AJARCDE
ASIAN JOURNAL OF APPLIED RESEARCH FOR COMMUNITY DEVELOPMENT AND EMPOWERMENT

Journal home page: http://ajarcde-safe-network.org ISSN 2581-0405

Empowering Farmers through Assistance in Producing Alternative Photosynthetic Bacteria (PSB) Fertilizers for Corn Crops in Sigi District

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ARTICLE INFO

Article History:
Received: 23 May 2024
Final Revision: 17 June 2024
Accepted: 19 June 2024
Online Publication: 19 June 2024

KEYWORDS

Fertilizer, Photosynthetic Bacteria, Capital Availability, community service, applied research

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A B S T R A C T

Edufarmers Foundation is an institution under the auspices of PT. Japfa Comfeed Indonesia, Tbk., was established to accelerate farmers' productivity and develop the potential of Indonesian youth in agriculture. As part of this initiative, they have created a farmer field school program, where empowerment activities for farmers to increase agricultural productivity occur. One of the activities involves mentoring farmers in producing alternative photosynthetic bacteria fertilizers made from affordable materials to help increase crop productivity while reducing input costs. This activity aims to educate and assist farmers in reducing farming costs by utilizing alternative fertilizers made from materials available at home while still emphasizing the productivity of cultivated crops.

1. INTRODUCTION

1.1. Research Background

Agricultural activities have risks and []]. Risks in agriculture can be divided into two main categories: business risk and financial risk. Business risks include production, price, institutional, and personal risks. Meanwhile, financial risks arise from various financing methods used in agricultural businesses. All of these types of risks significantly impact production and income and ultimately affect the welfare of farmer households. Efforts made in allocating household labor aim to improve farmer welfare.

Input costs in agricultural activities are one of the factors affecting the welfare of farmer households in Sigi District, Central Sulawesi. An increase in production costs will cause total costs to rise, ultimately reducing the income of farmer households and decreasing their level of welfare. One of the factors contributing to the increase in production costs is the rise in agricultural input prices. Increasing input prices will increase production costs, reducing income from farming activities. According to Ref. [2] policies to increase sugar prices positively impact the welfare of farmer households. However, increases in fertilizer prices and external labor wages will lead to a decrease in the welfare of farmer households.

The desire to reduce farmers' input costs by minimizing inorganic fertilizers aligns with efforts towards sustainable agricultural development. Sustainable agricultural development aims to enhance farmers' well-being, which can be achieved by increasing their income and reducing their expenses [3].

One effort to reduce input costs is to minimize input expenses, including utilizing organic materials as alternative fertilizers in cultivated plants. This is considering the increasing prices of fertilizers and the uneven distribution of chemical fertilizer subsidy targets in Sigi District, Central Sulawesi. According to the testimony of some farmers in Sigi District, the high price of fertilizers has caused farmers to experience financial difficulties, especially regarding the availability of capital for corn farmers in Sigi District, Central Sulawesi.

Based on the background above, a study on alternative fertilizers must be conducted. This research aims to improve the welfare of farmers by empowering them to produce alternative photosynthetic bacteria (PSB) fertilizers for corn crops in Sigi District, Central Sulawesi.

1.2. Literature Review

Organic fertilizer is fertilizer made from natural materials such as plants, manure, or animal body parts that can enhance the soil's biological, chemical, and physical structure, resulting in soil suitable for plant growth. The production of organic fertilizers generally involves waste from organic product processing that is left as is. Based on its physical form, organic fertilizers can be divided into solid and liquid organic fertilizers [4]. Liquid organic fertilizers have several advantages, such as accelerating and strengthening the formation of chlorophyll in leaves to enhance the plant's photosynthesis ability and absorb nitrogen from the air. Liquid organic fertilizers can also increase the strength and resilience of plants to drought, stimulate branch and production growth, and improve flower and fruit bud formation while reducing losses due to shedding [5]. Organic fertilizers aim to produce fertilizers rich in nutrients needed by plants, reduce dependence on inorganic fertilizers, and support the movement toward sustainable agriculture.

According to Minister of Agriculture Regulation No. 70/Permentan/SR.140/10/2011, which regulates organic fertilizers and soil amendments, the aim is to protect the sustainability of environmental functions, provide certainty to organic fertilizer entrepreneurs, and ensure their quality standards and effectiveness. According to Ref. [6] the presence of organic fertilizers is important due to the decreasing fertility of the soil. Photosynthetic bacteria (PSB) are autotrophic bacteria capable of photosynthesizing independently. PSB contains bacteriotropic pigments A or B, which can produce red, green, and purple pigments that capture solar energy and fuel photosynthesis. These bacteria can perform photosynthesis activities. Therefore, these bacteria are called photoautotrophic bacteria. If PSB is combined with eco-enzyme fermentation fertilizer, it will improve the quality of fertilizer and plant productivity [7].. Consistent application of photosynthetic bacteria influences shoot growth [8]. (Priyono, 2021).

According to Ref. [9], production cost refers to the expenses incurred in converting raw materials into finished goods. The expenses incurred in manufacturing activities are referred to as production costs or manufacturing costs. Input costs are the capital or expenses used or incurred during cultivation. Production costs or input costs include raw material, labor, and equipment costs during cultivation. These production costs are calculated from the initial to the final cultivation stage or can also be said to start from the pre-planting stage to the post-harvest stage.

1.3. Research Objective

This study aims to evaluate optimal parameters for the substrate of common reed and cow dung with different ratios (i.e. 1:1, 2:1, and 1:2) for improving the quality of methane content and biogas production.

2. MATERIALS AND METHODS

2.1. Program Implementation

This activity is carried out by 3 students from the Universitas Pembangunan Nasional "Veteran" East Java in 3 different districts within the scope of Sigi Regency. These 3 locations are in Kaleke Village, West Dolo District, Sidondo 1 Village, and Pulu Village, South Dolo District. This activity is part of the Magang Studi Independen Bersertifikat (MSIB) Program organized by the Edufarmers Foundation International. The activity is attended by 432 participants who are corn farmers registered in the "Bertani Untuk Negeri" (BUN) Corn Commodity Batch 8 program. This time, the participants of BUN Corn enrolled in 4 different districts, namely West Dolo District, South Dolo District, Sidondo Village, and Lambara Village. The expected outcome of this activity is to help farmers to decrease their production costs and to increase land productivity.

2.2. Tools and Methods

The materials used in this activity include bottles of packaged beverages, pond water, chicken eggs, PSB starter, salt, and Monosodium Glutamate (MSG). The tools used in this activity are markers, bowls, and spoons.

2.3. Activity Implementation Method

The activities conducted consist of 3 stages, including the production and multiplication of Photosynthetic Bacteria (PSB) organic fertilizer products, learning and demonstration of PSB product manufacturing to accompanying farmers in Farmers Field School (FFS) activities, and further assistance to each]accompanying farmer in the production of PSB products.

2.4. Production and Multiplication of PSB

The production, multiplication, and use of PSB products aim to enable farmers to reduce the input costs of corn cultivation and to implement sustainable farming practices while reducing the use of inorganic or chemical products that can harm the environment. Student participants of the BUN program carry out the production of PSB products, and the results are then distributed to the accompanying farmers of the BUN program (Figure 1)

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Fig.1. Production and Multiplication of PSB

 https://doi.org/10.29165/ajarcde.v8i2.423

2.5. Demonstration of PSB Product Production to Accompanying Farmers

The demonstration of PSB product production to farmers aims to provide them with knowledge about the process so they can independently create and multiply the products. This demonstration occurs within the Farmers Field School (FFS) activities focused on plant nutrition and alternative fertilization.

2.6. Farmer Mentoring in PSB Production

Farmer mentoring in PSB production is conducted so that farmers can directly practice making PSB products alongside students. The practical experience of producing PSB products aims to enhance farmers' understanding and retention of the tools, materials, and procedures involved in PSB product manufacturing, enabling them to produce multiplication independently (Figure 2).

Fig. 2. Farmer mentoring in PSB production

3. RESULT AND DISCUSSION

Fertilizer is a crucial factor, as it is a primary determinant of future production outcomes and an integral part of farming systems. This awareness among farmers underscores the vital role of fertilizer in achieving optimal yields, particularly in corn cultivation. Inadequate fertilizer application, whether in terms of dosage or type, can significantly impact corn harvests. According to Ref. [10], fertilizer is one of the essential inputs in agricultural production processes. Without fertilizer, plant growth will be hindered, resulting in reduced productivity. The high cost of fertilizer prompts many farmers to reduce its application to cut input costs, leading to decreased corn yields due to insufficient nutrient absorption by the plants, resulting in reduced cob weight.

Subsidized fertilizer is one alternative solution for the sustainability of agriculture in Indonesia and is also one of the government's efforts to increase agricultural production in the country. This program aims to assist farmers in obtaining affordable fertilizer and to enhance agricultural productivity. Sufficient availability of fertilizer would significantly contribute to increasing corn productivity. However, it is not uncommon for the distribution of subsidized fertilizer to be uneven, resulting in many corn farmers not receiving their allocated subsidies. The policy of fertilizer subsidies has been extensively studied in various researches, particularly its effectiveness. Studies conducted have indicated that providing subsidized fertilizer to farmers is not effective in improving farmer welfare [11,12, 13].

In addition to the increasingly scarce subsidized fertilizers, the rising prices of chemical fertilizers are causing farmers to experience increased input costs or production expenses in crop cultivation. The use of alternative or organic fertilizers has become a solution for farmers to reduce input costs in crop cultivation. Organic fertilizers are often cheaper than chemical fertilizers, and besides being cost-effective, they are also easier for farmers to produce. One of the alternative products is Photosynthetic Bacteria (PSB). PSB fertilizer, which is made from pond water, eggs, and Monosodium Glutamate (MSG), is a highly effective solution for reducing input costs and increasing profitability in agricultural operations. In crop cultivation, where the cost of buying synthetic nitrogen fertilizers can initially reach hundreds of thousands, it can now be reduced to tens of thousands with the production of PSB fertilizer, which contains natural nitrogen that plants more easily absorb. The presence of PSB can minimize plant dependence on chemical fertilizers. Therefore, farmers do not need to worry about the increasing prices of fertilizers in the market. The bacteria in PSB can also produce natural antibiotics that can compete with soil pathogens, helping to control plant diseases, thus reducing the need for pesticides and fungicides, reducing input costs in crop cultivation. Reducing input costs using Photosynthetic Bacteria enables farmers to allocate funds or capital to other areas to increase productivity and work efficiency. Using organic fertilizers will result in safer and environmentally friendly agricultural products and increase their market value.

For farmers to engage in practices that support farming efforts, they need innovative information in the field of agriculture. In this practice, farmers' participation with full awareness and responsibility in agriculture is needed [14]. Such information is typically obtained from various demonstration activities and extension services. The effectiveness of demonstration and extension programs can be achieved when the primary interests and needs of the community are prioritized [15].

The demonstration activity of Photosynthetic Bacteria (PSB) production was conducted as part of the Farmers Field School (FFS) program or Field School of each FDA in Kaleke Village, Dolo Barat District, Sidondo 1 Village, and Pulu Village, Dolo Selatan District (Figure 3). This activity took place within a one-day timeframe. The demonstration of product production was carried out concurrently with the delivery of materials on plant nutrition and fertilization, followed by the presentation of materials on the definition, content, benefits, and necessary dosages for PSB utilization. PSB aids in the growth and development of plants by absorbing sunlight energy and

converting it into a form usable by plants, thereby enabling optimal plant growth [16].

Fig.3. demonstration activity of Photosynthetic Bacteria (PSB) production was conducted as part of the Farmers Field School (FFS)

The production of PSB requires four ingredients: pond water, eggs, salt, and MSG. Firstly, pour pond water into a used plastic bottle, commonly with a size of 1.5 litres. Then, prepare a mixture of eggs, salt, and MSG in a 1:1:1 ratio for each egg used in the mixture. Stir the egg mixture until it is evenly mixed. Next, pour three tablespoons of the egg mixture into the bottle and fill the bottle with pond water until nearly full, then shake until the egg mixture is evenly distributed. After that, expose the solution to direct sunlight for two to three weeks until the solution turns reddish-purple. The propagation of PSB can be accelerated if farmers already have an existing PSB. Follow the same steps as making PSB, then add and mix a small amount of the existing PSB product. This way, the drying process can be shortened to 7-10 days.

Fig.4, Photosynthetic Bacteria

PSB can reduce farmers' cultivation input costs regarding fertilizer availability because PSB can decrease farmers' reliance on inorganic fertilizers such as Urea or Phonska, which farmers commonly use. Subsidized Urea and Phonska fertilizers are priced around Rp. 117,000 per 50 kg sack for Urea and Rp. 125,000 per 50 kg sack for Phonska. These prices are still considered quite burdensome for farmers in terms of capital, especially considering the scarcity of fertilizers. Under these conditions, most farmers are forced to reduce the amount of fertilizer used for corn fertilization, resulting in inadequate plant nutrition and suboptimal corn growth and development. PSB can be applied to address issues of plant nutrient deficiency and the scarcity or high cost of capital needed to purchase fertilizer. If previously, fertilization was done with one sack of each of Urea and Phonska per hectare of land at a cost of Rp. 242,000, fertilization using PSB at a dosage of 800 ml per 1000 m2 or 8000 ml per hectare only requires around Rp. 6,000 for purchasing raw materials. Using PSB can alleviate the burden of corn fertilizer costs for farmers and optimize corn plant growth, ultimately increasing land productivity and harvest yields.

The materials used in fertilizer production are simple and can be obtained from the kitchen or local markets in the farmers' environment. This activity makes farmers optimistic and enthusiastic because it provides new knowledge and reduces the burden of fertilizer expenses for farmers (Figure 4,5).

Fig.5. Application of Photosynthetic Bacteria (PSB)

4. CONCLUSION

The scarcity and increasing prices of fertilizers have prompted farmers to become interested in alternative products or organic fertilizers. Affordable and easily accessible alternative products would greatly assist farmers in reducing input costs or production expenses during cultivation. One alternative product that we consider effective is Photosynthetic Bacteria (PSB). Besides being inexpensive and easy to produce, PSB has been tested on several accompanying farmers' lands. By utilizing low-cost materials, the use of PSB significantly helps in reducing or

https://doi.org/10.29165/ajarcde.v8i2.423

minimizing input costs. With the availability of alternative products like Photosynthetic Bacteria (PSB), farmers can redirect their capital towards other agricultural needs, which can significantly impact cultivation success.

ACKNOWLEDGMENT

Thank you to Mr. Risqi Firdaus Setiawan, SP, MP, our supervising lecturer; the leadership of the Edufarmers Foundation; the student mentors in the Kaleke, Sidondo 1, and Pulu areas; all the assisted farmers; and all the residents of Kaleke Village in Dolo Barat District, Sidondo 1, and Pulu Village in Dolo Selatan District, Sigi Regency. We are grateful for your warm welcome and for allowing us to grow and make a meaningful impact in the community.

REFERENCE

[1] Ullah, R., Shivakoti, G.P., Zulfiqa, r F., Kamran, M.A. 2016. Farm risks and uncertainties Sources, impacts and management. SAGE Journal. 45(3):199-205.

[2] Aminda FR. Sinaga BM, Fariyanti A. 2017. Dampak Faktor Eksternal terhadap Kesejahteraan Rumah Tangga Petani Tebu Keprasan di Jawa Tengah. Jurnal Agro Ekonomi,2,(35):127-150.

[3] Setiawan, R. F. (2022). Kemiskinan Dan Kesejahteraan Dalam Kaitannya Pada Pembangunan Pertanian. Agridevina: Berkala Ilmiah Agribisnis, 11(1), 57-68.

[4] Lepongbulan, W., Tiwow, V. M., & Diah, A. W. M. (2017). Analisis unsur hara pupuk organik cair dari limbah ikan mujair (Oreochromis mosambicus) danau lindu dengan variasi volume mikroorganisme lokal (MOL) bonggol pisang. Jurnal Akademika Kimia, 6(2), 92-97

[5] Putra, B. W. R. I. H., & Ratnawati, R. (2019). Pembuatan pupuk organik cair dari limbah buah dengan penambahan bioaktivator EM4. Jurnal Sains & Teknologi Lingkungan, 11(1), 44-56.

[6] Munir Ozturk, Nudrat Aisha Akram, Bengu Turkyilmaz Unal and Muhammad Ashraf (editors). 2022. Introduction and Application of Organic Fertilizers as Protectors of Our Environment. Cambridge Scholars Publishing

[7] Rangkuti, Khairunnisa & Ardilla, Desi & Ketaren, Bunga. (2022). Pembuatan Eco Enzyme Dan Photosynthetic Bacteria (Psb) Sebagai Pupuk Booster Organik Tanaman. JMM (Jurnal Masyarakat Mandiri). 6. 3076. 10.31764/jmm.v6i4.9381.

[8] Anang Priyono. (2021). Mengenal Bakteri Fotosintesa dan Manfaatnya, diakses pada 20 Oktober 2022 dari https://distanpangan.baliprov.go.id/mengenalbakteri-foto-sintesa-dan-manfaatnya

[9] Dunia, Abdullah, Sasongko. (2019). Akuntansi Biaya. Edisi ke 5. Salemba Empat.Jakarta.

[10] Prasetyo, R., & Saksono, R. A. (2019). Pengaruh Subsidi Input Terhadap Nilai Tukar Petani Padi Di Indonesia.Jurnal Good Governance,15(2)

[11] Adirasaputra, P., & Supyandi, D. (2021). Efektivitas Kebijakan Subsidi Pupuk Di Desa Sukaasih Kecamatan Sukatani Kabupaten Bekasi.Mimbar Agribisnis: Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis,7(1), 594-606.Krisna, B., Mamilianti, W., Nuzuliyah, L. (2022). Pengaruh Subsidi terhadap Pendapatan Petani padi (Studi Kasus di Kecamatan Sukorejo Kabupaten Pasuruan). Jurnal of Agricultural Socio-Economics (JASE) Vol 3 Issue 2 (2022).

[12] Arisandi, N. W., Sudarma, I. M., & Rantau, I. K. (2016). Efektivitas distribusi subsidi pupuk organik dan dampaknya terhadap pendapatan usahatani padi sawah di Subak Sungsang, Desa Tibubiu, Kabupaten Tabanan.Jurnal Agribisnis dan Agrowisata,5(1), 1-10..

[13] Susila, W. R. (2016). Kebijakan subsidi pupuk: ditinjau kembali.Jurnal Penelitian dan Pengembangan Pertanian,29(2).

[14] Koampa, M. V., Benu, O. L., Sendow, M. M., & Moniaga, V. R. (2015). Partisipasi kelompok tani dalam kegiatan penyuluhan pertanian di desa Kanonang lima, kecamatan Kawangkoan barat, Minahasa. Agri-Sosioekonomi, 11(3A), 19-32.

[15] Khairunnisa, N. F., Saidah, Z., Hapsari, H., & Wulandari, E. (2021). Pengaruh peran penyuluh pertanian terhadap tingkat produksi usahatani jagung. Jurnal Penyuluhan, 17(2), 113-125.

[16] Brahmana, E. M., Dahlia, D., Mubarrak, J., Lestari, R., Karno, R., & Purnama, A. A. (2022). Sosialisasi Pembuatan Bakteri Fotosintesis sebagai Penyubur Tanaman: Socialization of Making Photosynthetic Bacteria as Plant Fertilizer. CONSEN: Indonesian Journal of Community Services and Engagement, 2(2), 67-71.