participatory learning, experience sharing, and practical demonstrations in boosting participant engagement. Furthermore, Rezaei-Moghaddam et al. (2020) reported that extension education on composting technology is positively correlated with farmers' pro-environmental behavior and acceptance of compost use, suggesting that such mentoring activities could support the adoption of more sustainable agricultural practices. However, because these survey results provide a descriptive account of participants' responses and acceptance, a positive response does not directly guarantee that participants will adopt the production and use of organic fertilizer over the long term.

Overall, the seminar and guidance sessions on organic fertilizer production had a positive impact on participants' knowledge, practical application, and acceptance. The average knowledge score rose from 34.2 on the pre-test to 86.8 on the post-test, with a normalized gain of approximately 80%, placing it in the high category (Hake, 1998), demonstrating that the combination of material delivery and hands-on practice effectively enhanced participants' understanding through experiential and contextual learning. This knowledge gain was reinforced by the results of applying "Komposku" to tomato plants, which showed potential for increasing plant height and leaf count, consistent with the known benefits of compost and organic fertilizer for plant growth and soil fertility (Wang et al., 2017; Li et al., 2023). Organic matter also improves soil structure, microbial activity, nutrient availability, and plant resilience to environmental stress (Liu et al., 2024), while enhancing plant height, leaf area, chlorophyll content, water retention, and tomato

productivity. This success aligns with the 96% average positive response from participants—comprising 95% enthusiasm, 98% interest, and 95% perceived benefit—indicating that the activity was considered engaging, relevant, and useful. Guidance provided through demonstrations and hands-on practice can boost community engagement, knowledge, and positive attitudes toward sustainable agricultural practices. However, increased knowledge and positive responses do not automatically guarantee the sustained adoption of organic fertilizer, as attitudes, social norms, extension support, experience, and resource availability also influence this. Thus, these findings mutually reinforce one another, demonstrating that such community service activities can encourage the use of local organic materials and foster more self-reliant, sustainable organic fertilizer management within the community (Pawar & Channaveer, 2025; Rezaei-Moghaddam et al., 2020).

The sustainability of the Komposku production program requires continued community involvement and institutional support beyond the completion of the community service activities. To support continuity, the knowledge and practical skills participants acquire during the training can serve as a foundation for developing a community-based organic fertilizer production initiative. The farmer group can be encouraged to coordinate the collection of locally available raw materials, such as cow manure, banana peels, eggshells, rice husks, and turmeric waste, and to organize periodic production activities. Furthermore, collaboration with the village government and the Village-Owned Enterprise (BUMDes) could be explored to facilitate production facilities, product packaging, distribution, and potential marketing. Although the establishment of a formal joint business group (KUB) or integration into BUMDes has not yet been established as part of the current program, these institutional arrangements represent potential strategies for strengthening the economic and organizational sustainability of Komposku production. Continuous mentoring, product quality evaluation, and monitoring of farmer adoption are also necessary to ensure the initiative becomes a sustainable community-based activity.

Conclusion and Suggestion

Community service activities involving seminars and practical guidance on organic fertilizer production effectively improved participants' knowledge, skills, and acceptance. This was reflected in an increase in the average score from 34.2 (pre-test) to 86.8 (post-test), with a normalized gain of

approximately 80%, which is classified as high. The application of "Komposku" to tomato plants also showed potential to support early vegetative growth, particularly plant height and leaf development. Furthermore, the average positive participant response of 96% indicated that the activities were engaging, relevant, and beneficial, and that they encouraged the use of locally available organic materials. Nevertheless, improved knowledge and positive responses do not necessarily ensure sustained adoption, underscoring the need for continued assistance and resources. Limitation: This activity had several limitations, including its limited implementation scale and duration. The evaluation involved a small number of tomato plants and focused only on early vegetative growth, without assessing flowering, fruit development, or final yield. In addition, Komposku had not undergone comprehensive laboratory analysis to determine its nutrient composition and chemical characteristics. The sustainability of its production and adoption by farmers also remains to be evaluated. Therefore, the findings should be considered preliminary evidence rather than definitive proof of long-term agricultural effectiveness—recommendations for Future Activities and Research. Future community service activities should prioritize continuous mentoring and institutional collaboration with farmer groups and village authorities. Establishing farmer-managed production groups or integrating production into Village-Owned Enterprises (BUMDes) could support sustainable production and distribution. Further research should include laboratory quality assessments, comparative field trials with different application rates and control treatments, and longer observation periods that cover the entire crop cycle and final yield. Monitoring farmer adoption over several months is also essential to assess long-term sustainability and the potential for wider implementation of this locally based organic fertilizer technology.

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