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Community Empowerment through Pala Waste Utilization: Ecoenzymes, Syrup, and Candied Nutmeg in Paya Village, Pesawaran District

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Abstract

This community engagement initiative unfolds in Paya Village, located in the Padang Cermin Subdistrict, Lampung Province, Indonesia. With a population of 1,190 individuals distributed across four hamlets, the village predominantly thrives on daily labor and agriculture, with nutmeg as a prominent crop. Organic waste generated from nutmeg fruit, particularly the husks and flesh, has been largely underutilized. This initiative, led by the PKK group, endeavors to empower the community, enhance household incomes, and address the issue of organic waste accumulation by converting nutmeg waste into value-added products. The program focuses on creating eco-enzymes, nutmeg syrup, and candied nutmeg. Capacity-building activities are central to this initiative, involving workshops, training, and educational programs. Regular evaluations highlight the program's success in enhancing participants' knowledge and awareness of nutmeg products.

Keywords *– candied nutmeg, community empowement, eco-enzyme, nutmeg syrup, organic waste*

Abstrak

Kegiatan pemberdayaan masyarakat ini berlangsung di Desa Paya, yang terletak di Kecamatan Padang Cermin, Provinsi Lampung, Indonesia. Dengan populasi 1.190 jiwa yang tersebar di empat dusun, desa ini sebagian besar penduduknya bekerja sebagai buruh harian lepas dan petani, dengan pala sebagai tanaman utama. Limbah organik yang dihasilkan dari buah pala, terutama kulit dan daging buah, belum banyak dimanfaatkan. Kegiatan yang dipimpin oleh kelompok PKK ini bertujuan untuk memberdayakan masyarakat, meningkatkan pendapatan rumah tangga, dan mengatasi masalah penumpukan limbah organik dengan mengubah limbah pala menjadi produk bernilai tambah. Program ini berfokus pada pembuatan enzim ramah lingkungan, sirup pala, dan manisan pala. Kegiatan peningkatan kapasitas merupakan inti dari inisiatif ini, yang melibatkan lokakarya, pelatihan, dan program pendidikan. Evaluasi rutin menyoroti keberhasilan program dalam meningkatkan pengetahuan dan kesadaran peserta akan produk pala.

Kata kunci *– manisan pala, pemberdayaan masyarakat, enzim ramah lingkungan, sirup pala, limbah organik*

INTRODUCTION

Paya Village, located approximately four kilometers to the east of the Padang Cermin Subdistrict office, is a vibrant community comprising four hamlets: Induk I, Induk II, Sinar Jaya, and Damarejo. Induk I is nestled at the lower part of the village, bordering Tambangan Village and Way Urang, while Sinar Jaya and Damarejo are situated on the highlands, sharing borders with Harapan Jaya Village and Pesawaran Indah. The journey from Induk to Sinar Jaya and Damarejo takes approximately 20 minutes. Induk I and Induk II are consolidated into a single neighborhood unit, while Damarejo is divided into three neighborhood units, and Sinar Jaya into two. For demographic data, Paya Village houses a total population of 1,190 individuals, distributed across 246 Family Cards, comprising 604 males and 586 females. Figure 1 displays the administrative map of Paya Village.

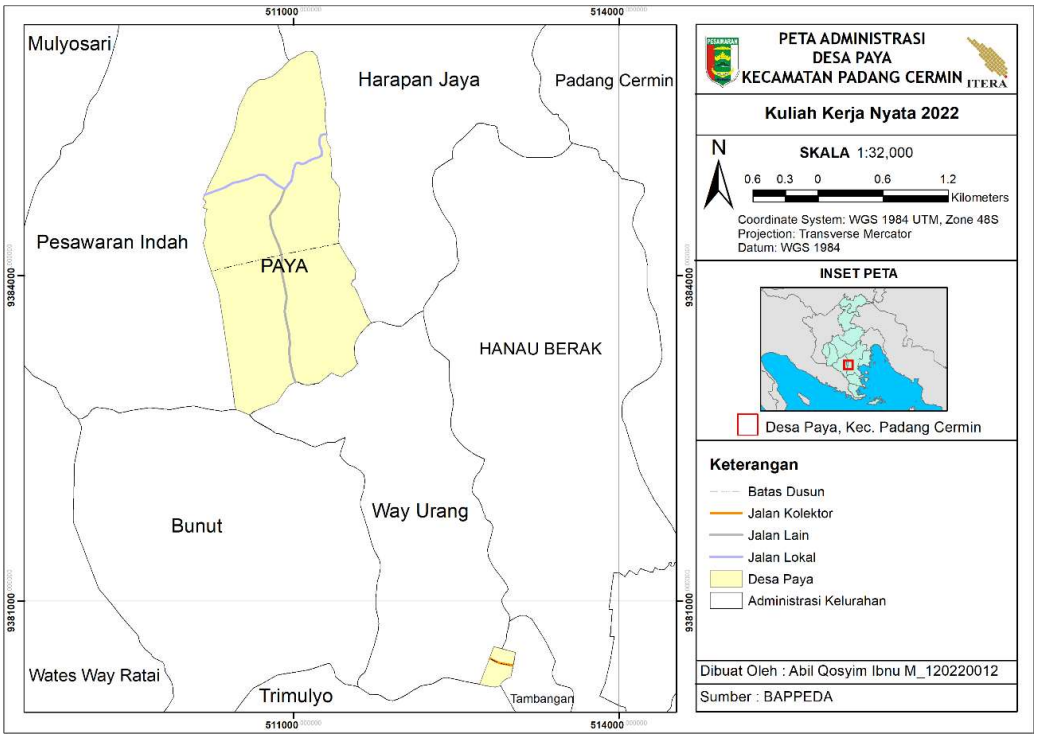

Figure 1.
The Map of Paya Village

In Paya Village, the primary livelihood of the community, particularly in Induk, revolves around daily labor, whereas Damarejo and Sinar Jaya residents predominantly engage in agriculture, capitalizing on the village's hilly terrain and abundant forests and plantations. The village's produce includes coconut, melinjo, coffee, chocolate, with a notable dominance of nutmeg (Kusmaria et al., 2022).

Nutmeg (Myristica fragrans) is a tropical evergreen tree native to the Moluccas, or Spice Islands, of Indonesia. It is primarily cultivated in Indonesia and the West Indies. Nutmeg has a distinctive pungent fragrance and a warm, slightly sweet taste, and is used to flavor various baked goods, confections, puddings, potatoes, meats, sausages, sauces, vegetables, and beverages. The fleshy arils surrounding the nutmeg seed, called mace, are also used as a spice. Nutmeg trees can reach a height of about 20 meters (65 feet) and yield fruit eight years after sowing, reaching their prime in 25 years and bearing fruit for 60 years or longer (Suaery & Akbar, 2022).

Nutmeg fruit is a rich source of diverse nutrients, and its nutritional values encompass various components that are important for overall health, including vitamins, minerals, and energy from carbohydrates. The presence of Vitamin A and C in nutmeg can provide additional health benefits. The nutritional values contained in nutmeg fruit are diverse, and in every 100 grams of nutmeg flesh, you can find the following nutritional composition: 42 calories, 0.30 grams Protein, 0.20 grams Fat, .90 grams Carbohydrates, 32 milligrams Calcium, 24 milligrams Phosphorus, 1.50 milligrams Iron, 29.50 Vitamin A, and 22 milligrams Vitamin C (Baszary, 2022).

Figure 2.
One of the Nutmeg Plantations in Paya Village

Fundamentally, the nutmeg used and processed by the community predominantly consists of the nutmeg seeds, sold directly without any prior processing (Safriani & Humaira, 2022). Nutmeg has found extensive applications in various industries, including the food, beverage, cosmetics, and pharmaceutical sectors. The primary yields of the nutmeg tree are dried mature nutmeg seeds and essential oil (Suloi, 2021). The nutmeg flesh and the shell of the nutmeg seed (husk) are considered waste products of the nutmeg commodity. One of the frequently utilized parts of the nutmeg fruit is its flesh, which is processed into candied nutmeg, syrup, and eco-enzymes. The nutmeg husks and flesh are often left unused, resulting in the accumulation of organic waste. However, these organic wastes from the nutmeg husks and flesh hold economic value when appropriately processed (Arief et al., 2016). Figure 2 illustrates one of the nutmeg plantations in Paya Village.

In response to the challenges faced by our community partners, the team responsible for the community empowerment initiative had proposed several solutions. These solutions involve providing information, knowledge, and practical skills to the PKK women, who play a pivotal role in driving activities within Paya Village. Under the leadership of the Village Head's spouse, the PKK (Family Welfare Empowerment) group represents a community that can be mobilized. Imparting knowledge, insights, and skills to the PKK members on the organic waste processing of nutmeg can substantially enhance household incomes. Not only intended for marketing, the products can also be consumed

within their own households, thus relieving the financial burden of providing for daily expenses (Ariningrum et al., 2020).

Figure 3.
The Stages of Making Eco-Enzyme

In economic terms, the conversion of nutmeg husks and flesh into value-added products offers an innovative opportunity to enhance the overall value of the nutmeg fruit. The utilization of these byproducts can lead to the creation of various nutmeg-derived products, such as: eco-enzymes (Prabulingga et al., 2020), nutmeg syrup (Diki Ulil Azmi & Herda Gusvita, 2021) and candied nutmeg (Musfila et al., 2022).

The organic waste from nutmeg husks and flesh can be transformed into eco-enzymes, offering an eco-friendly alternative for various applications, such as cleaning agents, agricultural inputs, and wastewater treatment, contributing to both environmental sustainability and increased income (Nurliah et al., 2022). Nutmeg-based syrup production can introduce a new and unique product to the local market, catering to the diverse culinary needs of Paya Village and its neighboring areas. This can expand income opportunities for the community (Farisi & Indra Rasyid, 2022).

Eco-enzymes represent environmentally sustainable biocatalysts with multifaceted applications spanning agriculture, wastewater treatment, and cleaning agents. Their production from organic waste materials, such as nutmeg husks and flesh, offers a promising and eco-friendly approach. These eco-enzymes hold significant potential as effective replacements for traditional chemical-based products, contributing to the reduction of environmental impact and the advancement of ecological sustainability.

The synthesis of eco-enzymes involves the fermentation of organic kitchen waste, comprising fruit and vegetable peels, along with sugar sources like molasses, palm sugar, or coconut sugar, combined with water (Mahmudah et al., 2021). Eco-enzymes are characterized by their distinctive dark brown hue and possess a pronounced sweet-sour fermented aroma.

Material selection plays a pivotal role in the eco-enzyme production process. It is advisable to refrain from using refined sugar (white sugar) due to its chemical composition. Instead, suitable sugar sources encompass liquid molasses, dry molasses, palm sugar, coconut sugar, and *lontar* sugar. A diverse range of water sources, including rainwater, well water, AC runoff, refill water, tap water (PAM), and gallon water, are suitable. Fruit and vegetable remnants are encompassed, excluding those that have undergone cooking processes (boiled, fried, stir-fried), display spoilage, infestations, mold,

or have tough peels such as *rambutan* and *durian*. So the organic waste of nutmeg flesh become the main ingredient in Paya Village.

Figure 3 shown the method for preparing eco-enzymes. Begin by cleansing the container to remove any traces of soap or chemicals. The chosen container should feature a wide-mouthed lid, be available in various sizes (small or large), constructed from plastic to mitigate the risk of explosions, and should not be made of glass to prevent breakage. Subsequently, ascertain the volume of the container and fill it with clean water, reaching 60% of the container's capacity. Add sugar at the recommended ratio, equivalent to 10% of the water's weight. Incorporate fruit and vegetable remnants, amounting to 30% of the water's weight, ensuring a thorough mixture. Seal the container tightly and label it with the production and harvest dates.

In the initial week, periodically open the container to release accumulated gases. Stir the mixture on the 7th, 30th, and 90th days to enhance fermentation. Proper storage is essential, entailing shelter from direct sunlight, adequate air circulation, and a distance from sources of electromagnetic interference, restrooms, waste disposal areas, incinerators, and chemical substances. Table 1 shown the following recommendation dilutions for various applications, given as the ratio of eco-enzyme solution to water (in milliliters).

Table 1.

Ratio of eco-enzyme solution to water (in milliliters)

No	
1	Dishwashing, greasy kitchen utensils (1:10-50)
2	Laundry (washing machine), use a concentrated solution with 1 part eco-enzyme, 1 part detergent, and water as per machine capacity
3	Room air freshener (1:1000)
4	Bathing, washing hands, body, and shampoo (1:500)
5	Watering plants (1:1000)
6	Organic disinfectant (1:500)
7	Organic disinfectant (1:500)
8	Mopping floors (1:1000)
9	Cleaning floors (1:1000)
10	Cleaning toilets (as needed)
11	Cleaning glass and others (as needed)
12	Cleaning fruits and vegetables to remove pesticides - soak for 45 minutes (1 bottle cap: 1 basin of water)
13	Detoxifying heavy metals in the body by soaking feet in warm water (30 ml: 1 basin/bucket of water)
14	Compress for wounds and skin issues (pure eco-enzyme)

Developing candied nutmeg offers an enticing prospect for Paya Village. These snacks can serve as a healthier and locally-sourced alternative to conventional sugary treats, providing a distinctive product to enhance the village's economic prospects (Maulina Dewi & Anggraeni, 2022).

Through these interventions, the project aims to not only address the issue of organic waste accumulation but also foster economic growth, improve livelihoods, and empower the community in Paya Village, Pesawaran District. This initiative aligns with the village's rich agricultural heritage and holds the promise of contributing to its economic development and sustainability.

The process of making candid nutmeg is shown in Figure 4. The process of making candied nutmeg involves several key steps to create a sweet and flavorful treat. It starts with the harvest of ripe nutmeg fruit with flesh, and the removal of the outer husk to access the nutmeg seeds and surrounding flesh. The nutmeg flesh is then carefully sliced into thin pieces, which can be shaped as desired, such

as strips, cubes, or rings. These slices are boiled in water for about 10-15 minutes to soften them and remove any bitterness, occasionally changing the water during the process. In a separate pot, a sugar syrup is prepared by combining sugar and water, with a ratio of about 2 parts sugar to 1-part water, adjusted to taste. After boiling, the softened nutmeg flesh is drained and added to the sugar syrup. The mixture is simmered over low heat, continuously stirred to ensure an even coating, until the syrup thickens and the nutmeg pieces become candied, which may take around 20-30 minutes. The candied nutmeg is then removed from the syrup and placed on a drying rack or parchment paper to air dry or be exposed to the sun to speed up the drying process. Once completely dry, the candied nutmeg can be stored in an airtight container to maintain freshness and enjoyed as a sweet and flavorful snack or used in various culinary applications.

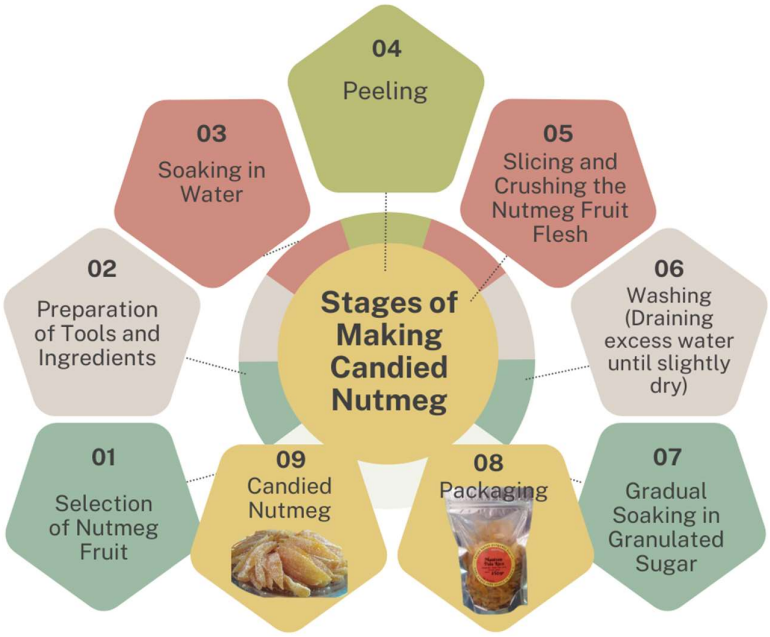

Figure 4.
The Stages of Making Candied Nutmeg

Traditional syrups are typically made from sugar and flavorings, but the incorporation of nutmeg into syrup production offers a novel and distinctive option. Nutmeg-infused syrups provide a unique and local flavor profile, adding a touch of warmth and spice to a variety of culinary creations. This innovation not only enriches the local product range but also has the potential to generate additional income for the community.

Figure 5 illustrates the step-by-step process of making nutmeg syrup. The process of making nutmeg syrup involves several distinct stages, resulting in a unique and locally flavored product with a delightful touch of warmth and spice. It begins with the selection of fresh nutmeg fruit, where the nutmeg seeds and their surrounding flesh are carefully separated from the outer husk. Following this, the preparation of tools and ingredients is essential.

The next step is soaking the nutmeg fruit in water to remove any impurities and ensure cleanliness. Subsequently, the fruit is peeled, and the nutmeg fruit flesh is obtained. This flesh is then soaked in a salt solution and pressed to extract the precious nutmeg fruit juice. The extracted juice goes through a settling and filtration process, leading to Nutmeg Fruit Juice II. Sugar is added to this juice in a 1:1 ratio, followed by thorough stirring. After filtration to remove any remaining impurities, the mixture is heated to almost boiling temperature and simmered for approximately 30 minutes.

Finally, the resulting nutmeg syrup is carefully bottled. This locally flavored syrup can be used to enhance a variety of culinary creations and provides a unique and versatile flavor that caters to the diverse needs of Paya Village and its surrounding areas. The process not only enriches the local product range but also offers an opportunity for additional income generation within the community.

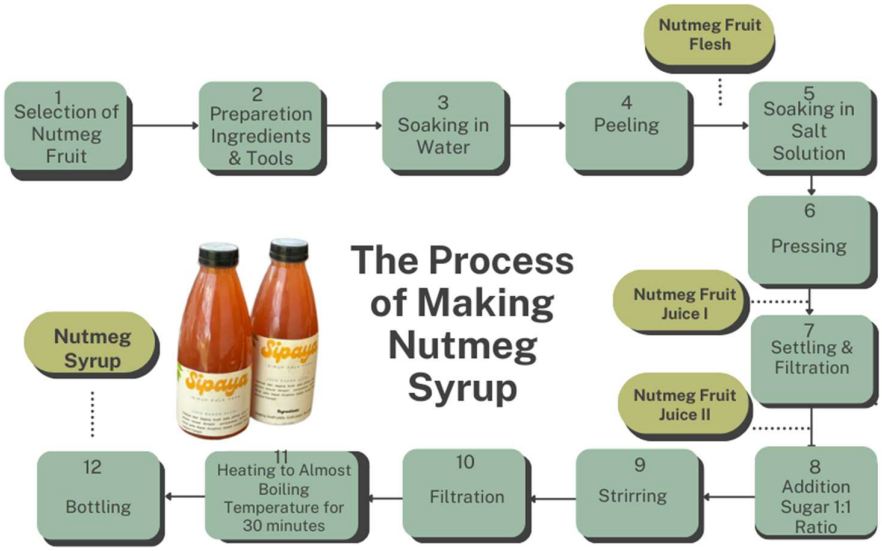

Figure 5.
The Stages of Making Nutmeg Syrup

METHOD OF ACTIVITIES

The method of activities, as illustrated in Figure 6, encompasses a four-stage approach meticulously designed to ensure a comprehensive and impactful engagement with the community for development. The inaugural phase of our initiative commences with a thorough preliminary survey intended to explore the targeted field. This preliminary survey lays the groundwork for a profound understanding of the context and the identification of potential opportunities. It encompasses a range of activities, including data collection, on-site visits, and active engagement with the local community to glean valuable insights into their needs and preferences.

Figure 6.
Flowchart Activities' Method

Building upon the insights acquired during the preliminary survey, the subsequent step entails the meticulous development of a comprehensive project proposal. This phase necessitates the formulation of a detailed plan, encompassing the project's objectives, scope, budgetary considerations, and a comprehensive timeline. The proposal is meticulously crafted, with due consideration to the knowledge amassed during the exploratory phase.

At the heart of our methodology lies the integral component of multifaceted capacity-building. This facet of our approach emphasizes the empowerment of the community through the imparting of diverse skills and knowledge. It is executed through a series of workshops, training sessions, and

educational programs tailored to cater to the specific requirements of the community. The ultimate objective is to enhance the capabilities of the community, thereby fostering self-sufficiency and ensuring sustainable growth.

A core tenet of our methodology is the continual and thorough evaluation of activity effectiveness. We maintain a constant vigilance over the activities we implement, with the objective of monitoring progress, quantifying outcomes, and soliciting feedback from the community. The insights garnered through this rigorous assessment process enable us to make adjustments and improvements, thereby optimizing the impact of our initiatives.

The interplay of these four stages embodies our method of activities, meticulously designed to ensure a comprehensive and impactful approach to community engagement and development.

RESULT AND DISCUSSION

This chapter delves into the outcomes of our activities and offers an in-depth discussion of the implications and significance of these results. The results presented herein are derived from a meticulous and rigorous assessment of the initiatives undertaken in the previous chapters.

Outcomes of Preliminary Survey

This section is dedicated to presenting the results of the preliminary survey conducted during the exploration phase. Herein, we elucidate the valuable insights acquired through a multifaceted approach, involving data collection, site visits, and extensive community interactions. The findings shed profound light on the specific needs and preferences of the Paya Village community, serving as the cornerstone upon which our subsequent actions are built.

The outcomes of the survey have shed light on a pressing concern; the suboptimal utilization of nutmeg fruit flesh, resulting in substantial wastage within the community. Candid interactions with the inhabitants of Paya Village have unveiled the challenges they confront, prominently including the detrimental consequences of poor road conditions and limited access to viable markets. Additionally, a conspicuous lack of awareness regarding the latent advantages associated with nutmeg fruit flesh utilization has been discerned. These insightful revelations have profoundly influenced the meticulous tailoring of our program activities to directly address the paramount issues articulated by the community.

The revelation of suboptimal nutmeg fruit flesh utilization resonates with the core principles of sustainability and resource optimization central to our initiative. The substantial wastage of nutmeg fruit flesh underscores the imperative for innovative solutions aimed at unlocking the full potential of this valuable resource. This, in turn, contributes to the promotion of both ecological and economic sustainability, aligning with our overarching goals.

The identified lack of awareness regarding the multifarious applications of nutmeg fruit flesh underscores the significance of knowledge dissemination. Our program activities, meticulously guided by these findings, aspire not only to curtail waste but also to empower the community with the requisite knowledge and skills. This empowerment equips the community to capitalize on the untapped economic opportunities offered by nutmeg fruit flesh, thus fostering self-sufficiency.

These insights, illuminated by the survey, are a poignant reflection of the community's needs and aspirations, heralding a future marked by enhanced sustainability, economic prosperity, and self-sufficiency. In the forthcoming chapters, we delve deeper into the efficacy of our program activities in addressing these concerns and fostering the overall well-being and development of the Paya Village community.

Development of Project Proposal

After conducting an extensive survey, we sought and obtained the invaluable consent and feedback from the community. This input played a pivotal role in shaping the development of a comprehensive program proposal. The proposal, meticulously crafted, delineated the overarching strategies and objectives of our initiative. Its primary aim was to empower nutmeg farmers and

augment the economic worth of nutmeg fruit flesh through the creation of high-value products. These products, with a specific emphasis on nutmeg syrup, candied nutmeg, and eco-enzyme derived from nutmeg flesh, were carefully integrated into the proposal.

The formulation of the program proposal is a crucial milestone in our initiative, driven by the collective aspirations of the community. The objectives outlined within the proposal serve as the compass guiding our efforts to empower nutmeg farmers and extract enhanced economic value from nutmeg fruit flesh. The particular focus on nutmeg syrup, candied nutmeg, and eco-enzyme embodies our commitment to sustainable and innovative solutions, aligning with both ecological and economic principles. The proposal not only encapsulates the vision of our program but also reflects the vital role of community engagement and co-creation in its development. This collaborative approach ensures that the proposed strategies resonate with the community's needs and aspirations, fostering a sense of ownership and active participation. In the subsequent chapters, we delve deeper into the practical implementation of these strategies and assess their effectiveness in realizing the program's objectives and enhancing the overall well-being of the community.

(a) (b) (c) (d) (e) (f)

Figure 7.
The Activity of Community Development

Diverse Skill-Building

At the core of our program lies the deliberate execution of capacity-building activities, meticulously designed to endow nutmeg farmers with the knowledge and competencies requisite for unlocking the full potential of nutmeg fruit flesh. Our strategy encompassed the organization of an array of workshops, training sessions, and informative seminars. These sessions comprehensively covered a spectrum of subjects, ranging from the optimization of nutmeg cultivation practices to the significance of nutmeg fruit flesh, along with its diversified applications in the creation of high-value products, including nutmeg syrup, candied nutmeg, and eco-enzyme.

Tabel 2.
Pre- and Post- Test Questions

No	Question
1	What is the primary goal of the community service program regarding nutmeg products like candied nutmeg, nutmeg syrup, and eco-enzyme?
2	How familiar are you with candied nutmeg production?
3	How familiar are you with nutmeg syrup production?
4	How familiar are you with eco-enzyme production?
5	Have you heard about the potential health benefits of nutmeg?
6	What is the primary component of candied nutmeg, aside from nutmeg itself?
7	What do you think is the primary color of nutmeg syrup?
8	What is the primary purpose of using eco-enzyme in cleaning agents?
9	What is the primary advantage of using eco-enzyme in agriculture?
10	Do you believe that the production of candied nutmeg, nutmeg syrup, and eco-enzyme can reduce wastage of nutmeg fruit flesh in the community?

The crux of our program revolves around the empowerment of nutmeg farmers, fortified through capacity-building endeavors. These carefully orchestrated activities aimed to foster a profound understanding of the multifaceted potential harbored within nutmeg fruit flesh. Farmers not only acquired knowledge pertaining to the health benefits associated with nutmeg but were also equipped with the practical skills required for the production of nutmeg syrup, candied nutmeg, and eco-enzyme. This multi-faceted training not only promised to augment the economic value of their harvests but also aimed to harness the full potential of nutmeg fruit flesh, fostering ecological and economic sustainability.

The significance of these capacity-building activities transcends mere skill acquisition; it encapsulates the essence of community empowerment and the cultivation of self-sufficiency. In the ensuing chapters, we delve deeper into the implementation and outcomes of these activities, dissecting their role in enhancing the overall well-being of the community and the sustainable development of the nutmeg farming sector.

To comprehensively evaluate the impact of our community service program, a pre-and post-test analysis was undertaken. This entailed a comparative assessment of participants' performance before and after their engagement in the program. Figure 8 succinctly encapsulates the results of this assessment, illuminating a notable enhancement in participants' grasp of nutmeg, its associated benefits, and the broader community service program. Post-test results underscore a significant upswing in the number of accurate responses to all questions, vividly underlining the program's effectiveness in elevating participants' knowledge and awareness. This heightened comprehension stands as a resounding testimony to the success of the community service initiative, signifying the seamless transfer of knowledge to the program's participants.

The cumulative results discussed in this section underline the tangible achievements of our program and its substantive contribution to the community's overall well-being and development.

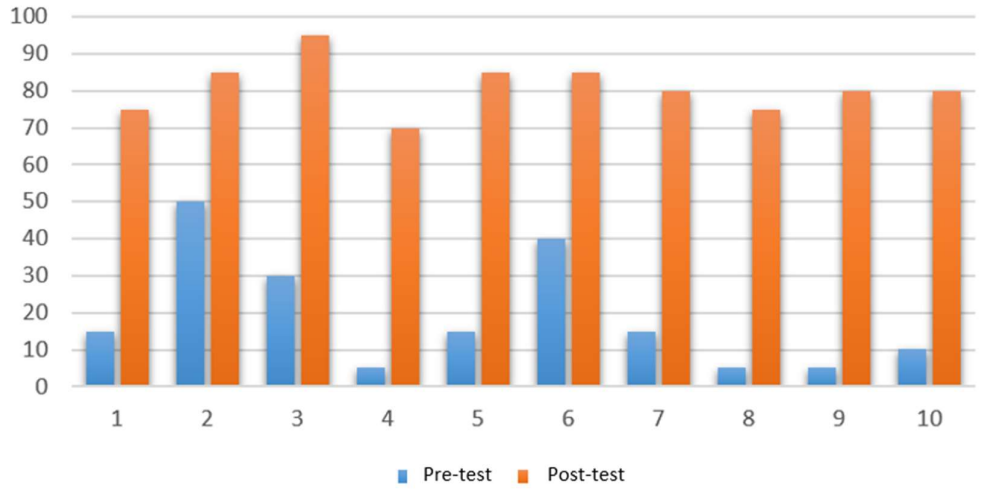

Figure 8.
The Result of Pre- and Post-Test

CONCLUSION

In Paya Village, the preliminary survey revealed the critical issue of suboptimal utilization of nutmeg fruit flesh, leading to significant waste. The community faced challenges like poor road conditions and limited market access, coupled with a lack of awareness regarding the potential uses of nutmeg fruit flesh. The subsequent development of a comprehensive project proposal aimed to empower nutmeg farmers and enhance the economic value of nutmeg fruit flesh. Capacity-building activities played a pivotal role in educating and training the community, fostering self-sufficiency, and sustainable growth.

The program's regular evaluations demonstrated a significant increase in participants' understanding of nutmeg and its benefits. Pre-and post-test results reflected enhanced knowledge and awareness, confirming the program's success in transferring valuable knowledge to the community. This initiative not only curbed organic waste accumulation but also contributed to economic growth and community empowerment. The multifaceted applications of nutmeg, including eco-enzymes, nutmeg syrup, and candied nutmeg, exemplify the potential of innovative and sustainable solutions to drive economic development and sustainability in the community.

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