

Plant Growth Promoting Rhizobacter as an Alternative Liquid Organic Fertilizer Based on Bamboo Roots

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Abstract: Fulfillment of fertilizer is still a crucial problem for farmers, especially young farmers who depend on helping their parents in the fields or gardens because they have to stop going to school due to their parents' low economic conditions. The lack of skills in processing agricultural products and the natural environment means that when the harvest season is over, many youth members just hang out without working. The aim of implementing this service is to transform the potential of bamboo roots by encouraging out-of-school youth to contribute to helping other farmers regarding the limitations of fertilizer through fermentation techniques in producing Plant Growth Promoting Rhizobacter (PGPR) based on weathered bamboo roots for partners, namely the Out-of-School Youth Group. The implementation method for community service is a participatory approach to society that is implemented in three stages: socialization, training, and partner assistance. The results showed that partner members experienced a significant increase in their ability to understand the benefits of bamboo roots and convert them into biofertilizers, with an achievement of 90%. This activity helps the community, especially partners, obtain alternative fertilizers and companions to sustain agricultural products as the main commodity for the partners' parents' income.

Keywords: green production; PGPR; weathered bamboo roots

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INTRODUCTION

The problem of fertilizer becomes crucial when the current essential needs of farmers to increase agricultural yields are constrained by distribution and several other requirements in obtaining

fertilizer which causes the community to have to think about other alternatives in meeting the need for fertilizer as is the case with the community in Balle Village, Bone Regency, South Sulawesi. Several young people who are members

of youth groups (young farmers) complain about the distribution of fertilizer to the community as well as the requirements regarding the existence of farmer cards, which are sometimes considered unfair to some farmers.

The use of chemical fertilizers is also a big problem. On one side, farmers want abundant results, but on the other is the impact of agriculture in the form of rice fields, which continuously use inorganic or chemical fertilizers which have negative impacts such as a lack of nutrients in the soil, degradation of soil fertility, and changes in the physical, chemical, and biological properties of the soil (Pubosari et al., 2021).

The reason for the decline in the organic matter content of paddy soil is due to the intensive use of inorganic fertilizers that has been going on for more than thirty years, which has caused soil sickness, soil fatigue, and inefficiency in the use of inorganic fertilizers (Murnita & Taher, 2021). One way to eliminate dependence on inorganic fertilizers is to switch to organic fertilizers as an alternative to inorganic fertilizers, thereby gradually reducing the use of inorganic fertilizers. Organic materials that are abundant around humans and are underutilized are rotted bamboo roots that contain many endophytic fungi that produce secondary metabolites in plants as bioprotectants for the development of pests and diseases, biostimulants that produce phytohormones,

Research by Asfar et al., (2022) shows that fungi on bamboo roots can become endophytes in plants while controlling disease and helping plant growth because they can provide the elements P, N, Mn, and S and help improve the physical properties or structure of the soil through the use of bacteria in bamboo roots which function as Plant Growth Promoting Rhizobacter (PGPR) through fermentation techniques. Apart from that, the

influence of endophytic fungi will increase plant growth by suppressing phytopathogens through the production of siderophores as well as synthesizing antifungal metabolism, so that they can suppress the growth of pathogens while providing nutrients and phytohormones (IAA, cytokinins, gibberellins, and compounds that inhibit ethylene production), increasing the process of nutrient absorption through mineralization and transformation and creating systemic resistance in controlling pests and plant diseases (biopectan) through the production of resistance compounds (Cahyani et al., 2018).

The application of biofertilizer from bamboo roots can be used on all types of plants to strengthen roots, such as corn, chilies, green beans, peanuts (Komansilan et al., 2023), and others where these plants are not included in the group of plants that receive subsidized fertilizer. Therefore, this community service will transform rotten bamboo roots into a plant growth agent or PGPR for youth groups in Balle Village so that they can have real work and contribute to agriculture. The application of biofertilizer from bamboo roots can be used on all types of plants to strengthen roots, such as corn, chilies, green beans, peanuts (Adoko et al., 2022), and others where these plants are not included in the group of plants that receive subsidized fertilizer. Therefore, this community service will transform rotten bamboo roots into a plant growth agent or PGPR for youth groups in Balle Village to have real work and contribute to agriculture.

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community service will transform rotten bamboo roots into a plant growth agent or PGPR for youth groups in Balle Village to have real work and contribute to agriculture. This community service will help partners obtain and meet the need for companion fertilizers in addition to chemical fertilizers so that the use of chemical fertilizers will be reduced, which will have an impact on reducing partners' operational costs in providing fertilizer.

METHOD

Implementation of this community service through society participatory approach in three main stages (Syaifullah et al., 2020; Yasser et al., 2020; (Asfar et al., 2021), namely socialization, training, and mentoring.

The partners in implementing this service are the School Dropout Youth Group in Balle Village, which was implemented for 4 months from June to September 2023. About 18 partners were provided with skills through three main stages, following Figure 1.

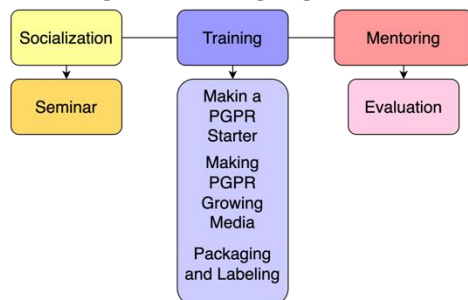


Figure 1 The implementation method

Counseling was the initial stage in persuading partners so that partners would have confidence in the benefits of implementing this community service (Asfar et al., 2022; Asfar et al., 2021).

Training was carried out as the main form of action in educating partners in increasing partners' knowledge and skills (Asfar et al., 2022; Asfar et al., 2023), especially in processing rotten bamboo roots into biofertilizer or PGPR.

Assistance was carried out as a follow-up to identify partners' obstacles in producing or making biofertilizers (PGPR).

RESULTS AND DISCUSSION

The results of community service are described based on the implementation method as follows.

Socialization

Socialization is the first step in community service. The partners' enthusiasm was shown in Figure 2 when a short seminar was held explaining the benefits of weathered bamboo roots, which can be the main source of organic fertilizer or biofertilizer as a growth agent or PGPR. Extension is an activity that aims to provide information, knowledge, and guidance to the community, especially partners or community groups who are interested in solving problems or developing the potential that exists in the environment (Asfar et al., 2023).



Figure 2 Socialization activities

This stage would awaken partners about the benefits of the service carried out (Asfar et al., 2023). At this stage, the implementing team prioritizes community participation so that in subsequent activities, partners are fully involved in each series of activities.

Training

The training activity consists of several stages, namely making a PGPR starter, making PGPR growing media, and product packaging and labeling, as shown in Figure 3.



Figure 3 Training activities for making PGPR starter

The stage of making a PGPR starter was carried out by first sorting the bamboo roots that would be used, then weighing 500 grams of bamboo roots, which would then be soaked in 2 liters of boiled water for three days. This process was the initial stage of fermentation to grow PGPR seeds. The successful growth of the PGPR starter is due to the presence of small bubbles that are visually visible in the fermentation jar.

The stage of making PGPR growing media was carried out to grow PGPR seeds through a fermentation process, with the media being a mixture of granulated sugar, injectable lime, name paste, and bran, which is cooked so that it mixes evenly. The fermentation process was carried out for 14 days. The process is carried out in Figure 4. The effective period for fermentation using rhizomes or roots is 14-21 days (Asfar et al., 2022).



Figure 4 Stages of making PGPR growth media

The packaging and labeling stage was carried out to provide partners with knowledge and skills regarding the commercialization content of the activities carried out so that partners can truly feel that this activity can be a way to increase income for themselves and their families by painstakingly making biofertilizers products (PGPR) in Figure 5. Labeling and packaging was the final stage of product training, which provided certainty to partners that the product being trained was a product that could be commercialized so that it would become a source of income for partners (Asfar et al., 2023).



Figure 5 Product packaging and labeling activities

Mentoring

Assistance is carried out to record conditions that have the potential to trigger production failure. However, the implementation team encountered very zero partner problems. This shows that partners have been able to independently make biofertilizers, or PGPR, from raw material preparation to packaging and labeling.

At the mentoring stage, partner evaluations were also carried out to get an idea of the increase in partners' knowledge and skills as a result of implementing this community service by giving partners a series of questions in the form of preference tests. The results of the analysis can be seen in Table 1. Increasing partner skills is symbiotic with increasing partner knowledge (Wahyuni et al., 2022).

The results of the analysis show that the increase in partner knowledge and

skills increased significantly by 90%. This increase was supported by the enthusiasm of partners as a result of the difficulty in fulfilling fertilizer, especially since there are regulations for some crops that do not receive subsidies, especially certain secondary

crops as well as the existence of the highest retail prices which are sometimes not in line with farmers' abilities and there are restrictions on the fulfillment of fertilizer (Rahmawati et al., 2023).

Table 1 Partner evaluation

Aspect	Implementation of the community service	
	Before	After
Knowledge (90% increase)	There is no knowledge regarding processing bamboo roots	Partners are able to find out the benefits of bamboo roots and procedures for selecting good bamboo roots to be used as a biofertilizer (PGPR)
Skills (90% increase)	There are no bamboo root processing activities	Partners have been able to make biofertilizer (PGPR) using fermentation techniques

CONCLUSION

Weathered bamboo roots can be an environmentally friendly biofertilizer as a source of PGPR to fertilize plants while improving the nutrients and physical properties of plants. This community service contributes to significantly increasing the knowledge and skills of partners in processing surrounding natural materials into products that have high economic value.

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