ISSN (print) : 2722-2934
ISSN (online): 2722-3043
BUBUNGAN TINGGI
JURNAL PENGABDIAN MASYARAKAT
Jurnal Pengabdian Masyarakat

Effective Microorganisms 4 (EM-4) Application in The Process of Making Compost from Household Organic Waste to Increase Skills of PKK Members

Tabitha Sri Hartati Wulandari*, Supiana Dian Nurtjahyani, Dede Nuraida, Christina Innocenti Tumiar Panggabean, dan Sukisno
Program Studi Magister Pendidikan Biologi
Universitas PGRI Ronggolawe, Tuban, Indonesia
* tabithawulandari7@gmail.com

Abstract: Handling the problem of household waste is getting more complicated by the day. Some people do not have a new perspective on dealing with waste. For this reason, serious handling is needed when utilizing household waste as a resource. Household waste is the largest contributor to creating organic waste, so to turn organic waste into resources, it is necessary to work on piles of organic waste from household waste by utilizing waste in compost. The benefits of compost are many in terms of fertilizing plants, so through community service, training activities for making compost with EM 4 were carried out for Baturetno PKK members, where 35 participants attended the training. The aim is to train PKK members skills in handling household organic waste by giving them EM4. In this activity, the methods used were socialization, training, and monitoring. In the training, a questionnaire was distributed to determine the participants' insight and response to the activity. The results of the questionnaire show that there is an increase in understanding and skills as seen from the average answer "YES" before the training of 58.53% with a sufficient category, and after the training to 93% with a very good category, thus indicating that the knowledge and skills of PKK members in Baturetno, Tuban district after training in processing waste from household organic waste into compost with EM 4, has increased.
Keywords: compost; EM4; training

Received: 29 September 2023 **Accepted**: 16 February 2024 **Published**:10 March 2024
DOI : https://doi.org/10.20527/btjpm.v6i2.10251

How to cite: Wulandari, T. S. H., Nurtjahyani, S. D., Nuraida, D., Panggabean, C. I. T., & Sukisno, S. (2024). EM-4 application in the process of making compost from household organic waste to increase skills of PKK members. *Bubungan Tinggi: Jurnal Pengabdian Masyarakat*, 6(2), 421-429.

INTRODUCTION

Fertilization is one of the most significant aspects of soil fertility management for boosting crop output. The community utilizes inorganic fertilizers because they believe they are more readily absorbed and do not undergo breakdown. Continuous use of inorganic fertilizers degrades soil and damages its biological, physical, and chemical qualities. As a result, it is vital to use organic fertilizers that are environmentally benign, increase soil texture, and serve as a solution for reducing the impact of using inorganic fertilizers.

Organic fertilizer is a fertilizer made from organic materials. Household waste is a source of organic material. Waste

refers to materials that are no longer in use. Household organic waste is residual material or waste produced by household-producing processes or activities. According to Government Regulation No. 81 of 2012, home waste is generated by daily household activities that do not include treads or other particular waste (Sima, 2012) .

Household waste production is steadily escalating in line with the rising population density. The accumulation of household waste at specific concentrations can pose a severe danger to the environment due to its capacity to cause pollution. Due to the negative impacts resulting from a disparity between waste production and processing, effective waste management is required to address waste issues.

An alternative waste management method involves converting specific types of organic waste into fertilizer. An approach to address the issue of how to process household waste appropriately and efficiently involves the conversion of household organic waste into compost, which is an organic fertilizer. Composting activities eliminate various materials, including household refuse, plant waste, and market waste, from the composting process. Composting is an ecological process through which organic substances are broken down into simpler components through the action of microbes. In other words, composting is a biological decomposition of matter, with microorganisms predominantly benefiting from the energy provided by organic matter (Ekawandani, 2019).

The production procedure can be executed in both aerobic and anaerobic environments. In essence, the production of solid and liquid organic fertilizers requires microbial activity to facilitate decomposition; thus, the quality and rate of compost decomposition are contingent on the condition and variety of microbes that are active throughout the composting process (Sulistiono et al., 2022). Compost improves soil structure by increasing soil organic matter content and increasing the soil's ability to retain soil water content (Wasis & Fathia, 2011). Compost formation typically requires three to four months to occur naturally; however, implementing Effective Microorganisms 4 (EM-4) technology can significantly reduce this time to three to four weeks. Bioactivator EM-4 Solution is utilized in composting to accelerate the decomposition process and as an inoculant to increase the population and diversity of microorganisms in soil and plants; this, in turn, can enhance crop yields in terms of growth, health, quality, and quantity (Ayu, 2022). Furthermore, applying EM-4 expedites the decomposition phase during the compost formation process. The findings of a study conducted by Jaya et al. (2014) demonstrated that incorporating an EM-4 activator into compost made from empty fruit clusters of oil palm resulted in enhanced absorption of the compost. Consequently, this accelerated plant growth as measured by height, leaf count, and weight (Jaya et al., 2014). Consequently, the advantages of supplementing decomposition with EM-4 are required to optimize compost formation. The EM-4 (effective microorganism 4) solution was identified by Ryukyus University, Japan, professor and doctor Teruo Higa. The implementation of the system in Indonesia was subsequently facilitated by Ir. Gede Ngurah Wididana, M.Sc. One benefit of utilizing the EM4 solution is its demonstrated ability to eliminate odors that may occur during the composting process if executed correctly (Dahlianah, 2015). Furthermore, empirical evidence supports the claim that EM-4 technology can generate organic fertilizer (compost) in a comparatively brief period when compared to conventional methods (Ali et al., 2018)

EM-4 have the potential to accelerate the decomposition process. EM-4 is a brownish liquid with a fresh aroma of sweet and sour flavors that contains a mixture of several beneficial microorganisms for nutrient assimilation in the soil (Putra et al., 2021). Phosphate-solubilizing Lactobacillus sp. (a bacterium that produces lactic acid) comprises 90% of EM-4, along with photosynthetic bacteria, Streptomyces sp., cellulose-degrading fungi, and yeast (Wirda, 2022). Furthermore, EM-4 promotes the growth of microorganisms and is advantageous for plants, including nitrogen fixers. Furthermore, EM-4 can expedite the organic waste decomposition process, making it compostable. Incorporating EM-4 elements into composting has significantly enhanced soil biology and physical and chemical fertility, promoting plant development and growth and augmenting soil and plant productivity (Sumarni et al., 2010). Similarly, Joshi et al. (2019) report that EM-4 products can promote healthy plant growth, as evidenced by the plants' high quality and increased yield (Joshi et al., 2019).

Therefore, although the significance of incorporating EM-4 into the composting process is widely recognized, it remains relatively unfamiliar to the public. In Baturetno, Tuban subdistrict, Tuban Regency, recovery and training on creating compost with the addition of EM-4 were provided to PKK members.

Baturetno Subdistrict is situated within the Tuban District of the Tuban Regency in the province of East Java. The population density of this urban village, situated in the heart of the city, has led to an increase in refuse accumulation, particularly household waste. This sub-village places Particular emphasis on waste management, particularly on PKK members who contribute household organic waste. It has been discovered that prior to receiving counseling and training regarding the incorporation of EM-4 into composting, the PKK members residing in Baturetno had already undertaken initiatives to process organic refuse from their households. They have acquired knowledge regarding environmental hygiene through reducing organic waste, which is subsequently converted into compost. However, field observations and interviews indicate that composting frequently encounters setbacks, including the presence of an offensive odor due to the protracted compost formation process, the exclusive utilization of organic materials derived from household waste without the incorporation of EM-4, and the improper suitability of compost results for application on planting media.

METHOD

This training activity was implemented on June 6 and 7, 2023, at the RT 1 RW 1 hall in Baturetno, Tuban sub-district, Tuban district. The participants of this activity were members of the PKK members's group, totaling 35 people. The mentoring method includes socialization, training, and monitoring.

The instrument was a questionnaire for interviews before and after the activity to see the extent of the activity's impact on improving PKK members' skills. Tools and materials: plastic containers, plastic barrels, stirrers, plastic, and rope to tie, as seen in Figure 1.

Figure 1 The tools

EM-4, granulated sugar or molasses, clean water, tablespoons, and organic household waste materials (banana peels, carrot peels, kale pieces, eggshells, spinach stems, sprouts, and dry leaves). This can be seen in Figure 2.

Figure 2 The materials

Previous to the commencement of the training, participants completed an attendance register and were administered a questionnaire to assess their level of comprehension and familiarity with the material to be covered. Then, socialization and counseling were conducted through the distribution of training materials containing queries and answers. A concise orientation regarding the various classifications of organic waste, the definition of compost, and the procedural phases involved in transforming organic waste into compost was provided via LCD with accompanying PowerPoint slides. Compost-making equipment and supplies, the advantages of incorporating EM-4 into the composting process, and the methodology for preparing compost using EM-4 as a mixture are discussed. Then, practical application of the materials and equipment to compost production ensued. Then, following the conclusion of production, evaluation and monitoring were conducted, and a questionnaire was distributed after the training. The training procedures for the PKK member's group are as follows:

1. Prepare all tools and materials beforehand.
2. Make an EM-4 solution of 1 EM-4 bottle cap with a mixture of 1 liter of water, then add three spoons of sugar or molasses (Jannah et all, 2021).
3. Mix the organic materials of household waste, with the ratio of brown dry leaves and green waste 2: 1; before entering, cut the material into small sizes, then stir until everything is mixed.
4. Put some of the finished compost into a plastic barrel, then add the organic materials cut into small pieces
5. Then, pour the EM4 solution into the ingredients in the barrel and stir until everything is mixed.
6. After all, it is almost on the surface of the barrel / plastic container, then covered with plastic tied tightly and then let stand and store in a shady and dry place, safe and not exposed to direct sunlight.
7. After 5-7 days, check to see the condition of the compost; if it is too hot, it is proven to feel warm in hand, then stirring is done so that the lower part becomes above and the upper part below, and if the condition is dry, then add a little water, then cover the plastic again and tie it. Closed tightly so that no more oxygen enters is called anaerobic. Anaerobic composting experiences a faster composting process than composting using an aerobic composter, resulting in composting forming like soil on day 12(Wardoyo & Anwar, 2021).
8. After three weeks, the compost is finished, indicated by the reduction in the volume of compost, which was almost complete; then, if it has gone through composting, becomes one-

third of the material put in the container, the color becomes dark, and not smell (Mirawati & Winarsih, 2019). It should be dried in the sun first before applying to plants.

RESULT AND DISCUSSION

The composting training session, which incorporated EM4, was conducted in Baturetno, Tuban District, East Java, in collaboration with the PKK members' group. The fundamental materials utilized were organic refuse from households and EM-4. The endeavor was executed without incident or difficulty. The PKK members's group participants exhibited a strong desire for this training and counseling. The village chief participated in the event until its conclusion and delivered a speech that received a favorable reception, indicating that every village official, including the chief, wholeheartedly supported this undertaking. The involvement of participants in the utilization of discarded organic household refuse provides them with a novelty. By combining EM-4 with 1 liter of water, EM-4 is intended to be dissolved. This mixture is intended to stimulate the microorganisms in EM-4 (Putra et al., 2021). Adding sugar or molasses gives microorganisms energy, allowing them to function optimally. Granulated sugar can significantly reduce composting time because it speeds up the composting process. Granulated sugar can improve the performance and quantity of microbial decomposers involved in compost formation (Septiani et al., 2022). EM-4 has the effect of hastening compost maturation. Good compost is matured and has qualities such as no odor, low water content, and a temperature that is consistent with the room temperature of the items generated, partner responses, and so on.

According to the questionnaire results before the course, there were fifteen (15) question items. The first inquiry was, "Do you have organic and inorganic waste in your home?" It received the highest percentage score, which was 100%. Meanwhile, the percentage score for item 3, "Do you understand how to distinguish between organic and inorganic waste?" and item 10, "Do you know the benefits of compost?" is 96%. This demonstrates that at the start of the training, the target human resources for the training were appropriate, namely PKK members (100%), because they were the materials to be processed as compost. The majority (96%) of the participants already knew how to distinguish between organic and inorganic waste and the benefits of compost, but only 65% of the participants performed waste sorting. In item 4, the question is, "Do you or your mother simply throw away organic waste at home?" It came out that the answer was "no" by up to 83%, showing that mothers had handled organic waste, but only in item 5, with the question "Have you ever processed organic waste in your home?" The "yes" response was barely 30%. Only 30% of respondents said "yes," indicating they had not composted organic waste at home. Essentially, the participants' knowledge of compost handling is already partially known, as indicated by the results of the questionnaire answers of more than 50% by answering questions item no. 7, 8, 9, 11, and 12, while in items no. 13, 14, and 15 related to the EM-4 question, the majority of the training participants answered "no," which is more than 50%. This demonstrates that most participants are unaware of EM-4, and the average "yes" response is only 58.5%, indicating the need for Baturetno PKK members to receive training on making ecologically benign fertilizer from home organic waste with the addition of EM-4. Figure 3 shows data on participants' answers before they start the activity.

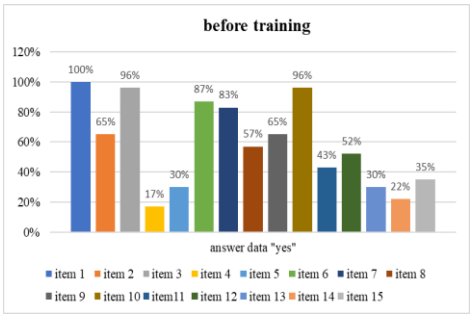

Figure 3 Participant questionnaire results before training

Based on the results of the participants' questionnaire after the training, it showed that there was a positive change as indicated by the answers to each question item, which obtained an average of more than 50%, while on the item with the question "Will you just throw away organic waste at home after attending the training?" answering "yes" only 17 percent, indicating that the mothers have supported utilizing household organic waste into compost, and the average of those who The outcome was an improvement in the skills of PKK members in creating compost with EM-4. The questionnaire revealed an increase in understanding from 58.53% to 93%, or a very good category, indicating that PKK members in Baturetno district Tuban now have more knowledge and skills in processing household organic waste into compost using EM-4. Figure 4 depicts data on participant responses following the activity.

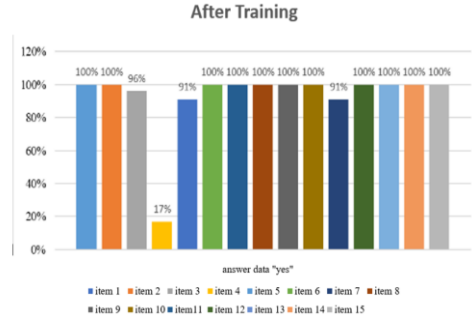

Figure 4 Participant questionnaire results after the training

This training activity has the potential to promote awareness and educate people about waste management and processing; therefore, it should be taught to all community groups, including children and adults, as soon as feasible. Mothers may help educate their children from a young age by improving the abilities of the PKK members. Children are taught how to treat organic waste so that they develop a love for the environment from a young age and make it a habit in their daily lives. Before the participants began practicing, the community service team demonstrated how to manufacture compost with EM-4. This gave the participants a clear image of what would happen. Participants practiced passionately and swiftly, following the examples provided. Demonstrations, such as the community service team's demonstration of how to manufacture compost fertilizer, are powerful ways to impart knowledge (Murtini et al., 2021).

The successful outcomes of the monitoring and evaluation activities included the manufacture of compost that was ready to be applied to plants, a significant gain in knowledge, and the formation of compost, which demonstrated that the Baturetno PKK members' skills had improved. The success of the Baturetno PKK members in making compost adds insight into organic materials from household organic waste that are environmentally friendly, can be used as a solution to reduce dependence on the use of chemical fertilizers and increase the independence of Baturetno PKK members in making organic fertilizers as an effort to preserve environmentally friendly farming, and economically can be family food security because they can make their own compost.

Figure 5 illustrates the participants who attended the training and were prepared to complete the pretest and depicts remarks made by the Head of Baturetno Village.

Figure 5 (a) Completion of pretest by trainees (b) Remarks by the head of Baturetno Village

Figure 6 depicts photographs of participants engaged in composting operations and finished compost results.

(a) (b)

Figure 6 (a) Composting practice (b) Compost results

The presence of good cooperation among fellow participants and team members, from planning to training implementation, contributed to the ease and success of this work program. The partners' enthusiasm was demonstrated by providing facilities and infrastructure through training equipment and materials made from prepared household waste. A large enough area was given for activities, allowing an LCD to be mounted and all 35 people to comfortably practice composting. Aside from that, it received full backing from the Village Head, the PKK Head, and the RW and RT dads, who were present to accompany and monitor the socialization, counseling, and training from start to finish. Moreover, the village leader was thrilled to deliver a nice speech.

In terms of preventing variables, there were individuals in the training who were already 65-72 years old; therefore, practicing took longer, and they required more support than younger participants. This occurred due to the aging process, which is marked by various setbacks and changes in all bodily systems. This is especially true for functional muscle alterations. In this situation, muscle strength and contraction, muscle suppleness and flexibility, muscle work speed, and reaction time have all decreased (Adliah et al., 2023). Furthermore, not all Baturetno PKK members took part in this activity since those who did were PKK members from Baturetno village.

CONCLUSION

The activity implementation stage occurred in June 2022, followed by monitoring and evaluation activities in July 2023. The training participants gave

positive feedback on the community service activities that had been carried out. This circumstance resulted from the trainees' high levels of attendance and enthusiasm. Furthermore, the questionnaire revealed an increase in understanding from the average "yes" before training of 58.53% to 93% after training, indicating a very good category, and the results of compost as the activity's output revealed an increase in the skills of PKK members in Baturetno, Tuban district, in terms of processing waste from household organic waste into compost with the addition of EM 4. Follow-up initiatives include monitoring PKK members's composting operations to ensure their sustainability. In addition to community service activities in Baturetno village, counseling, and composting training will be provided to PKK members in villages nearby in Tuban Regency.

ACKNOWLEDGMENT

The author would like to thank the Institute of Community Service at PGRI Ronggolawe University for funding this service activity. The author would also like to thank Mr. Lurah Baturetno, Mr. RW 1, Mr. RT 1, the PKK chairwoman, the neighborhood chairwoman, and all Baturetno PKK members for providing facilities and infrastructure for the success of this activity.

REFERENCES

Adliah, F., Rini, I., Natsir, W. S., & Sari, T. (2023). Effects of balance and strength tele-exercise (bast) on muscle strength and functional mobility in older adults. *Jurnal Ilmiah Kesehatan Sandi Husada*, *12*(1), 25–32.

Ali, F., Utami, D. P., & Komala, N. A. (2018). Pengaruh penambahan EM4 dan larutan gula pada pembuatan pupuk kompos dari limbah industri crumb rubber. *Jurnal Teknik Kimia*, *24*(2), 47–55.

Ayu, A. (2022). *Pengomposan sampah makanan dengan metode takakura menggunakan aktivator mikroorganisme lokal (mol) dari limbah ikan tongkol, limbah udang, sabut kelapa, dan sisa sayuran*. Universitas Andalas.

Dahlianah, I. (2015). Pemanfaatan sampah organik sebagai bahan baku pupuk kompos dan pengaruhnya terhadap tanaman dan tanah. *Klorofil: Jurnal Penelitian Ilmu-Ilmu Pertanian*, *1*(10), 10–13.

Ekawandani, N. (2019). Efektifitas kompos daun menggunakan EM4 dan kotoran sapi. *Jurnal Tedc*, *12*(2), 145–149.

Jaya, J. D., Nuryati, N., & Ramadhani, R. (2014). Optimasi produksi pupuk kompos tandan kosong kelapa sawit (Tkks) dan aplikasinya pada tanaman. *Jurnal Teknologi Agro-Industri*, *1*(1), 1–8.

Joshi, H., Somduttand, C. P., & Mundra, S. L. (2019). Role of effective microorganisms (EM) in sustainable agriculture. *International Journal of Current Microbiology and Applied Sciences*, *8*(3), 172–181.

Mirawati, A., & Winarsih. (2019). Kualitas kompos berbahan dasar sampah rumah tangga, sampah kulit buah, dan sampah daun dalam lubang resapan biopori. *Jurnal Lentera Bio* , *8*(3), 220–225.

Murtini, S., Sutedjo, A., Prasetyo, K., & Murtedjo, M. (2021). Pelatihan pengolahan sampah organik bagi masyarakat desa tlutup, Kecamatan Trangkil, Kabupaten Pati. *Jurnal ABDI: Media Pengabdian Kepada Masyarakat*, *7*(1), 60–66.

Putra, A. R., Afandi, K., Anjani, D., & Pradana, K. C. (2021). Pelatihan kelompok wanita tani dalam pemanfaatan EM4 terhadap pembuatan pupuk kompos. *Jurnal Abdi Masyarakat Saburai (JAMS)*, *2*(02), 73–81.

Septiani, F., Afwina, T. L., Dona, Y. R.,

& Fevria, R. (2022). Pembuatan kompos dari daun kering dengan menggunakan bantuan em4 dan gula pasir making compost from dried leaves using EM4 and granulated sugar. *Prosiding Seminar Nasional Biologi*, *2*(2), 426–435.

Sima, H. (2021). Penerapan Peraturan Pemerintah Nomor 81 Tahun 2012 dalam rangka pendauran ulang sampah rumah tangga di Kabupaten Asahan. *Jurnal Ilmiah Mahasiswa Ilmu Sosial Dan Politik [JIMSIPOL]*, *1*(3).

Sulistiono, W., Awaludin, M. F., Nurhasan, R., Aziz, A. A., Arrasyid, M. F., & Anwar, M. K. (2022). Pengembangan kualitas lingkungan masyarakat melalui kegiatan kemasyarakatan. *Prosiding Seminar Nasional Pengabdian Masyarakat LPPM UMJ*, *1*(1).

Sumarni, N., Rosliani, R., & Duriat, A. S. (2010). *Pengelolaan fisik, kimia, dan biologi tanah untuk meningkatkan kesuburan lahan dan hasil cabai merah*.

Wardoyo, S., & Anwar, T. (2021). Perbedaan penggunaan komposter an-aerob dan aerob terhadap laju proses pengomposan sampah organik. *Poltekita: Jurnal Ilmu Kesehatan*, *15*(3), 251–255.

Wasis, B., & Fathia, N. (2011). Pertumbuhan semai gmelina dengan berbagai dosis pupuk kompos pada media tanah bekas tambang emas. *Jurnal Manajemen Hutan Tropika*, *17*(1), 29–33.

Wirda, Z. (2022). Pertumbuhan dan hasil jagung akibat pemberian pupuk organik dan Effective Microorganisms-4 (Em-4). *Jurnal Multidisiplin Madani*, *2*(1), 543–556.