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Increasing Productivity in Planting Indigofera Tinctoria Plant Seeds as Producers of Natural Dyes in Pacarejo Village, Semanu, Gunung Kidul, D.I. Yogyakarta

Supriadianto[1*], Edia Rahayuningsih[2], Kumala Dewi[3], Mukmin Sapto Pamungkas[2]
[1]Department of Languages, Arts, and Culture Management, Vocational College, Universitas Gadjah Mada, Yogyakarta, Indonesia
[2]Department of Chemical Engineering, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, Indonesia
[3]Department of Tropical Biology, Faculty of Biology, Universitas Gadjah Mada, Yogyakarta, Indonesia

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Abstract This investigation was conducted in Pacarejo Village with the participation of thirty people. This activity was a follow-up to the second year of research, with the objectives of: 1) Increasing participation and strengthening the commitment of Gapoktan of Sembada, Pacarejo Village by planting Indigofera tinctoria as an alternative plant with a fixed price that can improve people's income, 2) Realizing additional land, provision of seeds, and matrices for planting Indigofera tinctoria plants to meet the availability of sustainable raw materials, and 3) Providing assistance in care. The expected outputs to achieve an independent village are as follows: 1) Realization of a Cooperation Agreement for planting Indigofera tinctoria on at least 2 hectares, 2) Development of a planting system, plant care, and harvesting methods with optimal and sustainable quality, and 3) Availability of natural dye raw materials extracted from Indigofera tinctoria leaves that meet raw material quality standards and are sustainable. This research effectively improved the well-being of the residents of Calonejo Village, particularly the Gapoktan Sembada, Pacarejo Village by increasing the Indigofera plant nursery productivity of farmers. This research was successful due to the conclusion of a cooperation agreement to plant Indigofera tinctoria on an area of 3 hectares, the establishment of a planting system, plant care, and harvesting methods with optimal and sustainable quality, and the availability of raw materials for natural dyes extracted from Indigofera tinctoria leaves with optimal and sustainable quality. Information session, Group Discussion Forums (FGD), Training, and Direct Assistance methods are used.

1. INTRODUCTION

In recent years, the agricultural sector has played a lesser role as the most significant contributor to economic development in the village of Pacarejo. Several factors contribute to economic development, including seasonal shifts, decreased precipitation, and the volatility of agricultural product prices (rice, tubers, peanuts, and corn). In addition, some villagers of Pacarejo were compelled to sell their agricultural land in order to meet their family's economic requirements (Kalurahan Pacarejo, 2014). Pacarejo Village was one of the areas most severely impacted by the COVID-19 pandemic and experienced a particularly severe PPKM period from June to September 2021, when wave 2 of the pandemic occurred. It is believed that the COVID-19 pandemic contributed to the sector's low productivity: agriculture, specifically the cultivation of Indigofera tinctoria seeds in Pacacejo Village.

The village of Pacarejo has 28 farmer groups that are members of Gapoktan Sembada and have agreed to carry out Indigofera tinctoria planting activities. Gapoktan Sembada has provided approximately ±30,000m^2 of land for cultivating the Indigofera tinctoria plant, which produces natural dyes. The Indigofera tinctoria plant has

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*Corresponding author: Supriadianto
Department of Languages, Arts, and Culture Management, Vocational College, Universitas Gadjah Mada, Caturtunggal, Depok, Sleman, Yogyakarta, Indonesia, 55281
Email: supriadianto84@ugm.ac.id

great potential from an economic standpoint to increase the welfare of the people of Pacarejo Village. In line with the findings of Muzzazinah (2016), Indigofera plants are potential color-producing plants to be developed. This plant produces natural dyes that can protect the environment, and in the textile industry, using natural dyes does not cause allergies for consumers with sensitive skin. The existence of natural dyes from the Indigofera plant is a form of environmental preservation and economic empowerment with local potential (Martuti et al., 2019). However, it is still necessary to conduct continuous research so that plants with superior varieties can be produced and increase marketability and competitiveness.

Despite this, the villagers of Pacarejo Village are still unable to cultivate Indigofera tinctoria due to the ignorance of farmer groups regarding the process of seeding and sowing Indigofera plants and the lack of a planting period matrix for Indigofera plant seeds planted by farmers. This issue led to the production of few Indigofera plant seeds, an irregular seedling growth period, and irregular seed dispersal on agricultural land (Supriadianto et al., 2021). Therefore, direct strengthening and training programs for producers are required so that Indigofera plant seeds can flourish. Thus, Indigofera plants can be utilized to their maximum capacity to produce natural dyes. In the meantime, from an economic standpoint, by cultivating the Indigofera tinctoria plant, the residents of Pacarejo Village can increase their economic income for the community's long-term well-being.

This research aims to: 1) Increase participation and strengthen the commitment of the Gapoktan in Pacarejo Village through the Indigofera tinctoria plant as an alternative plant with a fixed price that can improve people's welfare, 2) Realize additional land, seeds, and matrices for planting Indigofera tinctoria plants to meet the availability of sustainable raw materials, and 3) Provide assistance in the care, fertilization, and identification of the time of harvesting Indigofera tinctori. Through this research, a cooperation agreement has been established for the planting of Indigofera tinctoria on a minimum area of 2 hectares, the establishment of a planting system, plant care, and harvesting methods with optimal and sustainable quality, and the availability of raw materials for natural dyes made from Indigofera tinctoria leaves that meet material quality standards and are sustainable.

2. METHOD

The concept used in the activity was to increase farmers' productivity of Indigofera plant nurseries on agricultural land to increase their sustainable welfare (Rahayuningsih, 2015). The method used in the community service program based on the assisted villages in Pacarejo Village was sharing information or knowledge, focus group discussions (FGD), training, and mentoring. This activity involved 30 participants, consisting of 1 farmer group leader, 1 field extension officer, and 28 farmer group leaders from each hamlet in Pacarejo Village. The empowerment activities carried out are described in detail in Table 1.

Table 1 . Activities and implementation methods

No	Activities	Method
1	Outreach to the community about building a commitment to adding more land, increasing seed production, and building matrices for planting Indigofera plants	Coordination meetings
2	Development of planting systems, plant care, and harvesting methods with optimal and sustainable quality	Workshop
3	Assistance in plant care and fertilization	Direct assistance
4	Harvest time identification training	Direct assistance
5	Training on how to harvest leaves and care for post-harvest plants	Direct assistance
6	Field Monitoring and Evaluation	Coordination meetings

3. RESULT AND DISCUSSION

The implementation of Fostered Village-Based Community Service program in Pacarejo Village has been successfully implemented following the stated activity objectives, as follow.

3.1 Building commitment and sharing knowledge

The coordination meeting activities were held on June 15, 2022, at the Field Extension Executor's home, Mr. Wartoyo, in the Serpeng Lor hamlet. In this activity, coordination and agreement were carried out to build a commitment to increase and ensure land for planting Indigofera plants. In this activity, information session was also carried out regarding the explanation of seed production and the planting matrix together with the Sembada Farmers Group Association of Pacarejo Village. The implementation team succeeded in coordinating with the Chairperson of the Gapoktan and several Chairmen of the Pacarejo Village Farmers' Group, as shown in Figure 1 and Figure 2.

To build on the commitment to add Indigofera plantation land with the Sembada Farmer Group Association in Pacarejo Village, the research team, namely the UGM INDI Team, confirmed the availability of Indigofera Tinctoria L. planting land in Pacarejo Village. Using the concept of mutualism symbiosis, INDI UGM would directly purchase the harvest from Indigofera plant leaves in order to convince the Sembada Pacarejo Farmers Group Association that this program would be sustainable and beneficial to the community. In addition, the research team disseminated information on increasing Indigofera plant seeds through a local farmer nursery system in Pacarejo Village by dispersing seeds directly on the land. Pacarejo Village was appropriate for the cultivation of Indigofera plants; according to (Ariyanti & Asburr, 2017), Indigofera plants can grow at altitudes between 0 and 1,650 meters above sea level.

This activity also presented a matrix for planting Indigofera plants on agricultural land and an economic

analysis matrix, as seen on Figure 3. The explanation for the Indigofera planting matrix is as follows:

1. The size of the nursery bed is 1.0 m x 5 m. Each bed requires 3 ounces of seeds.
2. Nursery beds must be free of weeds, and the soil must be loosened and mixed with sand.
3. Nursery beds topped with paranet 70%.
4. Beds watered to maintain humidity.

The Chairperson of Gapoktan Sembada, Pacarejo Village, namely Mr. Watino and together with the Chairperson of the other Farmers' Groups, stated and convinced the Research Team that Gapoktan had provided land for planting Indigofera Tinctoria L., an area of approximately three (3) hectares located in the former tourism area of Bendung Jowinantang Dusun Serpeng Lor. The location of the land can be seen in Figure 4.

Figure 1 . Location agreement for Indigofera Tinctoria planting Area: Service socialization program

Figure 2 . Location agreement for Indigofera Tinctoria planting Area: Gapoktan Sembada of Pacarejo community photo

Plant cultivation activities, especially Indigofera plants, are a shared responsibility of the Indonesian people. This is an effort to preserve and prevent the scarcity of these plants, as it is known that currently, the need for dyes in the textile industry is dominated by artificial dyes, which have a negative impact on the environment. Therefore, there is a need for the support and commitment of the community, both farmers and academics, to develop appropriate technology to support the cultivation of Indigofera to produce superior varieties. The superior varieties expected for Indigofera as dyes are certified seeds, easy to plant under various stresses, and highly productive (Muzayyinah, 2014).

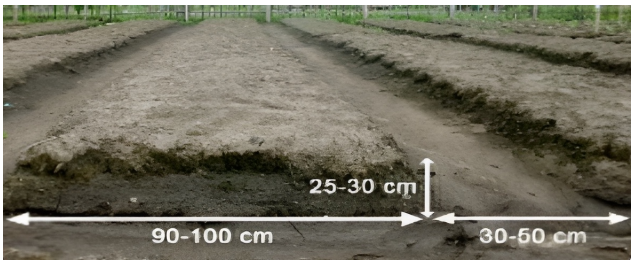

Figure 3 . Matrix for planting Indigofera plants

Figure 4 . Location of Indigofera Tinctoria L. planting land

3.2 Development of an Indigofera planting system

After a joint agreement was reached between the research team and Gapoktan Sembada, Pacarejo Village, regarding the availability of land and human resources who would manage the land, one week later, an activity was held to develop an Indigofera planting system on planting the land with a spacing of 50-100 cm^2 between other plants. The planting system development activities were carried out in the following way - development of a planting system for land clearing and clearing, as shown in Figure 5.

Indigofera plants are tolerant of dry land and lots of sun. However, choosing land with loose soil, containing enough nutrients, and being close to water sources is necessary. The soil is loosened for land preparation, and beds are made with grooves to place the essential fertilizer. Essential fertilizer can be prepared using fermented manure with a sugar solution, 500 ml of EM4, covered with a tarpaulin, and let stand for at least one week (the longer, the better). Finished fertilizer is characterized by its black-brown color and has no sharp odor. The manure is put into the grooves of the beds with NPK 15-15-15 fertilizer, and then the grooves are covered again with soil while beds are formed with a width of 1 meter, a height of 30-40 cm beds, and a distance between beds of 90 cm. Seedlings 1 to 2 months old can be transplanted into the prepared beds. Transfer of plants in the field is done in the afternoon to prevent the plants from

wilting. Plants need to be watered with enough water (Dewi et al., 2022).

Figure 5 . Land clearing activities development of distance planting system and seeding

3.3 Providing plant care and implementing harvesting methods with optimal and sustainable quality

The next stage was after the Indigofera plant nursery had been carried out in the planting area shown in Figure 5. At this stage, knowledge sharing of plant care and sustainable harvesting methods was also carried out in Gapoktan Sembada, Pacarejo Village, on the DEM Plot 1 land of Indigofera plants that were already thriving. The knowledge sharing of how to care for and harvest Indigofera plants was facilitated by Prof. Dr. Kumala Dewi., M.Sc., St., which can be seen in Figure 6.

Figure 6 . Dissemination of care and harvesting of Indigofera plants by the research team

Indigofera plant care is carried out through the following steps: 1) Monoculture planting, which aims to increase agricultural yields and prevent other disturbing organisms so that the quality of the stems and leaves produced can be maximized, 2) Dissemination of irrigation methods; during the rainy season the land for planting Indigofera is made mound so that the water flows evenly to keep the soil moist. This is because if too much water supply is accommodated in the Indigofera plant land, it will cause the leaves to fall off, be affected by fungus, and allow the plants to die. Meanwhile, during the dry season, the soil for Indigofera plantations should only dry out a little. Therefore, it is necessary to water it once a day so that the soil for Indigofera plants becomes moist and reduces yellowness and the arrival of pests and diseases on the plants, 3) Fertilization stage, carried out with manure to produce high-quality green leaves. It is highly not recommended to use chemical fertilizers because chemicals will cause the soil to dry quickly and the leaves to fall off easily even though the plants look green; and finally, 4) sharing the knowledge of anticipating pests handling and other issues (Dewi et al., 2022).

3.4 Monitoring of Indigofera tinctoria plantations

At this stage, the Indigofera tinctoria planting area was monitored. The three hectares of land promised by Gapoktan had been fulfilled, and Indigofera Tinctoria seeds have been planted, as portrayed in Figure 7. However, it was discovered that some Indigofera plants had not been appropriately watered; this was because the irrigation system had not run optimally or was still conventional. According to Muzzazinah et al. (2022), using a sprinkler irrigation system further expands the watering area so all trees can be adequately watered. A sprinkler irrigation system can efficiently use irrigation water, and the uniformity of irrigation provided can be more than 85%. The hope is that a sprinkler irrigation system can be applied in the next period of community service activities. After the monitoring activity occurs, the next activity stage can be carried out, namely evaluating the progress of planting Indigofera (Muzzazinah et al., 2022).

Figure 7 . Indigofera Planting land

Based on monitoring activities, it was also found that increasing the productivity of Indigofera plants could be done by maintaining the light intensity used. The highest indigo pigment is often found in Indigofera plants, which are cultivated in areas with low light intensity. This aligns with previous studies, which explained that giving low light intensity, namely 25% and 10%, could produce Indigofera plants with the highest secondary metabolite content. Because of this, in subsequent activities, it is necessary to inform about and monitor the provision of light intensity to obtain the best results (Huda et al., 2022).

3.5 Evaluation of the progress of planting the Indigofera tinctoria plant

Furthermore, the UGM INDI team and Gapoktan Sembada Pacarejo have evaluated Indigofera planting. This activity was attended by 30 people consisting of 1 farmer group leader, 1 field extension worker, and 28 farmer group leaders from each hamlet in Pacarejo Village. Indigofera

plant seeds planted in this year's planting area have only reached 4,000 Indigofera plant trees. This planting target has only reached 25% of 28,000 Indigofera trees

The number of Indigofera plants that have been planted on the available planting land had not been achieved because 1) there were still a large number of human resources from members of the farmer groups in each hamlet who had not carried out nurseries, so the achievement of Indigofera plant seeds had not been implemented and 2) the cohesiveness of the farmer group members under the auspices of Gapoktan Sembada Pacarejo was still being determined, so the land clearing had not yet been implemented. In accordance with this, the benefits of Indigofera planting would be maximized and effective if all members of the Gapoktan group could support and carry it out collectively (Sandyatama & Hariadi, 2012). In order for Gapoktan Sembada Pacarejo and the residents of Pacarejo Village to achieve the use value and economic value, it is necessary, based on the program evaluation as seen on Figure 8, to incorporate a sustainable design into the previously proposed community service roadmap.

Figure 8 . Monitoring and evaluation with the Gapoktan Sembada Pacacejo

4. CONCLUSION

Based on the achievement of a significant commitment from Gapoktan Sembada of Pacarejo Village in the form of three hectares of land, the following have been achieved: land clearing activities, understanding the realization of the size of the planting distance, Indigofera plant nurseries on the land, and a sustainable plant irrigation process. In conclusion, the UGM INDI Assisted Village Program activities in 2022 were smoothly and successfully organized and completed. As a result, the realization of the outputs that were projected during the program planning was successfully achieved at the end of the Assisted Village activities. Based on this, it is hoped that this second-year activity can be continued until the third year in accordance with the community service roadmap that has been outlined in the 2022 Foster Village proposal.

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CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest in this research publication

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