PGPR Preparation Training to Improve Cassava Production for KOPASAMU Farmers in Kalasan

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Abstract. Cassava farmers grouped in Koperasi Sejahtera Muhammadiyah (KOPASAMU) in Kalasan often faced challenges of low production level of cassava (5 - 10 tonnes/ha) due to lack of growth and unhealthy conditions as a result of plant pest disturbance. Previous studies have demonstrated that such problem may be alleviated by the application of Plant Growth Promoting Rhizobacteria (PGPR). PGPR is a consortium of bacteria-producing plant growth hormones that improve cassava plant health and increases production. In addition to the use of PGPR, plant productivity may also be improved by using organic fertiliser, inoculated with mycorrhiza, stem wounding, and foliar fertiliser spray. The purpose of this community service was to improve farmers’ understanding and skills in applying PGPR to increase cassava production. The activities of the services were: (1) extension training on PGPR, (2) training on PGPR preparation, and (3) mentoring in the application of PGPR in cassava production demonstration plots (demplot). The results of the community services demonstrated that the extension programme has increased farmers’ understanding of PGPR by 100%, also resulting in an increase in farmers’ spirit and passion for applying PGPR. Following the extension programme, it was observed that the farmers’ skills have improved by 100%. However, among the farmers who were involved in the extension programme, 54.55% stated that they already mastered the PGPR preparation, while the other 45.45% stated that they required further training to improve their skills.

Keywords: PGPR, innovation technology, cassava production

1 Introduction

The Muhammadiyah Agro Prosperous Cooperative (KOPASAMU) is engaged in agriculture and fisheries whose members are spread across the Special Region of Yogyakarta, one of which is the Cassava farmer group in the Kalasan area. Cassava production in Kalasan farmers is still low, namely 5-10 kg per plant because the cultivation is without fertilisation and other technologies.

Improvement efforts have been made through outreach and innovation technology training. Assistance to cassava farmer groups in Kalasan has been carried out before, namely by implementing the “Cassava Cultivation Innovation Technology Package” (which is the result of research by Agung Astuti et al., which has registered a patent), namely organic matter fertilisation, mycorrhiza inoculation, cutting and spray systems Nano Potassium Fertilizer. The results of research by Astuti et al. (2020) showed that Mycorrhizal inoculation can increase the amount of cassava up to 20 kg per plant [2]. According to Prematuri & Faiqoh (1999), mycorrhizae are fungi associated with plant roots, which can increase water and nutrient uptake so that they can be used as biological fertilisers [3]. Research results from Ilyas (2020) showed that giving mycorrhizal inoculums to Renek’s cassava plants can

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increase the tuber yield of cassava by 5.18 tons/ha compared to Renek’s cassava plants that are not given mycorrhizal inoculums of 1.68 tons/ha [4,13,14]. While the Keratan system on cassava seeds can increase root proliferation so that cassava yields reach 51 tons/ha [5,11,12,1]. Withdrawing cassava seedling stems and mycorrhizal inoculation, cassava yields increased by 54% (54.32 tons/Ha) [3].

The results of the cassava demonstration plot with innovative technology at KOPASAMU Kalasan have not been maximised because the Ministry of Agriculture’s target is 40-60 tonnes/ha. There is even a Tiara variety of cassava in Samarinda with a yield of 80 tonnes/ha. The problem faced by KOPASAMU cassava farmers in Kalasan is that the growth of cassava plants is less fertile, and there are pest attacks. The solution to this can be overcome by the application of Plant Growth Promoting Rhizobacteria (PGPR), which coincides with the application of the Innovation Technology Package that has been applied to the demonstration plots.

PGPR, namely bacteria that grow on plant roots, is beneficial because of hormone production and increases the availability of nutrients [6]. Types of Rhizobacteria include Bacillus, Pseudomonas, Enterobacter, Burkholderia, Klebsiella, Variorvorax, Azospirillum, Azotobacter, Serratia [7,8] which are widely found in bamboo plant roots. PGPR is able to increase nutrient absorption so that plants become healthier and more resistant to pest attacks so that crop yields increase [6,9,10]. The purpose of this counseling and training is to increase farmers’ understanding and skills about PGPR (Plant Growth Promoting Rhizobacteria) to increase cassava yields.

2 Methodology

2.1. The stages in implementing the solutions offered to overcome the problems of the KOPASAMU Cassava Farmers Group are as follows:

2.1.1. The Extension Program was given by Dr. Ir. Gatot Supangkat, MP. IPM (UMY FP Lecturer), with participants from the cassava farmer group members of KOPASAMU, was held in Kalasan, Sleman. Includes counseling activities on “Benefits of PGPR on cassava plant.”

2.1.2. The Training Program was given by Ir. Agung Astuti, MSi (UMY FP Lecturer), with participants from the cassava Farmers Group members of KOPASAMU, held in Kalasan, Sleman. Includes training activities on “Making PGP” and Assistance and Monev to partners during the making of PGPR.

2.1.3. PGPR Application Demonstration on Cassava Plants accompanied by Ir. Mulyono, MP (UMY FP Lecturer) on about 500m2 of land owned by residents. Partners apply PGPR to cassava seeds and then plant them in cassava plantations. Farmers maintain with organic matter fertilisation and mycorrhizal inoculation, and the seeds are cut.

2.2. Partner participation so that activities can run smoothly. The cassava farmer group members of KOPASAMU provide a place and their farmer members who are ready to be trained and are willing to monitor and evaluate, assist, and evaluate program achievements that have been implemented between the service team towards partners. While the service team facilitates, accompanies, and conducts coaching from the beginning to the end of the program.

2.3. Evaluation of program implementation and program sustainability in the field after community service activities have been completed are Quality Assurance of Biopesticide Products and evaluation of cassava farmer groups members of KOPASAMU. After counseling about the benefits of PGPR on cassava plants, and training on making PGPR, it was evaluated by pre-test and post-test and then analysed for increasing understanding of
PGPR. Based on this evaluation, if the program is partially successful, it is necessary to analyse the causes of some of the failures and then try to solve the problem. Then accompanied until the quality of PGPR products is guaranteed. Evaluation and follow-up are carried out so that the program can run on an ongoing basis it needs to be done.

3 Results and Discussion

3.1 Counseling about the Benefits of PGPR in Cassava Plants

Counseling on the benefits of PGPR on cassava plants was delivered by Dr. Ir. Gatot Supangkat, MP. IPM. The cassava farmers who are members of KOPASAMU welcome the extension activities about the benefits of PGPR on cassava plants, shown by being curious and asking lots of questions during the discussion session. PGPR is new knowledge for all farmers. They have never known about PGPR, so the participants are enthusiastic about learning about PGPR. In the counseling, it was explained what PGPR is, its benefits, how to make it, and its applications. In nature, PGPR is associated with the roots of bamboo plants, so it is not difficult to make it. It can be applied to various food plants. The benefits are that it can stimulate roots and produce PGR so that it increases water and nutrient uptake and stimulates growth so that plants become fertile and healthy.

The results show that counseling about PGPR increases farmers’ understanding of 100%. Before counseling, all farmers (100%) did not know about PGPR (figure 2a). However, after being explained about PGPR, 100% of the farmers understood, although not all farmers were moved to want to learn how to make PGPR.
After the discussion forum, many farmers asked questions and explained by showing products and testimonials from the application results. Then there were 72.73% of farmers who wanted to learn to make PGPR. However, there were still 18.18% of farmers who were unsure, and 9.09% of farmers said they did not want to learn how to make PGPR (figure 2b). With training in making PGPR, all farmers (100%) can make PGPR, resulting in an increase in skills of 72.73%.

### 3.2 PGPR Making Training

Ir. Agung Astuti, MSc, guided the PGPR manufacturing training. After understanding the benefits of PGPR on cassava plants, all partners were very enthusiastic about practicing making PGPR. It begins with soaking the bamboo roots for 24 hours. Meanwhile, the PGPR propagation medium was made by boiling potato water and adding sugar. After it is cold, put it in the gallon, then inoculate it with water, soaking the bamboo roots (picture 3). Then fermented with aeration settings for 14 days. Application to plants, namely by dilution of 5 ml/lt, can be leaked or sprayed on plants.

![Figure 3. PGPR Making Training](image)

The results of the pre and post-test analysis of the Training on Making PGPR are presented in Figure 4 as follows:

![Figure 4. Pre and Post-Test Results for PGPR Making Training](image)
results of the analysis of the pre and post-tests show that training can improve farmers’ skills by 72.22%. Initially, only 18.18% of farmers were able to make PGPR, and 81.82% were unsure. After the training, 54.55% of farmers found it easy to make PGPR (an increase of 36.36%), although there were still 45.45% of farmers who had difficulty (figure 4). For this reason, further training is needed.

3.3 PGPR Application Demonstration on Cassava Plants

PGPR Application Demonstration on Cassava Plants is accompanied by Ir. Mulyono, MP, on a resident’s land of about 500m². With assistance from the service team, the partners are very enthusiastic about making PGPR and working together. The partners work together to apply cassava seeds (figure 5a) and then plant them in the cassava demonstration plot (figure 5b). Farmers maintain basic fertilisation, first fertilisation, second fertilisation, removal of grass and weeds, and irrigation, if necessary, until the 5-month-old plants are harvested.

![Figure 5. PGPR Application Demonstration on Cassava Plants in the Field](image)

For the continuation of the training on making PGPR, tools for inoculation, propagation, and production of PGPR were handed over to the KOPASAMU Cassava Farmers Group (figure 6). Furthermore, mentoring and evaluation will continue to be carried out by the service team. The goal is to be able to produce PGPR commercially in the future. For this reason, business management and quality testing are needed [11,12,13].

![Figure 6. Submission of materials and tools for PGPR production](image)
4 Conclusions

Counselling about the benefits of PGPR on cassava plants increases farmers’ understanding by 100%. Discussions after counselling and showing PGPR products and testimonials resulted in 72.73% of farmers wanting to learn how to make PGPR. However, there were still 18.18% of farmers who were unsure, and 9.09% of farmers said they did not want to learn how to make PGPR. With training in making PGPR, all farmers (100%) can make PGPR, resulting in an increase in skills of 72.73%.

References

