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Increasing Jatam Kroya's Agricultural Production by Creating "Boosters" from the Environment

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ABSTRACT

This community service (IbM) aims to increase agricultural production in the community that is part of the Muhammadiyah Farmers Association (Jatam) in Kroya District, Cilacap Regency, Central Java by making "Boosters" from various natural resources. This effort is a solution to the increasing cost of chemical agricultural drugs that can have an impact on environmental pollution, which in turn can be harmful to humans. This community service method uses a participatory-educational method, through a direct educational approach, practical training, and mentoring. The community service team visits a number of farmers' gardens and rice fields, provides extension services by inviting agricultural experts from universities, monitoring, and evaluation at any time carried out through the WhatsApp Group. The community service team in this case provides extension on how to make Boosters from materials available in the surrounding environment, in the form of: Root and vegetative growth boosters; Flowering and fruit boosters; Disease resistance boosters; and soil fertility boosters. A sign that fermentation is successful is, a sour or sweet aroma, no foul odor. If moldy, add 2 tablespoons of sugar to activate good microbes.

Iptek bagi masyarakat (IbM) ini bertujuan untuk meningkatkan produksi pertanian pada masyarakat yang tergabung dalam Jamaah Tani Muhammadiyah (Jatam) di Kecamatan Kroya, Kabupaten Cilacap, Jawa Tengah dengan membuat "Booster" dari berbagai barang yang ada di alam sekitar. Petani selama ini menggunakan pupuk kimia sebagai andalan. Upaya ini menjadi solusi dari semakin mahalnya obat-obatan pertanian kimia yang dapat berdampak pada pencemaran lingkungan, yang pada gilirannya dapat membahayakan manusia. Metode pengabdian pada masyarakat ini menggunakan metode partisipatif-edukatif, melalui pendekatan edukasi langsung, pelatihan praktis, dan pendampingan. Pengabdi melakukan kunjungan ke sejumlah kebun dan sawah petani, penyuluhan dengan mendatangkan pakar pertanian dari perguruan tinggi, monitoring, dan evaluasi setiap saat yang dilakukan melalui Grup Whatsapp. Pengabdi dalam hal ini memberikan penyuluha tentang cara membuat Booster dari barang yang ada di lingkungan sekitar, berupa: Booster akar dan pertumbuhan vegetatif; Booster pembungaan dan buah; Booster ketahanan penyakit; Dan Booster kesuburan tanah. Pertanda bahwa fermentasi sukses adalah, beraroma masam atau manis, tidak berbau busuk. Jika berjamur, tambahkan 2 sdm gula untuk mengaktifkan mikroba baik.

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A. INTRODUCTION

Becoming a successful farmer with abundant yields is certainly every farmer's dream. Abundant yields guarantee a prosperous and happy life. Unfortunately, plant care requires not only water, a primary need for all living things, but also other treatments, such as soil cultivation, fertilizer application, pesticides, or the use of other pesticides. Fertilizer and water are essential for plants. Without both, although plants can survive, they cannot produce optimally. However, reality proves that fertilizer costs are actually more expensive than water, which is more practical and economical (Arianto at al, 2021: 118).

Communities, especially smallholder farmers, do not completely reject chemical pesticides for fertilizing their crops. However, they recognize that chemical pesticides are toxic, causing environmental pollution and endangering human health. Their excessive use results in very high external costs. Since 1989, the Indonesian government has been working to reduce the use of chemical pesticides through the Integrated Pest Management program. (J. Mariyono and Irham 2015). Chemical control is, in fact, the most common method used by farmers to control plant pests. However, the use of chemical pesticides has many negative impacts, both on the environment and human health. Furthermore, the relatively high cost of chemical pesticides adds to the problems faced by farmers. Therefore, farmers have turned to botanical pesticides as an alternative. They have found that pest control using alternative pesticides is quite effective (Hasanah and Sutrisno 2021).

Data on the pesticide industry and marketing prospects shows that pesticide marketing and use have been increasing year after year, reaching IDR 6 trillion per year. Farmers have relied on chemical pesticides to control pests and plant diseases. However, chemical pesticides are expensive and have negative impacts on the environment and human health. Another negative impact is the potential for pests to develop resistance, leading to new pest outbreaks (resurgence). All of these symptoms have the potential to create epidemics, the accumulation of chemical residues in plant parts that can poison livestock and even other organisms, thus reducing biodiversity, the accumulation of chemical residues in crops that can potentially poison humans, the killing of natural predators, and environmental pollution. Further impacts include human poisoning, blindness, infertility, and other adverse effects (Nurmianti and Gusmarwani 2020).

The positive aspect of biological pesticides is that they do not harm the environment, thus protecting agriculture from damage. However, the downsides of using biological pesticides are their slow reaction time, time-consuming preparation, short shelf life, and the need for regular application (Syafiruddin and Hilda 2023). Organic farming is a breakthrough in producing healthy agricultural products while maintaining environmental sustainability. Consuming organic foods, such as organic vegetables, is one way to maintain a healthy lifestyle globally. Unfortunately, some farming groups still cultivate organic vegetables at relatively high costs, resulting in high prices, making them inaccessible to all segments of society. This also results in lower profits for organic farmers (Yahya et al. 2023: 289).

Every time a farmer plants, they inevitably need fertilizer, from rice seeding to harvest. However, most fertilizers used are expensive, manufactured chemicals. Unwise use and excessive dosages can even lead to hardening of the soil and eutrophication in aquatic environments. In 2010, the government introduced a "back to nature" initiative in the agricultural sector, utilizing natural materials, such as biological raw materials and household waste, as ingredients in fertilizers and pesticides, as pest and disease control agents (Abidin and Rohman 2020: 89).

Demand for organic products is currently increasing with increasing health awareness. In response, farmers are also increasing their organic products, including organic rice. Consumers are generally willing to pay a higher price for organic rice. Therefore, organic farmers' income is determined by the difference in revenue (due to decreased production and increased selling prices) and changes in production costs (due to decreased use of chemical fertilizers and pesticides). The results of the study indicate that the quantity and price of organic rice sales have increased over time. The results of multiple regression estimates even show that organic rice productivity, the price of cow urine, and labor wages have a significant effect on the income of organic rice farmers. Meanwhile, the price of seeds, the price of manure, the price of organic pesticides, and marketing costs do not significantly affect the income of organic rice farmers (Zikrina at al, Darus, and Chalil 2013).

The current skyrocketing price of chemical fertilizers is causing hardship for farmers. Many cannot afford the cost of these fertilizers. One solution offered is the production of organic fertilizers, the ingredients of which are easily obtained and even readily available. One such solution is rabbit urine. The large number of rabbit breeders in the region makes the raw material readily available (Mutiara et al. 2022: 27). Besides rabbit urine, cow dung is also widely used to help farmers produce biogas. Biogas is a gas produced through the anaerobic fermentation of various organic waste into energy. The resulting energy can be used to meet daily fuel needs, eliminating the need for kerosene for cooking (B.Satata 2016).

Farmers generally rely on chemical fertilizers, with few utilizing natural ingredients, such as cow dung. Yet, manure-based fertilizers can increase agricultural yields and boost the local economy. Although many people are starting to use cow dung as a booster, the process of commercializing the product still requires support (Sutrisno and Priyambada 2019). To gain added value from cow dung, the people of Kalitelon, Kaligenting, Boyolali, have even developed a machine to process cow dung waste and produce organic fertilizer through composting. In addition to the economic benefits, public health has also improved due to the elimination of pollution from cow dung (Arifin et al. 2019).

In response to this environmental impact, the Muhammadiyah Farmers' Association (Jatam) of Kroya, Cilacap, has undertaken various efforts to create medicines using locally available materials. One example is a "booster" made from cow dung. They continue to conduct various experiments to increase agricultural production, efficiency, and ensure a healthy environment free from chemical pesticides.

B. METHODS

The Community Service Program, entitled “Increasing Agricultural Production in Jatam Kroya Cilacap by Making a ‘Booster’ from Cow Manure,” used a participatory-educational approach, through direct educational approaches, practical training, and mentoring for farmers who are members of the Muhammadiyah Farmers' Association in Kroya District, Cilacap Regency, Central Java. The implementation process involved the following stages:

First, identifying the problem and conducting a field survey. The community service team conducted an initial visit to the Muhammadiyah farmer association in Kroya. During this initial visit, the community service team identified the various types of crops being grown, land conditions, planting patterns, and fertilization techniques used. They also interviewed farmers regarding productivity issues and fertilizer utilization, both chemical and organic.

Second, program socialization. During the initial meeting, the community service team met with Jatam Kroya to explain the objectives, benefits, and stages of the community service program. They engaged in an open discussion to garner farmers' enthusiasm and commitment as partners in the program. The farmers were very enthusiastic, as they were thirsty for knowledge about organic fertilizers and medicines. The community service offered assistance by bringing in agricultural experts from the Faculty of Agriculture and Fisheries, Muhammadiyah University of Purwokerto.

Third, they conducted training on making "boosters" from cow dung. The community service could be described as systematizing and harmonizing the knowledge of Jatam Kroya farmers. Many farmers are learners. They read extensively in books and watch social media platforms related to agriculture, particularly on medicines made from locally available materials. When they encounter problems, they consult Artificial Intelligence (AI), even comparing the AIs with each other. They then practiced making various medicines using various objects around them. They needed community service experts from universities to confirm whether their actions were correct.

Fourth, they conducted training on making boosters from cow dung. Before the community service arrived to conduct the training, Jatam Kroya farmers had already processed the manure through fermentation to create a “booster” that would be an effective plant growth enhancer. The training covered the booster composition, which includes cow manure, EM4, molasses or brown sugar, and organic waste. The instructor then explained the fermentation process, its preparation time, storage techniques, and application to plants. At the end of the presentation, the farmers practiced making the booster, assisted by the instructor.

A month later, the community service worker met with farmers from Jatam Kroya to conduct trials and apply boosters on their land. First, the farmers identified a pilot site. From several options, the trial was conducted on Mr. Fajar Arifin S.Ag.'s rice field in Karag Hamlet, Gentasari Village, Kroya. Although Mr. Fajar is a teacher, he is a dedicated farmer and has experimented with various organic agricultural products. The community service worker provided guidance in applying the boosters to the agreed-upon plots. Furthermore, the community service worker and the Jatam Kroya farmers exchanged information through a WhatsApp group regarding the progress of the trials on their respective plots. Through this WhatsApp group, the community service worker monitored plant growth and yields using natural boosters compared to those without boosters or those using chemical boosters.

Fifth, a joint evaluation and reflection was conducted on the effectiveness of the boosters and their benefits to agricultural yields. The community service worker documented each farmer's experience in making and using boosters made from cow dung, as well as any technical challenges they encountered. Meanwhile, other farmers offered suggestions and demonstrated successful practices to address issues, which could then be used as lessons for future use. The community service team continued to monitor and conduct follow-up visits to ensure the continued use of the booster and address emerging farmer needs.

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C. RESULTS AND DISCUSSION

Carrying out community service for the Muhammadiyah Farmers' Congregation (Jatam) is slightly different from community service in general, even though Indonesians are also religious. Using a theological foundation is a necessity, so that everything done has the value of worship. One verse that serves as the theological foundation is Surah Al-An'am, verse 165 of the Quran, which reads, "It is He who has made you vicegerents (caliphs) on the earth and has raised some of you in degrees above others, that He may test you by what He has given you. Indeed, your Lord is swift in punishment, and indeed, He is Oft-Forgiving, Most Merciful." This responsibility as vicegerents on earth requires us to care for nature, one way of doing this is by using natural materials that do not harm the environment.

The community service was carried out through an interactive demonstration in the field, specifically in Mr. Fajar Arifin's rice field. It began with a demonstration of how he mixed a bucket of water with a small amount of booster made from cow dung. Fajar Arifin then measured the pH of the water and determined the amount of booster that should be added. Once he deemed it sufficient, he picked up a sprayer and sprayed the booster onto the rice in his field. He only used a few drops of booster, but it was mixed with a substantial amount of water, more than a bucketful. After filling the tank, the booster, mixed with water, was sprayed onto several squares of rice fields.

Table 1. Featured Crops in Kroya, Cilacap

Crops	**Recommended Local Boosters**	Method and Dosage
Rice	Bamboo shoot soaking water	Spray at 15 and 45 days after planting (200 ml/tank).
Chili	Fermented banana peels and rice husk ash	Water the roots every 2 weeks (1 L/tree).
Corn	Molasses, plus fermented chicken manure	Water at the beginning of planting (500 ml/hole).

"Booster made from cow dung doesn't smell, it even smells good," said Fajar Arifin while showing an example of the booster he had made. The servants tried to smell it. It turned out to be true, even though it was made from cow dung, this natural booster had a fragrant aroma. Fajar Arifin then continued spraying his relatively large rice field, but did it quickly. At that time, the rice he sprayed was just starting to grow and had not been sprayed before, so it looked thin. However, a week after the spraying, the rice looked fresh, and even a few weeks later the rice looked more fertile, not inferior to rice sprayed with chemical fertilizers.

After demonstrating the spraying of rice in his field, Fajar Arifin invited the community members to his home. The back of his house resembled a laboratory. He conducted various experiments creating agricultural chemicals from locally available materials. He fermented onion peels, banana leaves, fruit stimulants, plant fertilizers, and other natural, organic products. He then explained how to make boosters from cow dung.

Fajar explained that boosters, in the context of agricultural chemicals, are better known as agrochemicals. The term "booster" itself does not refer to an official category like pesticides or fertilizers, but rather a marketing term for products designed to increase the effectiveness of plant care or provide an additional boost to plant growth or protection. It could be said that the term "booster" is a general term that is often misunderstood. In the agricultural world, boosters are not a standard concept like vaccinations are for humans.

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Prof. Dr. Cahyono Purbomartono, M.Sc., a community member from the Faculty of Agriculture and Fisheries, Muhammadiyah University of Purwokerto, explained that people use boosters because they see products labeled "booster" on the market. In fact, the term booster does not have an official definition in agricultural regulations. However, this term is often used as marketing for various types of products. He explained that agricultural boosters can be classified into: (1) Growth and root boosters, which function to stimulate the

Figure 1: Fajar Arifin, a Jatam Kroya farmer, spraying rice in his rice field using a booster made from natural materials.

development of roots, shoots, and vegetative biomass; (2) Flowering and fruit boosters, which function to stimulate flower formation, prevent fruit drop, and increase fruit size; (3) Plant resistance boosters, which function to increase immunity against disease and environmental stress such as rain or drought; (4) Soil fertility boosters, which function to improve soil structure and add beneficial microbes; (5) Fertilizer or pesticide efficiency boosters, which function to increase the absorption of nutrients or drugs, and reduce chemical doses.

Prof. Cahyono reminded farmers not to mix fertilizers haphazardly. For example, don't mix acidic boosters, which consist of vinegar and coconut water, with basic pesticides like chlorpyrifos. He also reminded farmers to conduct a compatibility test by mixing a small amount in a small bucket and observing for about an hour. If sediment or clumps appear, do not use the mixture. The professor at the Faculty of Agriculture and Fisheries at UMP also reminded farmers about storage, by storing the fermented booster in a shady place for a maximum of three months.

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In his explanation, Prof. Cahyono revealed that Kroya has a rich source of local booster ingredients. For example, farmers can replace the growth regulator (PGR) Auxin with bean sprout soaking, by soaking 1 kg of bean sprouts in 5 liters of water overnight. Farmers can also replace fungicides by boiling 10 betel leaves and 5 cloves, then spraying the plants in the morning. Farmers can even replace NPK by mixing wood ash (K) with animal blood (N), and ground bone (P). Most importantly, Prof. Cahyono reminded that boosters are not substitutes for primary fertilizers or pesticides, but rather complements, not standalone solutions. However, the dosage must be precise, as overdosing can poison plants. In other words, agricultural boosters are smart companions that optimize plant care, including nutrient absorption, pesticide effectiveness, stress resistance, and recovery.

Figure 2. A durian tree that had not borne fruit for four years immediately produced flowers after receiving a booster made from natural sources.

The basic principle of using natural boosters is that farmers should focus on organic materials rich in nutrients, enzymes, or bioactive compounds, said Prof. Cahyono. The available materials are then processed through fermentation to increase nutrient availability. This method should be applied regularly, once a week, for optimal results. He further explained that there are four types of natural boosters that farmers can make:

First, how to make a root and vegetative growth booster. The ingredients consist of 1 kg of young banana stems, cut into small pieces; 1 handful of brown sugar or palm sugar dissolved in 200 ml of water; and 10 liters of clean water. To make it, soak the banana stem pieces in 10 liters of water; add the sugar solution, then stir thoroughly; cover tightly, ferment for 7-10 days in a shady place; then strain and collect the water. To apply it, dilute it with water at a ratio of 1:10 and pour it onto the soil around the plant roots. This booster, rich in potassium and natural auxins, functions to strengthen roots, especially for rice and leaves.

Two, a flowering and fruit booster. The ingredients for this booster include: 1 kg of banana peels. Dry them in the sun for two days; 200 grams of rice husk ash; 1 tablespoon of fermented cassava yeast; and 5 liters of coconut water. To make it, blend the dried banana peels and mix them with the rice husk ash until smooth. Mix with the coconut water and

fermented cassava yeast; then ferment for 14 days in a closed container. To apply, dilute 250 ml of the solution with 10 liters of water, then spray it on the leaves or flowers. The potassium in banana peels, phosphorus in rice husk ash, and cytokinins in coconut water can stimulate flowering in chilies or tomatoes.

Three, a disease resistance booster. The ingredients for this booster include: 500 grams of turmeric, plus 200 grams of garlic, finely ground; 1 liter of rice washing water (leri water), and 1 tablespoon of apple cider vinegar. To make it, combine the turmeric, garlic, leri water, and vinegar. Ferment all these ingredients for seven days, then strain. To use, dilute 100 ml with 5 liters of water, then spray it all over the plants. This way, curcumin (turmeric) and allicin (garlic) can act as effective natural antimicrobials for leaf rot.

Fourth, soil fertility booster. This booster can be made with 5 kg of fresh goat or rabbit manure, 1 kg of bran, 1 bottle of EM4 (rice husk) or rice bran as a substitute, and 20 liters of water. To make it, dissolve the EM4/bran in water. Mix it with the animal manure, then store it in a barrel. Ferment for 21 days, stirring every 3 days. To use, dilute it 1:20 with water, then water the beds. This way, beneficial microbes improve soil structure.

Prof. Cahyono gave tips to the Kroya Muhammadiyah Farmers' Congregation (Jamaah Tani Muhammadiyah Kroya) to use containers such as used plastic buckets or drums. Ensure the containers are clean. He reminded them that a sign of successful fermentation is a sour or sweet aroma, not a foul odor. If mold appears, add 2 tablespoons of sugar to activate the beneficial microbes. A safe dosage is to spray the leaves until they are wet, but not dripping. For the soil, water 200-500 ml per plant, depending on the age of the plant. Application times are in the morning before 9:00 AM or in the afternoon after 4:00 PM. Avoid spraying during rain or extreme heat.

The soil in the Kroya area, which is close to the South Sea, is typically red (laterite) and poor in nutrients. A natural booster solution is to use a mixture of fermented chicken manure, rice husk ash, and water in a ratio of 3:1:5. This method can increase soil pH and add micronutrients. In one trial, a farmer's long bean yield increased by 25% after three applications. Prof. Cahyono cautioned farmers against using human or carnivorous animal waste, as it carries the risk of pathogens. Ensure proper fermentation, at least seven days, to eliminate odors. Once ready, store the booster out of reach of children.

D. CONCLUSION

From the description above, it can be concluded that making "Boosters" from various natural materials is one solution for farmers to overcome the increasingly expensive price of chemical fertilizers. Making these natural "Boosters" is also an effort to save the environment from pollution caused by chemical-based agricultural drugs. This effort is also an effort to make agricultural production more efficient, because the price of chemical fertilizers continues to rise. Science and technology for the community (IbM) socialized to the community who are members of the Muhammadiyah Farmers Association (Jatam) in Kroya District, Cilacap Regency, Central Java in the form of "Boosters" for roots and vegetative growth; flowering and fruit boosters; disease resistance boosters; and soil fertility boosters. Signs that fermentation is successful are, sour or sweet aroma, no foul odor.

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the Director of Postgraduate Studies UMP; and the Dean of the Faculty of Teacher Training and Education UMP.

F. AUTHOR CONTRIBUTIONS

The article, entitled, "Increasing Jatam Kroya's Agricultural Production by Creating Boosters from the Environment," is a collaboration between Wakhudin, Beny R. Wijarnako, and Cahyono Purbomartono. Wakhudin acts as the coordinator, overseeing preparation, implementation, monitoring, and evaluation. Beny R. Wijarnako is more specialized in social communication, connecting human resources at Muhammadiyah University of Purwokerto with the community members of Jatam. Meanwhile, Cahyono Purbomartono is more dominant in his role as an expert in the fields of agriculture and animal husbandry. He is the person who is most familiar with the issue of artificial booster substances from the surrounding environment.

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