



Optimizing honey production in stingless bee farming

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| ARTICLE INFO | ABSTRACT |
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| <p>Article history Received: 2023-05-24 Revised: 2023-05-29 Accepted: 2023-05-30 Published: 2023-07-02</p> <p>Keywords Honey Management of vegetation Stingless bee SDGs Goals</p> | <p><i>Harapan Jaya Village, Way Ratai Subdistrict, Pesawaran Regency has very promising potential for cultivating trigona bees. Lecture and student from University of Lampung team conducted training on stingless bee cultivation in this village in 2022. At the end of 2022, several stingless bee colonies experienced deaths that were allegedly due to lack of nectar sources. This community service activity was carried out to provide understanding and training on vegetation management and adding stingless bee colonies. Activities are carried out with lectures, discussions, and hands-on practice. The results of the activities that have been carried out include the addition of seven types of nectar source plants and two stingless bee colonies. In addition, the community's understanding of the maintenance of stingless bee colonies and their supporting vegetation also increased. This is very supportive of long-term programmed in the achievement of SDGs, especially in the goals of life on land and no poverty.</i></p> |
| <p>Kata Kunci Lebah tanpa sengat Madu Pengelolaan vegetasi Tujuan SDGs</p> | <p>Optimalisasi Produksi Madu pada Budidaya Lebah Tanpa Sengat. Kabupaten Pesawaran memiliki potensi yang sangat menjanjikan untuk membudidayakan lebah trigona. Tim dosen dan mahasiswa dari Universitas Lampung melakukan pelatihan budidaya lebah trigona di desa ini pada tahun 2022. Pada akhir tahun 2022, beberapa koloni lebah trigona mengalami kematian yang disinyalir karena kurangnya sumber nektar. Kegiatan pengabdian masyarakat ini dilakukan untuk memberikan pemahaman dan pelatihan mengenai pengelolaan vegetasi dan penambahan koloni lebah tanpa sengat. Kegiatan dilakukan dengan metode ceramah, diskusi, dan praktek langsung. Hasil dari kegiatan yang telah dilakukan antara lain penambahan tujuh jenis tanaman sumber nektar dan dua koloni lebah tanpa sengat. Selain itu, pemahaman masyarakat mengenai pemeliharaan koloni lebah tanpa sengat dan vegetasi pendukungnya juga meningkat. Hal ini sangat mendukung program jangka panjang dalam ketercapaian SDGs khususnya pada tujuan <i>life on land</i> dan <i>no poverty</i>.</p> <p style="text-align: right;">Copyright © 2023, Priyambodo et al This is an open access article under the CC-BY-SA license</p> <div style="text-align: right;">  </div> |

How to cite: Priyambodo, P., Rustiati, E. L., Permatasari, N., Sidik, M., Lestari, I. A., Yani, A. A., & Sa'uddah, L. D. (2023). Optimizing honey production in stingless bee farming. *Journal of Community Service and Empowerment*, 4 (2), 360-361. <https://doi.org/10.22219/jcse.v4i2.26431>

INTRODUCTION

Pesawaran is the eleventh regency in Lampung Province formed in 2007 based on Law No. 33 Year 2007. Pesawaran Regency has its capital in Gedong Tataan, 27 km away from Bandar Lampung. Pesawaran has 11 sub-districts and 144 villages. Way Ratai Sub-district is one part of the Pesawaran Regency area. The north side of Way Ratai Sub-district is bordered by Kedondong Sub-district of Pesawaran Regency. South is bordered by Gedong Tataan District of Pesawaran Regency. East bordered by Padang Cermin District. The west is bordered by Kelumbayan District, Tanggamus Regency. Part of the Way Ratai sub-district area is a lowland area, partly a hill area and with a total sub-district area of 127.21 km². Way

Ratai Sub-district has its capital in Wates Way Ratai Village which is 41 km from the capital of Pesawaran Regency. Wates Way Ratai Village has the smallest area of 21.56 km².

Way Ratai Sub-district is one of the developing areas that is in the spotlight of the government because there are many potential areas that can be developed and become regional advantages. including being a tourist area, agricultural commodity areas, plantations and freshwater fisheries. Being a new development area causes RTs and hamlets in Way Ratai Sub-district to change so that in 2014 until now there are 206 RTs and 72 hamlets.

Based on its location, Way Ratai Sub-district is bordered to the north by Kedondong Sub-district, to the south by Gedong Tataan Sub-district, to the west by Kelumbayan Sub-district, to the east by Padang Cermin Sub-district. With the characteristics of an area whose morphology is mostly hills and forest areas, there are still many area forests and protected forests. The natural forest land cover area borders Way Ratai District, namely the Wan Abdurahman Forest Park area. This section could also provide the expected results.

Harapan Jaya Village, Way Ratai Subdistrict, Pesawaran Regency is a village that borders directly with the Forest Protection Block Register 19 Wan Abdul Rachman Forest Plantation (Tahura) in the north. Harapan Jaya Village is located close to the forest area. The annual rainfall is \pm 2500-3000 mm, located at an altitude of more than 500 meters above sea level with a hilly topography dominated by steep slopes so that the development of population settlements is spread out and has an area of \pm 15 km² consisting of 8 hamlets and 17 RT, Harapan Jaya Village is located quite far from the Capital of Pesawaran Regency (\pm 70km) with road access mostly in the form of rocky soil so that it makes this village a little difficult to experience development both in terms of social and economic.

In this village there is a very promising potential for cultivating trigona bees. Trigona bees are very potential to be cultivated because they produce at least three main products, namely honey, propolis and beebread. The stingless bee sub-family Melliponinae is one of the highly morphological bees with distinct behaviours, and has a variety of species among the Apini, Bombini and Meliponini bees (Lamerkabel et al., 2021). The production and development of stingless bees, including Trigona sp is strongly influenced by environmental factors, including temperature, air humidity, rainfall and altitude. In addition, the availability of feed determines the success of stingless bee cultivation (Fidela et al., 2019).

Trigona honey is valued at 300 thousand - 2 million rupiah per kilo depending on the type of bee. Bee propolis is valued at 150-500 thousand per kilo, and bee pollen is valued at 100-300 thousand per kilo. Honey bee cultivation can be used as an effort to rehabilitate forest areas (Wicaksono et al., 2020). Honey bee cultivation can also be an alternative livelihood for the community, especially those living around forest areas. Honey bee cultivation can attract the active role of the community in preserving the environment (Priawandiputra, 2020). This effort is in line with the achievement of the 15th target of the Sustainable Development Goals (SDGs), namely life on land. In accordance with the policies of the 2020-2024 National Medium-Term Development Plan (Rencana Pembangunan Jangka Menengah Nasional /PJMN), SDGs goals related to life on lands can be focused on activities that include: (1) Restoration of pollution and damage to natural resources and the environment; (2) Reducing the rate of deforestation in Indonesia; and (3) Reducing the rate of forest degradation. in Indonesia; and (3) Reducing the rate of forest degradation (Rudiyanto, 2020).

Honey bees are already widely used as pollinators and are an integral part of intensive crop cultivation (Alvarado-Cárdenas et al., 2017). Honey bees have an important function as assisting insects for crop pollination, especially plants that cannot pollinate themselves and can increase the production of cultivated plants (Windarsih & Efendi, 2019). Stingless bee cultivation, or meliponiculture, has recently become its own trend in the midst of society, even various regions of the community are very eager to develop this bee cultivation.

Various community service activities on stingless beekeeping have been carried out in various regions in Indonesia. Dewantari and Suranjaya (2019) developed environmentally friendly stingless bee cultivation in Tabanan Regency. The Health Safety & Environment Division of PT Adaro Indonesia, South Kalimantan has conducted activities to improve the production and quality of kelulut honey at partner Small and Medium Enterprises (SMEs) in Paringin, Balangan Regency (Triwibowo, 2021). Training on stingless bee cultivation and its benefits has also been conducted in Simalungun Regency (Harmain et al., 2023). Training in Trigona stingless bee cultivation has also been conducted in Maros Regency by introducing colony splitting techniques and variations in stup shape (Nuraeni et al., 2022). In particular, in Banjar Regency, a community service programme has been conducted by a team of lecturers from the Faculty of Economics at the Islamic University of Kalimantan MAB Banjarmasin on the economic potential of stingless beekeeping (Purboyo et al., 2022). In Tretes Hamlet, Bendosari Village, Pujon District, Malang Regency has also carried out community service on Trigona sp. as an effort to increase productivity community by lecturers from Universitas Muhammadiyah Malang (Wibowo et al., 2022). This has shown that public interest in stingless bee farming is very high.

The University of Lampung Student Creativity Program for Community Service (Program Kreativitas Mahasiswa Pengabdian kepada Masyarakat/PKM-PM) team conducted training on stingless bee cultivation in Harapan Jaya Village, Way Ratai District, Pesawaran Regency at 2022. PKM-PM activities aim to introduce stingless beekeeping techniques to the community. This training activity is an integrated part of the PKM-PM implementation. The training was conducted at the Harapan Jaya Village Office and one of the houses where the bee logs will be placed. The method of implementing training through focus group discussion, audio-visual media playback, questions and answers, and practical activities. Villagers were trained to make bee logs and choose the location for placing Trigona itama bee logs. An increase in community understanding is expected to have an impact on improving the people's economy, especially in the post-pandemic era

(Sidik et al., 2022). This effort is in line with the realization of the first target of the SDGs, namely no poverty. This is in line with the Outcome Document Transforming Our World: The 2030 Agenda for Sustainable Development, the goal of ending poverty is the "main" goal of the 17 goals agreed in the SDGs. The first of the 17 goals is "End poverty in all its forms everywhere". The main goal should be the development theme, the main and ongoing agenda that underlies various other development goals such as infrastructure, tourism, food and energy and others (Rudiyanto, 2020).

Permatasari et al. (2023) have conducted training on planting nectar source plants in Harapan Jaya Village. The plants used are from the genus *Antigonon*. The constraints experienced by partners include less than optimal honey production from stingless bee colonies at partner locations and lack of knowledge on how to optimize honey production from stingless bee colonies at partner locations. However, based on monitoring that shows that honey production is not optimal, so it is necessary to provide assistance to the community in order to optimize honey production in stingless bee cultivation in Harapan Jaya Village, Way Ratai District, Pesawaran Regency, in the form of improving colony quality and increasing the quantity and diversity of nectar source plants.

METHOD

This community service activity was carried out at Harapan Jaya Village Hall, Way Ratai District, Pesawaran Regency, Lampung Province (Figure 1). The location of community service is about 65km from Lampung University (Unila) with a distance of 120 to 150 minutes (Figure 2). The methods to be implemented include: (1) Focus Group Discussion (FGD); and (2) Capacity Building.

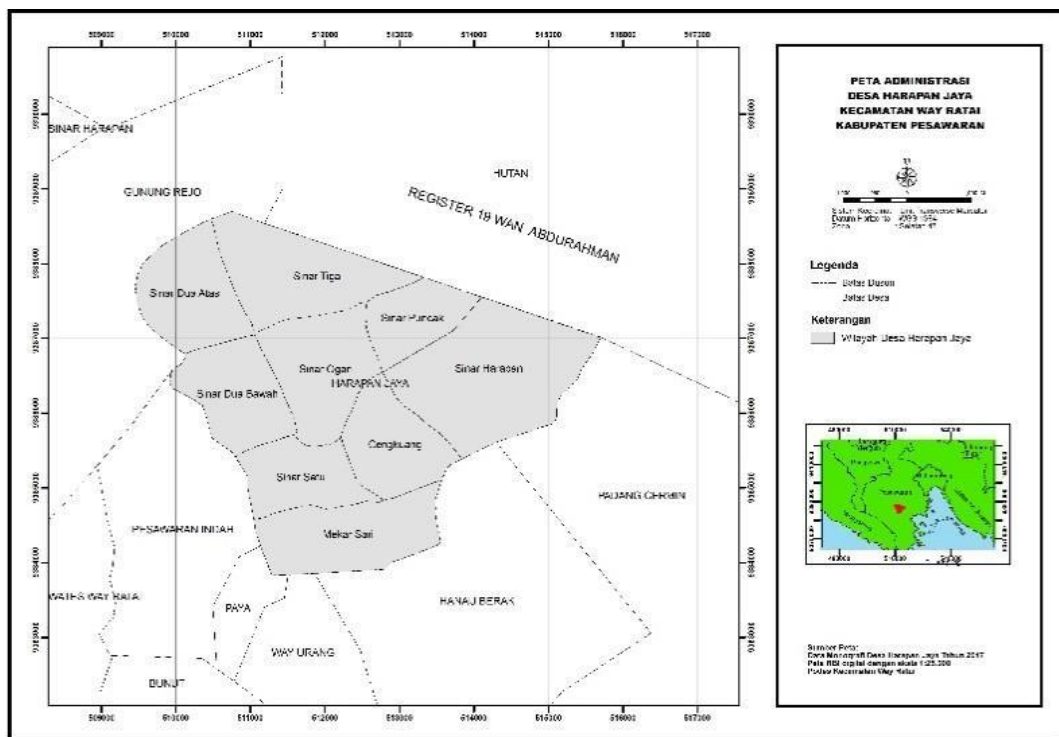


Figure 1. Maps of Harapan Jaya Village.

The FGD method began with the provision of materials and information related to stingless beekeeping. Some of the main materials that have been given are techniques for managing vegetation in order to support the availability of nectar sources for stingless bees. In addition to these materials, how to maintain stingless bee colonies in optimal numbers was also presented. After the presentation of materials and information, the discussion process continued. The discussion method is carried out to provoke feedback from participants. This method can be carried out in writing or orally. The discussion method is also carried out directly during counseling / workshop activities or can be carried out through virtual communication media which will later be created to facilitate communication and coordination with the Community Service Implementation Team.

Capacity building activities are intended to transfer skills to the community. Capacity building activities are carried out with a direct practical process in the field. The practical method is carried out by participants during: vegetation management and adding/planting bee colonies. Activities that will be disseminated to the community are knowledge and experience in the form of practices related to the following: (a) Knowledge and skills in vegetation management to suit the needs of stingless bee colonies; and (b) Knowledge and skills in stingless bee colony replanting.

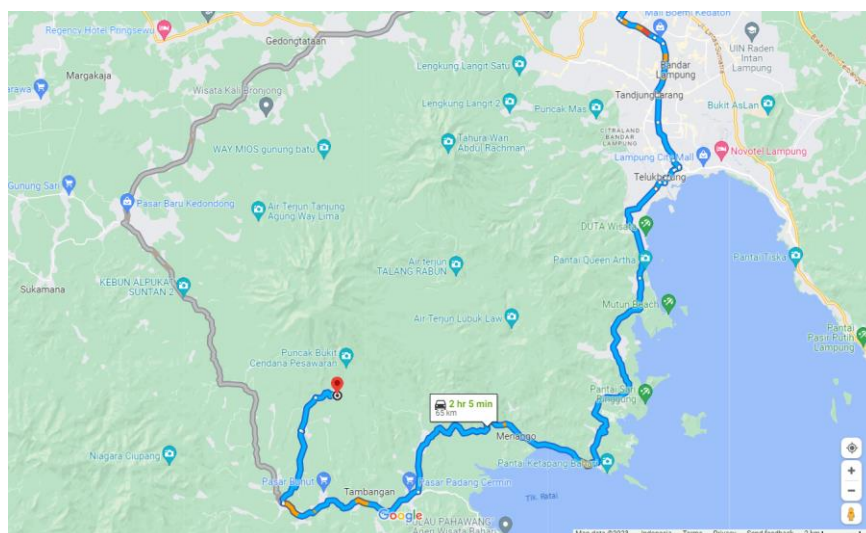


Figure 2. Travel route from Unila to location (Harapan Jaya Village).

Indicators of the success of community service activities that have been carried out are reflected in the increase in knowledge and skills of the society in accordance with the programmed objectives in order to optimise honey production from stingless beekeeping. This has been evident in a number of ways, including increased knowledge of vegetation management with different types of nectar-sourcing plants and the skills to plant and care for them. The increase in knowledge and skills is also measured by the community's expertise in caring for stingless bee colonies. This success indicator will then be monitored on an ongoing basis, in accordance with the recommendations of good agricultural counselling, which is to conduct continuous visits to the target group being assisted (Daud et al., 2022).

RESULTS AND DISCUSSION

Community Service activities in Harapan Jaya Village, Way Ratai District, Pesawaran Regency have been carried out synergistically between the implementers of Community Service and the Way Ratai Village Government and its residents. The activity implementation team involved two lecturers from the Department of Biology, Faculty of Mathematics and Natural Sciences, University of Lampung and one lecturer from the Department of Plantation Crop Cultivation, Lampung State Polytechnic. In the activities that have been carried out, the lecturer team also involved four students from the Biology and Chemistry undergraduate study programmed, Faculty of Mathematics and Natural Sciences, Lampung University. The participants consisted of 32 people from Way Ratai Village.

The implementation of the activity began with coordination activities carried out via telephone facilities. Furthermore, part of the Community Service team conducted a survey and preparation for the implementation of activities on 6 May 2023. In the implementation of this survey and preparation, coordination has been carried out on the place and time of activity implementation.

Focus Group Discussion

The community service activity was conducted to provide comprehensive information about the activities carried out in the community service (Figure 3). In the implementation of the speeches that have been carried out, a comprehensive overview is given related to vegetation management and how to add individuals to bee colonies. In addition to the theoretical explanation, practical steps were also given related to the implementation and follow-up activities that must be carried out.

Vegetation management is an effort made to support the continued availability of nectar and pollen for stingless bees. Vegetation management can be done by planting nectar and pollen-producing plants for stingless bees. Vegetation management must be carried out because the need for large amounts of nectar and pollen must remain stable. Permatasari et al. (2023) have conducted training on planting *Antigonon* plants as nectar source plants. This effort continues with the provision of several *Antigonon* seeds so that the number of plants is increasing. *Antigonon* plants were chosen because of their character that can bloom throughout the year without any seasons (Syaifudin, 2020). This is important to support the survival of stingless bee colonies.

The second part of the presentation was related to the addition of stingless bee colonies. The presentation focused on how efforts can be made to increase stingless bee colonies and the maintenance process of cultivated stingless bee colonies. Some of the tips given during the presentation on caring for stingless bee colonies included: (1) cleaning the stup from dirt and keeping the hive moist; (2) keeping stingless bees away from pests such as ants, spiders, lizards and wild wasps, as well as keeping colonies away from poultry such as chickens, and (3) checking stingless bee colonies at least every 2 weeks to ensure colony health. Unhealthy colonies will usually have a reduction in the number of honeycombs, few eggs and unaggressive bee activity.



Figure 3. Presentation process and presentation materials in community service activities.

Discussion activities were held to provide an opportunity for the villagers to ask questions and clarify the information that had been presented previously. The villagers were also allowed to ask other questions related to stingless bee cultivation and the potential that can be obtained from stingless bee cultivation. The discussion was not only conducted in the room after the presentation, but also continued until the practical process of adding stingless bee colonies and planting nectar source plants (Figure 4).



Figure 4. Discussion on community service activities.

Capacity Building

Honey production of stingless bees is influenced by the type and size of the colony, because the production of honey and other products depends on the number of worker bees in the colony that search and collect food. Honey productivity of stingless bees averages 100- 250 ml per 3 months and propolis productivity averages 2 kg/year for each colony. Variations in the amount of honey and propolis produced and its flavour depend on the types of vegetation around the hive as a food source.

The practical activities were divided into two main activities. The first practice is the implementation of adding stingless bee colonies. In the community service activity that was carried out on 13 May 2023, two new colonies were introduced to the cultivation area (Figure 5). This was due to the death of several stingless bee colonies that had been cultivated previously. This death was due to a lack of nectar sources around the end of 2022.

The subsequent follow-up to the death of several stingless bee colonies at the end of 2022 was carried out with training in planting *Antigonon* plants (Permatasari et al., 2023). Furthermore, the current community service activity is to carry out vegetation management by adding several types of nectar source plants, not only focusing on *Antigonon*. There are seven types of plants that have been planted in this community service activity (Figure 6). The seven plants are kaliandra (*Calliandra* sp.), santos (*Xanthostemon* sp.), air mata pengantin (*Antigonon* sp.), asoka (*Saraca* sp.), jambu kristal (*Psidium guajava*), jambu air (*Syzygium aqueum*), and kembang merak (*Caesalpinia Pulcherrina*). In addition to the cultivation process, the villagers were also introduced to how to maintain the plants according to their individual characteristics.

The selection of the seven plants planted in the process of improving vegetation around stingless bee colonies has its own reasons. The selection of Kaliandra (*Calliandra* sp.) was made because this plant is a source of stingless bee food that has been trialled by stingless beekeepers in Mempawah Regency (Syaifudin, 2020). Based on trials that have been carried out, nectar from kaliandra flowers can make the flavour of honey produced by stingless bees sweeter. Zakaria et al., (2017) mentioned that the kaliandra is a plant that is easy to cultivate with the potential not only as a nectar-producing plant, but also can be utilised as part of the leaves of the plant as animal feed. In addition, kaliandra can be an alternative choice in supporting slope stability, but it must be adjusted to the character profile of the local area, so that it can be a potential in supporting regional development.



Figure 5. Bee colony addition activities in Harapan Jaya Village.



Figure 6. Symbolic cultivation process by the community service team.

Xanthostemon sp. morphologically can be recognised with red flowers, long stalks, the base of the fruit is fused with the hypanthium, single leaves and seeds are flat, light, hairless and wingless (Wilujeng, 2015). The plant is known to tolerate very low moisture, infertile, and dry soils very well (Nazarudin et al., 2015). The nectar from the flowers of this plant is also known to be a food source for several types of insects. Several insect species have been known to consume nectar from the plant such as black wasps (order Hymenoptera) and black ants (family Formicidae) (Sanito, 2018).

Air mata pengantin plant (*Antigonon* sp.) is one of the most popular plants grown by stingless beekeepers. The selection of plant material in the form of bridal tear flower plants is based on the consideration that air mata pengantin plants are easy to cultivate, flowering regardless of the season and are highly favoured by stingless bees (Lukman et al., 2021). Therefore, training on planting and caring for this plant species has been widely implemented. Rosawanti et al. (2022) have conducted training on planting bridal tears in Anjir Village, Kahayan Hilir District, Pulang Pisau Regency, Central Kalimantan.

Guava (*Psidium guajava*), kembang merak (*Caesalpinia pulcherrima*), and asoka (*Saraca asoca*) at the community service location is an effort to add nectar source vegetation. Feed availability is one of the factors that influence the success of honey bee cultivation (De Lima et al., 2020). Nectar becomes a source of carbohydrates, pollen as a source of protein, fat, vitamins and minerals, and resin becomes propolis (Abrol, 2011). Bee food is necessary to sustain life and maintain the growth and development of bee colonies. Dependence on nectar and pollen makes the development and population of honeybees entirely determined by plant availability and flowering season. The three plants are potential nectar sources as has been researched in Mirring Village, Binnang District, Polewali Mandar Regency (Tahir et al., 2021).

Good vegetation will increase the carrying capacity of the environment, providing a good habitat for stingless bees and other organisms. This is in line with the Sustainable Development Goals (SDGs) fifteenth mission of life on land. In the world of agriculture, it is familiar to buy and sell crop pollination services carried out by bees. Bees will usually be rented to be returned in agricultural areas such as corn, coffee, longan and so on to help pollinate. Pollination by bees can increase agricultural yields by 80-100%. Managed pollination services are mutually beneficial for farmers and honey breeders. If you look at the Lampung area, especially the Pesawaran area, most of the population works as farmers, therefore this pollination service has the potential to be a profitable service for both parties.

Evaluation of the success of the service activity programme that has been carried out can be seen from the increased knowledge of residents on the types of plants that are potential nectar source plants for stingless bees that have been cultivated. In this case, the knowledge and skills in planting and caring for nectar-producing plants owned by the villagers have increased. Residents have also been able to understand that the presence of varied plants can have a good impact on the ecosystem. This improvement is shown in their enthusiasm to cultivate bee food plants as an effort to improve the quality of the ecosystem. The success in the short term of the implementation of community service that can be seen from

the evaluation process will be monitored periodically. This is a form of effort to be able to obtain optimal efforts in obtaining programme success in the long term.

Honey produced by stingless bees has different characteristics from Apis bees in terms of flavour. Based on research, stingless bees have higher acidity than the required quality standard for honey acidity. Some honey bees with high acidity originating from Southeast Asia are *Homotrigona fimbriata*, *Lepidotrigona flavibasis*, *Lepidotrigona doipaensis*, *Trigona apicalis*, and *Trigona melanoleuka* (Wahyuni & Anggadhania, 2020). In addition to honey, the results that can be harvested from stingless beekeeping include beebread, royal jelly, and propolis. The results obtained by the community from stingless beekeeping have the potential to be further developed to support efforts to increase community income to reduce poverty. This will support the achievement of another goal of the SDGs, namely no poverty.

CONCLUSION

The implementation of the talks and training for vegetation management by planting nectar source plants and adding more stingless colonies has the potential to optimise honey production in stingless beekeeping in Harapan Jaya village, Ray Ratai District, Pesawaran Regency. This strongly supports efforts to achieve two SDGs goals, namely life on land and no poverty.

ACKNOWLEDGEMENT

The authors would like to thank the Rector of the University of Lampung and the Head of the Institute of Research and Community Service (Lembaga Penelitian dan Pengabdian kepada Masyarakat/LPPM) of the University of Lampung for the funding provided through contract number 1027/UN26.21/PM/2023. Gratitude was also expressed to the Dean of Faculty of Mathematics and Natural Sciences (FMIPA) University of Lampung for issuing the Letter of Assignment with Number 2529/UN26.17/KP.03.03/2023, also to the Village Government and the Villagers of Harapan Jaya Village, Way Ratai District, Pesawaran Regency.

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